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FOR THE COMMANDER

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LASER-INDUCED DIODE LINKING FOR WAFER-SCALE INTEGRATION

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ABSTRACT

We study the use of laser-beam melting of silicon for the purpose of forming electrical links between two adjacent diodes. The diodes, which are formed by ion-implantation and diffusion in a conventional CMOS process, are positioned such that when desired they may be used to obtain an electrical link between two otherwise separate sections of the integrated circuit. Electrical connections so obtained enable the realization of wafer-scale ICs, as demonstrated in recent applications. We discuss the theory of laser-beam application to silicon, and show how the various beam and substrate parameters affect the properties of the diode links.

We pay particular attention to the important issue of the reflectivity from the composite system. Careful analytical examinations of the resulting molten zone properties have been performed in order to fully qualify the use of laser radiation in this technology. Both scanning electron microscopy and secondary-ion mass spectrometry were used to examine such parameters as the lateral and in-depth extension of the molten zone. In addition, electrical measurements were carried out. The results for the various observables compare well with the theoretical predictions.

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1. INTRODUCTION

Laser processing of semiconductor materials has been the subject of many studies in the past decade [1]–[5]. The realization of the first MOSFET device on laser recrystallized polycrystalline silicon opened the field to intensive research activity. This development roughly coincided with another important trend in microelectronics; namely, the push to higher levels of integration. A comprehensive list of early references along with a thorough discussion of the development of laser-beam processing of semiconductors may be found in References [4] and[5]. Perhaps the most studied application was that of laser annealing of the damage caused by ion-implantation. However, the advent of new techniques such as the rapid thermal annealing (RTA) by means of incoherent flash lamps [6] all but eliminated the need of lasers for damage annealing. The use of lasers to produce silicon-on-insulator (SOI) structures has proved to be more successful [7].

Laser-beam processing techniques have found widespread applications in the repair of integrated circuit chips for yield enhancement, and in some customization processes. The extrapolation of such defect avoidance (redundancy) and customization techniques to build very large integrated circuits is the basis for the technology of wafer-scale integration (WSI) [8,9]. An extension of the laser defect avoidance techniques is to alter the signal paths in order to alter the operation of the circuit itself. In such an application, a general collection of gates, inverters, and other basic circuit blocks are linked in a manner that creates a specific, new circuit function. Most commonly this has been done with Programmable Logic Arrays (PLAs), for what are now called Application Specific Integrated Circuits (ASICs). Sample chips could be produced from a standard unprogrammed PLA by making connections to device blocks [10,11]. This process used both deletive (cutting), and additive connection techniques [12].

At present there is much interest in raising the capabilities of integrated circuits by increasing the area of a single circuit system from the current chip size of < 1 cm^2 to devices that > 10 cm^2. This effort has come to be known in the literature as wafer-scale integration. WSI is achieved by interconnecting the operable circuit elements while avoiding the defective ones [13,15].

Five different WSI circuits have been built in this laboratory using a laser link structure which requires special wafer processing. These are a fast Fourier transform processor (FFT), a two-dimensional convolver, a Hough transform processor, a far IR (FIR) filter, and a digital integrator. A sixth circuit, for a speech recognition system, was built in a silicon foundry [13] using the laser link discussed in the present study, which requires no change in a conventional MOS process. This link consists of two pn junction diodes, identical to the drains of two adjacent transistors. The link comes about as a result of dopant diffusion from the junction regions into the gap that separates the diodes. The fast diffusion is made possible by the creation with a laser pulse of a small molten zone that encompasses parts of the diode regions and the gap between them. The laser is incident through several layers of glass. Figures 1-1 and 1-2 depict a typical structure used in creating the Laser-Induced Diode Link (LIDL). Figure 1-1 is a micrograph showing actual links. Here, a higher than necessary power was applied in order to raise the melt's temperature enough to create a high vapor pressure. This caused the cover oxide to curve upward, forming dome-like structures, and

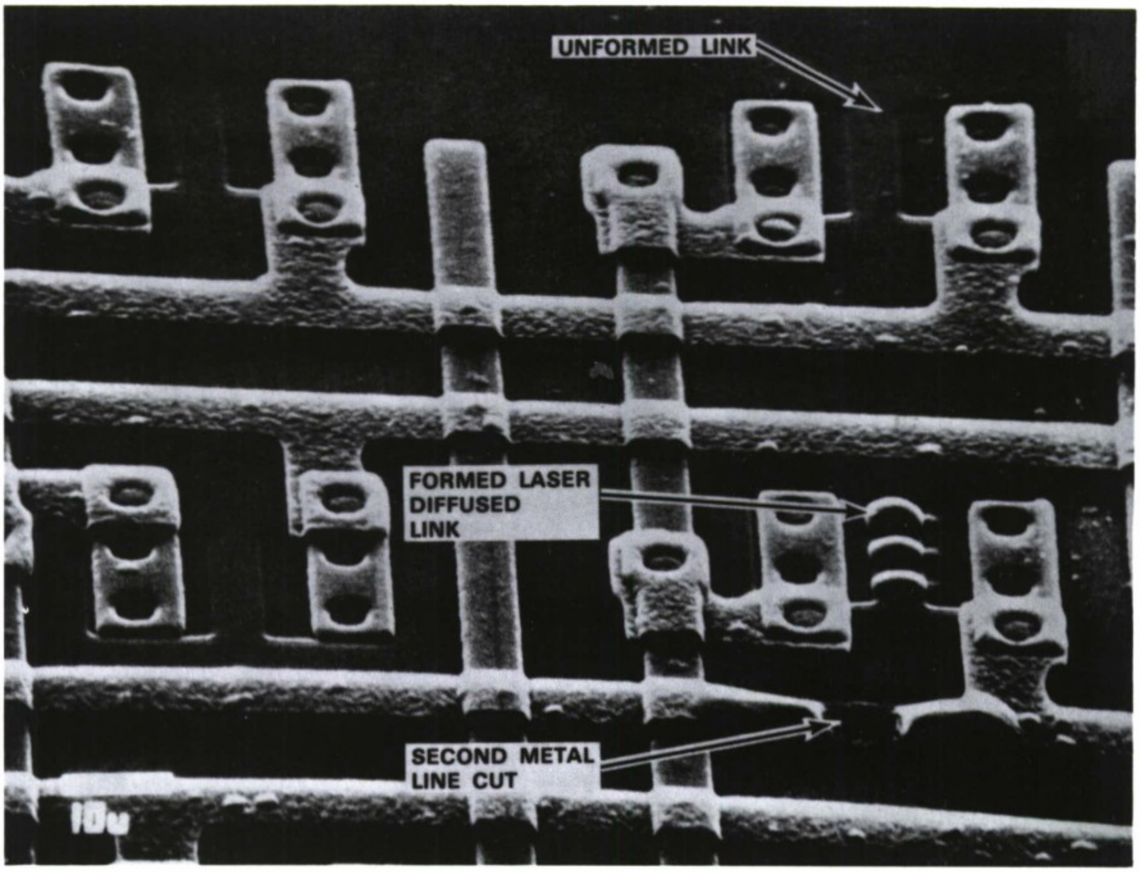

Figure 1-1. SEM micrograph of a laser-induced link and a second metal cut. Both formed and unformed links are shown. The formed links utilized a higher than needed power level. This gave rise to the curving-up of the field oxide, and rendered the laser effect visible.

rendering the links visible. Figure 1-2 is a schematic cross section of the link region. The linking process is done after all other processing steps have been completed and following functionality tests of the various components of the WSI system. Because of this, an accurate control of the process parameters is necessary, or else irreversible damage to nearby devices may occur. Hence, it is essential to accurately quantify the resulting molten zone characteristics following the application of the laser pulse.

The theory of laser melting of a semiconductor substrate is basically that derived from the heat-diffusion equation and, as such, is common to all applications involving heating or melting a substrate. The type of laser used, however, depends on the particular application, and in turn dictates certain theoretical (and practical) considerations. In particular, the question of reflectivity from a combined liquid/solid system was not adequately addressed in previous studies. We shall pay special attention to this issue.

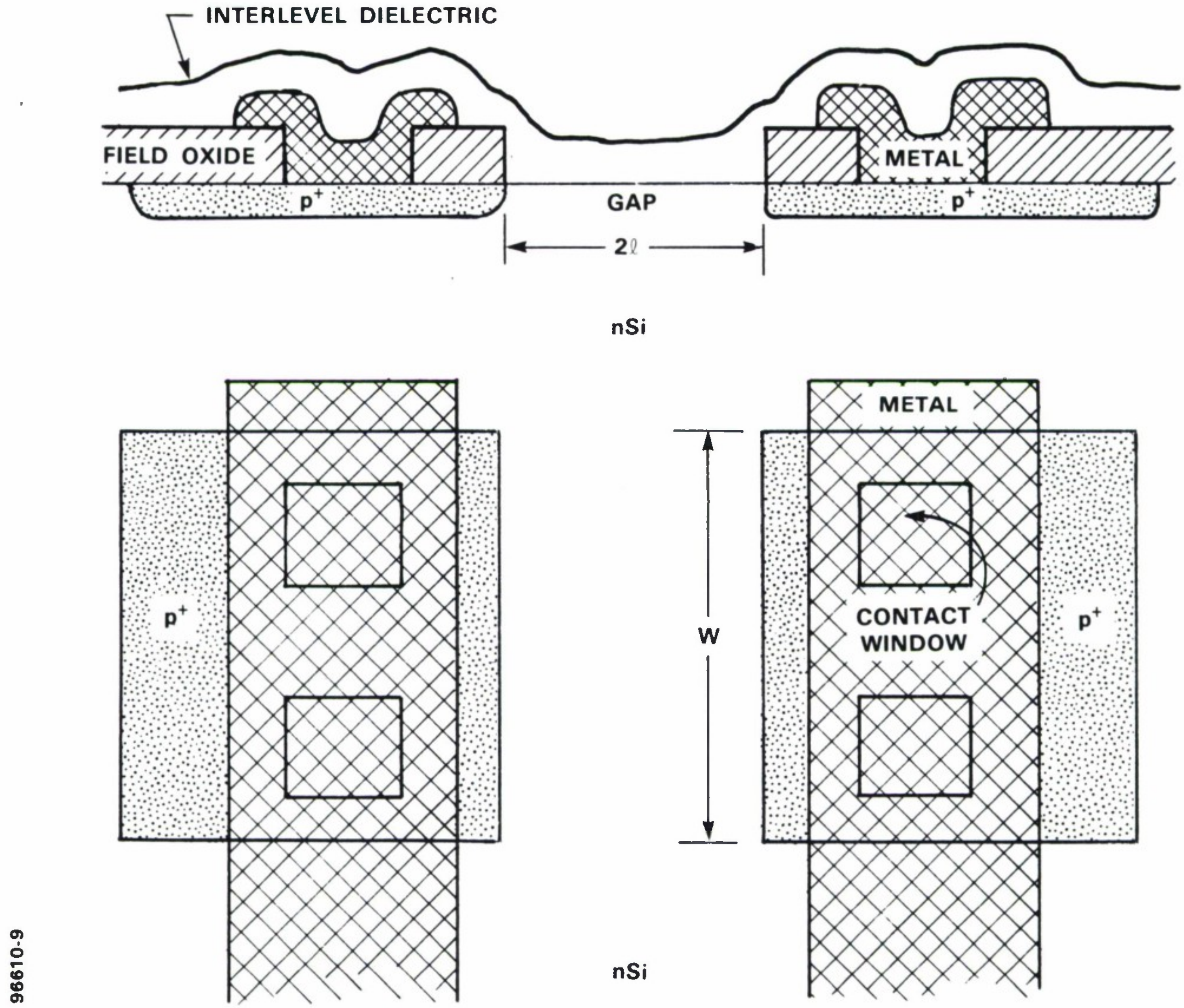

Figure 1-2. Schematic cross section and top view of the LIDL structure.

The plan of this report is as follows. In Section 2 we outline in detail the theoretical considerations that form the basis for the analysis of WSI applications. In Section 3 we describe the experimental system used for realizing the LIDL concept. We follow by appropriate calculations of the thermal profiles in the substrate and related quantities. These calculations and the related experimental results are detailed in Section 4. We conclude in Section 5 with a summary.

2. THEORETICAL CONSIDERATIONS

In the present study we model the case of a bare silicon substrate subject to a laser pulse of a given power, and temporal and spatial characteristics. In a real device the planar silicon surface is covered with several layers of oxides and other insulators. The main effect of these films is to change the degree to which the incident beam is reflected. For the purpose of elucidating the important effects of the laser-silicon interaction, we need not consider the influence of these films. This can be done in a straightforward manner once the films' thicknesses and their refractive indices are known.

The local heating caused by a laser beam applied to an absorbing medium, and related phenomena have been the subject of many studies. The basic heat conduction phenomena were in fact fully understood well before the invention of the laser, and all the necessary theoretical tools were already developed [16]. Thus, the studies aimed at characterizing the laser-induced processes have only to properly account for the properties of a given laser/substrate system [17]-[31]. For the LIDL application, the laser pulse is a few watts at about 500-nm wavelength (argon ion, multimode), with duration of 10 to 1000 μs. The time to melt silicon is < 1 ps (provided the power level is adequate), so that it is appropriate to treat the laser as a true stationary source and determine a steady-state solution.

2.1 BACKGROUND

The phenomenological theory of heat conduction in matter relates the flux, or rate of heat transfer, to the temperature gradient which is the cause of the heat flow. In three dimensions the fundamental law of heat conduction is formulated as [16]

$$\vec{\Phi} = -k \vec{\nabla} T \tag{2.1}$$

where $\vec{\Phi}$ is the flux vector, k is the thermal conductivity and $\vec{\nabla} T$ is the temperature gradient. By relating the flux vector to the time rate of change of the enthalpy the heat-diffusion equation is obtained

$$\frac{\partial}{\partial x}\left(k\frac{\partial T}{\partial x}\right) + \frac{\partial}{\partial y}\left(k\frac{\partial T}{\partial y}\right) + \frac{\partial}{\partial z}\left(k\frac{\partial T}{\partial z}\right) + S(x,y,z;t) = \rho c\frac{\partial T}{\partial t} \tag{2.2}$$

where the specific heat c, the conductivity coefficient k, and the density ρ are all temperature dependent. The function $S(x,y,z;t)$ describes the heat source. We have substituted $\rho c T$ for the enthalpy ignoring the small contribution to H that is due to the latent heat of melting. This is justified in all cases where the deposited energy is much larger than required for the phase transition in forming the molten zone. Since the latent heat of melting for silicon is 3280 J/cm^3, a relatively small amount of energy is needed to form a typical LIDL molten region whose volume is usually under 10^{-9} cm^3. A simple calculation reveals that for a typical power level of 3 W, a pulse duration larger than few 10 μs is sufficient to satisfy this assumption.

Equation 2.2 is non-linear, and as such does not lend itself to a tractable analytical solution. A common approach employed in studying the solutions of this equation is to invoke the Kirchhoff transformation [16]

$$\Theta = k_0^{-1} \int_{T_0}^{T} k dT \tag{2.3}$$

where $k_0 \equiv k(T_0)$, and T_0 is the ambient temperature. The parameter Θ has dimensions of temperature and is known as the linear temperature. Combining Eqs. 2.2 and 2.3 leads to the linearized heat-diffusion equation

$$\nabla^2 \Theta - D^{-1} \frac{\partial \Theta}{\partial t} = \frac{-S}{k_0} \tag{2.4}$$

where $D = k/\rho c$ is the heat diffusion coefficient. The temperature distribution obtained from the solution of Eq. 2.4 has to be back transformed in order to obtain the one for the real physical system.

The solution of Eq. 2.4 can be most simply described in terms of the appropriate Green's function. The solution depends on the given boundary conditions. In our case, dealing with a semi-infinite substrate, we demand that $\partial\Theta(z)/\partial(z) \mid_{z=0} = 0$, and $\lim_{z\to\infty} \Theta(z) = 0$ (the sample's surface is located at $z = 0$). If ϕ is the solution of Eq. 2.4 with $S = 0$ then it can be shown that for the non-homogeneous Eq. 2.4 we have

$$\Theta(\vec{r}, t) = \int_{-\infty}^{t} dt' \int_{-\infty}^{\infty} d^3 r' \frac{DS}{k_0} \phi \tag{2.5}$$

with the solution of the homogeneous equation being [16]

$$\phi = \frac{1}{8[\pi D(t-t')]^{3/2}} \exp\left[\frac{-(\vec{r} - \vec{r}') \cdot (\vec{r} - \vec{r}')}{4D(t-t')}\right], \quad t > t' \tag{2.6}$$

Thus all that is needed in order to determine the linear temperature is knowledge of the laser source function.

The function $S(x, y, z; t)$ in the case of interest here describes a laser source applied for a short duration of time and confined in space to a small spot. Other features of the heat source that we need consider are the penetration depth of the beam, and the absorptivity as a function of depth. A subtle question is that of the reflectivity from the surface and from the melt once it starts to form. The electrical properties of the molten semiconductor resemble those of a metal. There is, therefore, a jump in the reflectivity at this point. For the time being, however, we shall make the simplifying assumption that the reflectivity is constant. This assumption allows us to obtain closed-form analytical expressions for the relevant quantities. The real physical nature of the reflectivity will be accounted for in a numerical model that we shall introduce later on.

The source function is given as the product of the beam power density $Q(x, y, z)$, the total absorption function $f(z)$, and the non-reflected fraction $1 - R$, where R stands for the reflectivity

$$S(x,y,z) = (1-R)Q(x,y,z)f(z) \tag{2.7}$$

The beam's power density per unit of volume is defined as

$$Q(x,y,z) = \frac{P}{\pi x_e y_e}\alpha I(x,y) \tag{2.8}$$

where $I(x,y)$ is the spatial profile intensity of the beam, P is the total incident power, x_e and y_e are the $1/e$ radii of the beam which is assumed to have an elliptical intensity profile, and α is the absorption coefficient. The absorption coefficient enters this equation as a measure for the penetration depth. Note that $\pi x_e y_e/\alpha$ is the characteristic unit of volume.

In our system the laser beam is a Gaussian of circular symmetry in the (x,y) plane, which we take to be the surface plane of the sample. Thus, the origin $x=y=z=0$ marks the center of the beam on the silicon surface. The z axis is taken along the direction of propagation of the beam. For a beam of circular symmetry $x_e = y_e$ and we have

$$I(x,y) = \exp\Big(-\frac{x^2+y^2}{x_e^2}\Big) \tag{2.9}$$

The actual form of $f(z)$ depends on the type of laser used. For most of our work we use an argon ion laser with wavelengths about 500 nm. For this laser a δ-function dependence, i.e., $f(z) = \delta(\alpha z)$ is a very good approximation. This is so because for this type of laser when applied to silicon, $\alpha^{-1} \ll 1$ μm (at elevated temperatures), which is of the order of a typical diffusion length for sufficiently long pulses. In fact, according to Jellison and Modine [32], α as a function of temperature is given by $\alpha(T) = 7.5 \times 10^3 \exp(T/435)$ cm^{-1}, so that at higher temperatures we indeed find very small penetration depths.

The δ-function representation of $f(z)$ assumes, of course, that the entire beam energy is deposited on the surface. In reality, the beam does penetrate the solid to some extent, particularly if melting does not occur instantaneously. Thus, a more adequate choice for $f(z)$ may be obtained by using the Beer-Lambert law, which yields the general form $f(z) = \exp(-\int_0^z \alpha(z')dz')$. This may be approximated by $f(z) = \exp(-\alpha z)$ if we assume the absorption coefficient to be depth independent. Either of these forms may be necessary in dealing with laser radiation that has a high penetration depth into silicon. For example, for a CO_2 laser the value of α at room temperature is about 1 cm^{-1} [25].

2.2 TEMPERATURE PROFILES

The general form of the Gaussian source function is thus given by

$$S(x,y,z) = \frac{(1-R)P}{\pi x_e^2}\alpha(T)\exp\Big(-\frac{x^2+y^2}{x_e^2}\Big)\exp\Big(-\int_0^z \alpha(z')dz'\Big) \tag{2.10}$$

Inserting the expressions for the source function with $f(z) = \delta(\alpha z)$, together with the expression for ϕ, in Eq. 2.5 and integrating over the $\vec{r}\prime$ space, leads to

$$\Theta(x,y,z;t) = \frac{(1-R)P}{k_0} \int_{-\infty}^{t} dt' \; D \frac{\exp\left[-\frac{x^2+y^2}{4D(t-t')+x_e^2}\right] \exp\left[-\frac{z^2}{4D(t-t')}\right]}{[\pi^3 D(t-t')]^{1/2}[4D(t-t')+x_e^2]} \tag{2.11}$$

Now, substitute $\xi^2 = 4D(t-t\prime)$ so that $dt\prime = -\xi d\xi/2D$. With this Eq. 2.11 transforms into the following expression

$$\Theta(x,y,z) = \frac{(1-R)P}{\pi^{3/2}k_0} \int_0^{\infty} d\xi \frac{\exp\left(-\frac{x^2+y^2}{\xi^2+x_e^2}\right)\exp\left(-\frac{z^2}{\xi^2}\right)}{\xi^2+x_e^2} \tag{2.12}$$

This result does not depend on any parameter that is temperature dependent except for the reflectivity R. If the integration were only extended to an upper limit that equals the diffusion length $2\sqrt{Dt}$, then the result would be the linear temperature at time t. Hence, for finite times, Θ depends on the value of the diffusivity, D, as well. The upper limit of infinity expresses our assumption of a steady state.

The heat conductivity and diffusivity in silicon show a typical hyperbolic dependence on temperature [19,22]. The fitted expression for $k(T)$ reads

$$k(T) = \frac{299}{T-99} \tag{2.13}$$

This relation holds true for as long as $T \leq T_{\text{mlt}}$, where T_{mlt} is the melting temperature. For the melt itself, we assume a different temperature dependence based on available experimental data for the electrical conductivity. The data quoted by Glazov et. al. [33] suggest that the electrical conductivity drops slowly with the increasing melt temperature. It is roughly $1.15 \times 10^4 \Omega^{-1}$ cm^{-1} at the vicinity of the melting temperature. The thermal conductivity of the melt may then be obtained by appealing to the Weidemann-Franz law [34]

$$k(T) = L\sigma T \tag{2.14}$$

where the Lorenz number L is equal to 2.45×10^{-8} W Ω/K^2. Substituting the above value for σ we get for the melt's conductivity $k_{\text{mlt}} = 0.5$ W/cmK. From Eq. 2.3 we have

$$\Theta(T) = k_0^{-1}\Big[\int_{T_0}^{T \leq T_{\text{mlt}}} \frac{299}{T'-99} dT' + \int_{T_{\text{mlt}}}^{T} k_{\text{mlt}} dT'\Big] \tag{2.15}$$

A straightforward integration gives

$$\Theta(T) = (T_0 - 99)\ln\Big(\frac{T-99}{T_0-99}\Big), \quad T \leq T_{\text{mlt}} \tag{2.16}$$

and

$$\Theta = (T_0 - 99) \ln \frac{T_{\rm mlt} - 99}{T_0 - 99} + k_{\rm mlt} \frac{T_0 - 99}{299} (T - T_{\rm mlt}), \quad T > T_{\rm mlt} \tag{2.17}$$

The first term in Eq. 2.17 is simply $\Theta_{\rm mlt}$, the linear temperature that corresponds to the real melting temperature, so that

$$\Theta = \Theta_{\rm mlt} + k_{\rm mlt} \frac{T_0 - 99}{299} (T - T_{\rm mlt}), \quad T > T_{\rm mlt} \tag{2.18}$$

We may rearrange these relations in order to express the real temperature in terms of the linear temperature. The results read

$$T(\Theta) = 99 + (T_0 - 99) \exp\Big(\frac{\Theta}{T_0 - 99}\Big), \quad \Theta \leq \Theta_{\rm mlt} \tag{2.19}$$

and

$$T(\Theta) = T_{\rm mlt} + \frac{299}{k_{\rm mlt}(T_0 - 99)} (\Theta - \Theta_{\rm mlt}), \quad \Theta > \Theta_{\rm mlt} \tag{2.20}$$

These are the main results that follow from the solution of the linearized heat-diffusion equation. Once Θ is obtained numerically by solving the integral of Eq. 2.12, T may be calculated by means of Eqs. 2.19 and 2.20. Certain other quantities can be expressed in a closed form. Thus, Eq. 2.12 can be solved analytically for the maximum linear temperature, $\Theta_{\rm max}$, obtained at the origin. Setting $x = y = 0$ in Eq. 2.12, results in

$$\Theta_{\rm max} = \frac{(1-R)P}{\pi^{3/2} k_0} \int_0^\infty \frac{d\xi}{\xi^2 + x_e^2} = \frac{(1-R)P}{2\pi^{1/2} k_0 x_e} \tag{2.21}$$

The temperature distribution along the z-axis may be obtained by setting $x = y = 0$. We have

$$\Theta(z) = \frac{(1-R)P}{\pi^{3/2} k_0} \int_0^\infty d\xi \frac{\exp\Big(-\frac{z^2}{\xi^2}\Big)}{\xi^2 + x_e^2} \tag{2.22}$$

Upon integration we obtain

$$\Theta(z) = \Theta_{\rm max} \Big[1 - \Phi\Big(\frac{z}{x_e}\Big)\Big] e^{z^2/x_e^2} \tag{2.23}$$

where the probability integral is defined as

$$\Phi\Big(\frac{z}{x_e}\Big) = \frac{2}{\pi^{1/2}} \int_0^{z/x_e} dt\, e^{-t^2} \tag{2.24}$$

Finally, simplified results may be written down for the maximum temperature and the power required to reach the melting stage. By substituting the expression for $\Theta_{\rm max}$ in Eq. 2.19 we obtain

$$T_{\max} = 99 + (T_0 - 99)\exp\Big[\frac{(1-R)P}{598\pi^{1/2}x_e}\Big], \quad T_{\max} \le T_{\text{mlt}} \tag{2.25}$$

or

$$T_{\max} = T_{\text{mlt}} + \frac{299}{k_{\text{mlt}}(T_0 - 99)}(\Theta_{\max} - \Theta_{\text{mlt}}), \quad T_{\max} > T_{\text{mlt}} \tag{2.26}$$

Setting $T_{\text{mlt}} = T_{\max}$ in Eq. 2.25 we obtain for the threshold power to melting

$$P_{\text{mlt}} = \frac{598\pi^{1/2}x_e}{(1-R)} \ln \frac{T_{\text{mlt}} - 99}{T_0 - 99} \tag{2.27}$$

If we assume α to be finite but independent on z, then we have $f(z) = e^{-\alpha z}$. Inserting this relation in Eq. 2.7 leads to the following result for the linear temperature

$$\Theta(x,y,z) = \frac{(1-R)P\alpha}{2\pi^{3/2}k_0}\int_0^\infty d\xi I(z,\xi)\frac{e^{-\frac{x^2+y^2}{\xi^2+x_e^2}}}{\xi^2+x_e^2} \tag{2.28}$$

where

$$I(z,\xi) = \frac{\sqrt{\pi}}{2}\xi e^{\alpha^2\xi^2/4}\left\{e^{-\alpha z}\left[1-\Phi\left(\frac{\alpha\xi}{2}-\frac{z}{\xi}\right)\right] + e^{\alpha z}\left[1-\Phi\left(\frac{\alpha\xi}{2}+\frac{z}{\xi}\right)\right]\right\} \tag{2.29}$$

Eq. 2.28 reduces to Eq. 2.12 at the limit $\alpha \to \infty$, as can be readily verified.

2.3 THE ISSUE OF THE REFLECTIVITY

Thus far we have treated the reflectivity as being constant. The reflectivity of a sample is a function of the density of free charge carriers and hence in a semiconductor it is a strong function of the temperature. At the solid/liquid transition the reflectivity shows a discontinuity, jumping to a high value appropriate for a metallic-like state. Thereafter it continues to climb at a slow rate. For the temperature range preceding melting this dependence can be approximated for the argon ion laser by [22]

$$R(T) = 0.367 + 4.29 \times 10^{-5}T \tag{2.30}$$

This equation gives the correct observed value at room temperature (0.37 for the argon 514-nm band) as well as that near melting (0.44). For a deep enough puddle of melt the reflectivity value is 0.72. For a shallow melt the value is not quite as high, increasing with the molten layer thickness owing to optical interference effects. This property of the reflectivity is very important for the melt formation, and hence deserves a careful examination. A detailed derivation of the parameters of interest may be found in the monograph by Born and Wolf [35]. The essential results are discussed in the Appendix A.

The argon ion laser source has several bands. Dominant outputs fall at roughly 458, 488 and 514 nm. At these frequencies the indices of refraction for [liquid, solid] silicon are $[(1.999 + i4.453), (4.633 + i0.096)]$, $[(2.142 + i4.594), (4.356 + i0.064)]$, and $[(2.267 + i4.716), (4.241 + i0.046)]$, respectively [36]. Figure 2-1 depicts the results of the calculation of the reflectivity for these three major bands. Note the gradual increase in the reflectivity of the melt as the melt depth increases. We see that the transition at melting is not a sharp one due to the interference effects discussed above. This gradual increase in R allows for a "smoother" coupling of the laser power to the substrate. Otherwise, for a sharp transition some 70% of the impinging power would be reflected immediately and the melt would probably resolidify, leading to oscillations in the phase transition process.

2.4 A DYNAMICAL MODEL FOR THE REFLECTIVITY

In many published studies on laser applications to semiconductors the reflectivity is taken to be that of the solid phase even when melting is known to take place. Strictly speaking, the reflectivity is a function of space and time during the pulse duration because it is a function of temperature, and this happens to vary for each point during the time portion of the pulse when the power increases to its maximum value. However, a simple analytical model for R is not available. One attempt to account for the reflectivity in obtaining the temperature distribution in the substrate had to rely on assuming a particular functional form for R, and having to a priori assume the melt position [20]. In another attempt [22] the solid-state value of R was used throughout, and the resulting unrealistically high temperatures were superficially renormalized in order to better conform with expected temperature distributions in the substrate. Most other studies ignored the important issue of the reflectivity change upon melting, and hence their results are only valid for a heated solid.

According to Eqs. 2.5 and 2.7 the reflectivity parameter should indeed appear inside the spatial integral. Taking R outside the integral can be justified provided an adequate algorithm can be developed that would allow for a numerical account of the effect due to the reflectivity. Let us assume for a while that R can assume only one of two possible values: either the solid or the (bulk) liquid reflectivity value. For values of the power which are smaller than the threshold power to melting (Eq. 2.27) the above theoretical results are obviously justified. For the rest of the time during which the power increases, the molten surface region continues to grow until a steady state is reached. During this growth stage the reflectivity keeps changing for surface points that undergo the phase transition. However, what is conceptually important is that for each region (solid or liquid) the reflectivity is a constant that may be taken outside the integral, giving justification to the theoretical approach outlined above. The model so far is equivalent to assuming a step function form for R, with the discontinuity positioned at x_{mlt}, where the latter stands for the melt position at the surface along the x-axis (for a circularly symmetric beam it is sufficient to consider the x and z coordinates). As the melt grows, x_{mlt} increases so that the pattern of R varies with time during the period when the power increases to its maximum value. Adding the dependence on the melt depth to R, as dictated by Eq. A.11 of Appendix A, poses no conceptual difficulty, and only

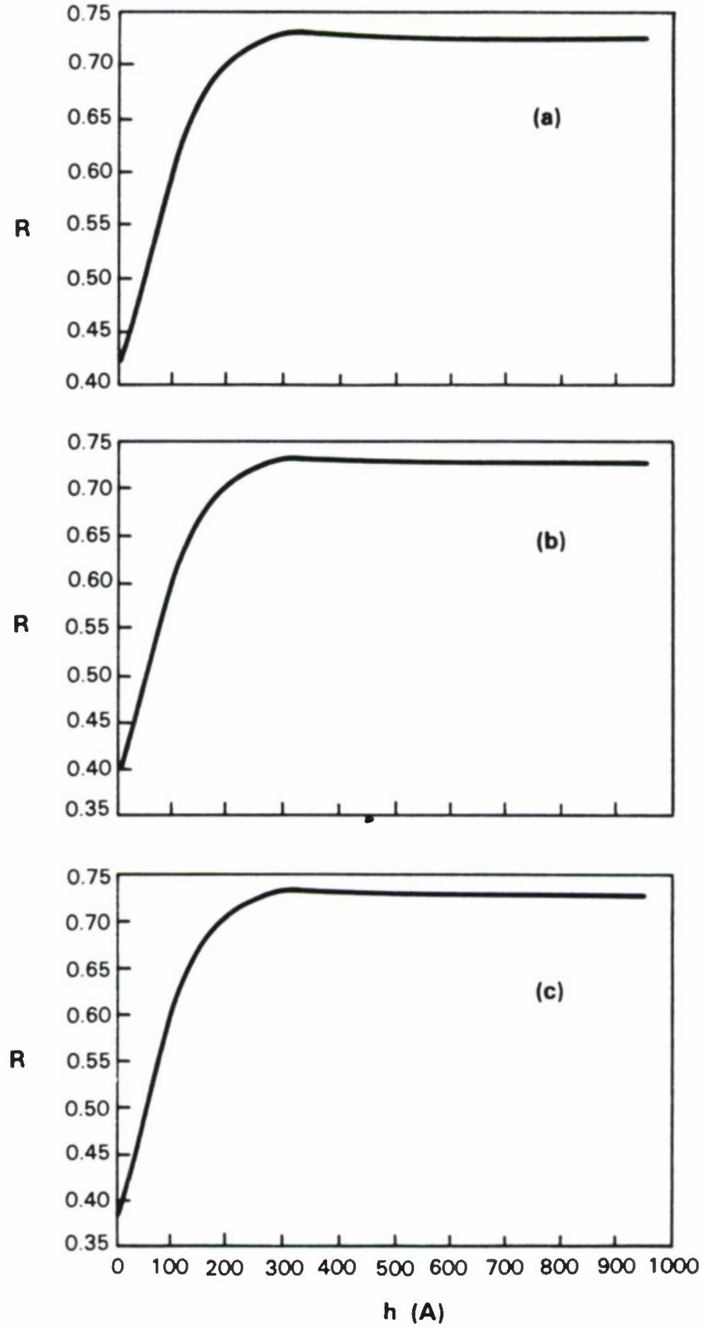

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Figure 2-1. The reflectivity of molten silicon as a function of the melt thickness. The calculation according to Eq. A.11 is for the three main argon laser modes at (a) 458 nm, (b) 488 nm, and (c) 514 nm.

requires a proper adjustment in the numerical algorithm. This entire approach is based on the fact that for relatively long pulses ($\gg 1\mu$ s) the power reaching the surface rises to its maximum value over a period of time, long enough as compared with a typical diffusion time needed to reach the final position of the melt front. For example, in the LIDL process a typical melt radius (at the surface) is roughly 5 μm. At the melting temperature the heat diffusion coefficient is equal to 0.1 cm^2/s. Based on these we get for the diffusion time, $t = x_{\rm mlt}^2/4D$, a value of 0.625 μs . The melting process is directly related to the rise time for values comparable to or greater than this diffusion time. Our laser system meets this criterion.

This time dependence of the pulse power controls the temperature evolution in the substrate. Since the power is being deposited gradually, in the evaluation of Eqs. 2.12 or 2.28 we slice the oncoming power to n portions, the number n being dependent only on the required accuracy. Usually a value of $n = 100$ is sufficient to obtain satisfactory results. The linear temperature is assumed to be made of a sum of n contributions according to $\Theta(\vec{r}) = \Sigma_{i=1}^{n}\Delta_i\Theta(\vec{r})$. In the first step we calculate $\Delta_1\Theta$ by means of Eq. 2.12, taking, say, R to be the value of the solid at room temperature, and the power is simply $\Delta p = P/n$. The temperature distribution is then obtained by means of Eqs. 2.19 and 2.20. This temperature distribution is then used to calculate the value of the reflectivity as a function of position. The new $R(x, z)$ dependence is used in calculating the next contribution to the linear temperature at each point, $\Delta_2\Theta$. Once $\Delta_2\Theta$ is obtained it is added to $\Delta_1\Theta$, and the sum is used to calculate the new intermediate temperature distribution. This is then used to obtain the next reflectivity profile needed to calculate the contribution $\Delta_3\Theta$, and so on. When the melt front on the surface reaches a prescribed value, say $3x_e$, (the results are insensitive to the exact number) the entire remaining power is applied at once taking R to be that of the bulk liquid. This accounts for the Gaussian shape of the source, and is only important for very narrow beam sources. We note that this model for the reflectivity may also be suitable for applications where a scanning, rather than stationary, laser beam is applied.

As we shall discuss in section 4, the process described above has been used in obtaining the melt characteristics in typical LIDL applications. The numerical results agree well with available experimental data. Before turning to discuss these data, however, we wish to present some additional theoretical results that set the limits on the geometrical features of the molten zone, for the case of an argon ion laser.

First consider Figure 2-2a. Here we display the results of the calculation for a typical application when the power is set to 3.5 W and the argon laser beam diameter is 5 μm. The silicon substrate is held at room temperature. In this particular calculation the reflectivity was taken to be constant at the value of the solid, and hence the entire power was applied in one step. For these beam parameters, this establishes an upper limit, x_s, on the melt's lateral extension at the surface.

We can obtain an exact result for a practical lower bound on $x_{\rm mlt}$ and an upper bound on the equivalent parameter $z_{\rm mlt}$ if we examine the limiting case of a very narrow beam, i.e., at the limit $x_e \to 0$. For such a beam the power density is infinite, so the silicon under the beam melts immediately, and the bulk liquid value of the reflectivity, $R_{\rm liquid}$, is appropriate for all of the power. Let us first examine the value of the lateral extension of the melt in this limit, x_l. From Eq. 2.12 we have for the temperature on the surface

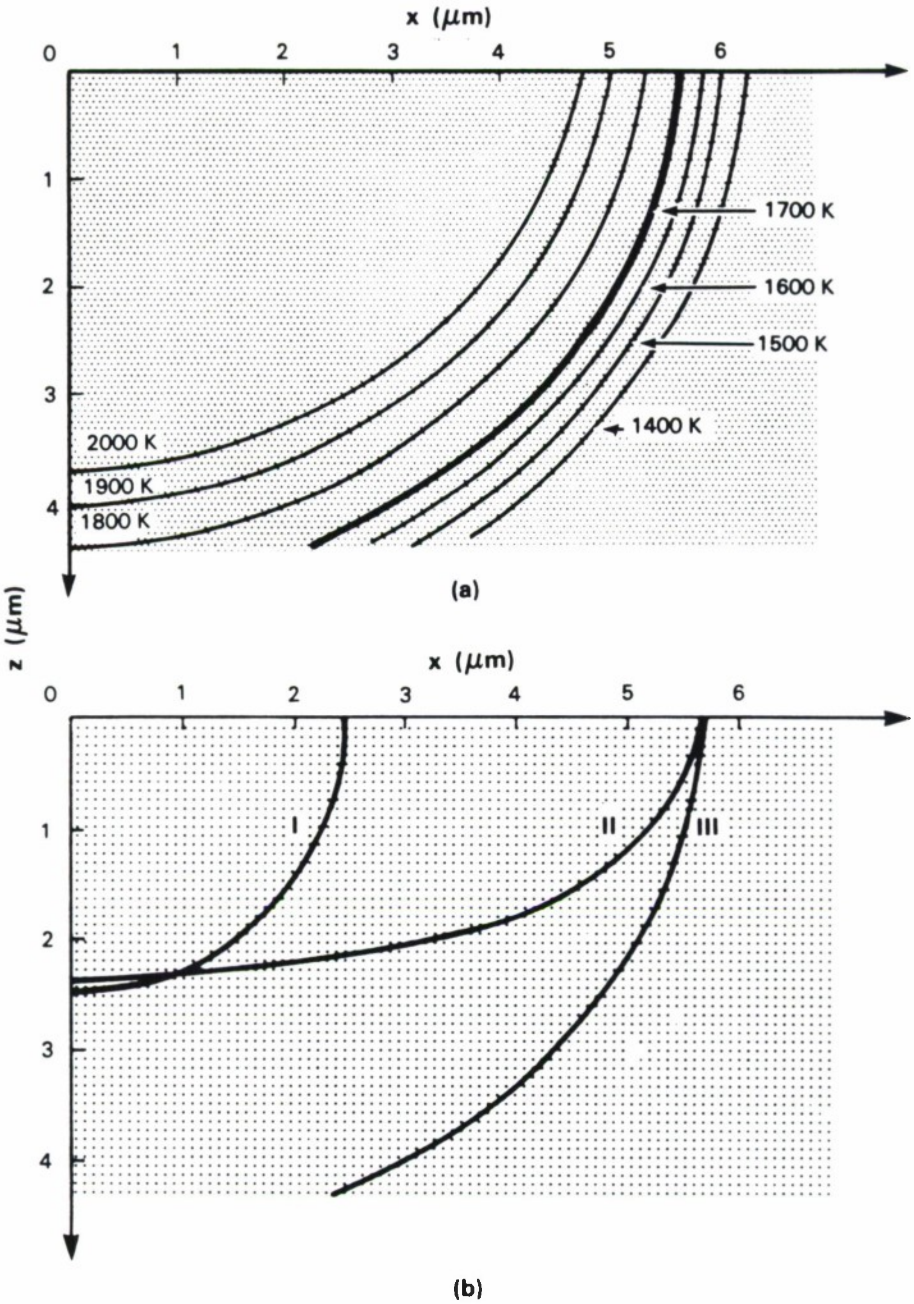

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Figure 2-2. The temperature profile in silicon at steady state. $P = 3.5$ W, $x_e = 2.5$ μm, $T_0 = 295$ K. Case (a) describes the results of the calculation assuming the reflectivity value to be constant at the solid value. Case (b) shows the melt front position as determined by the choice of the reflectivity value. Thus I stands for the reflectivity being constant at the molten silicon value and $x_e \rightarrow 0$, III is as in case (a) above, and II is the result of the calculation according to the model for the reflectivity described in the text with the beam parameters being as for III.

$$\lim_{x_e \to 0} \Theta(x) = \lim_{x_e \to 0} \frac{(1-R)P}{\pi^{3/2} k_0} \int_0^\infty d\xi \frac{e^{-x^2/\xi^2 + x_e^2}}{\xi^2 + x_e^2} = \frac{(1-R)P}{2\pi k_0 x} \tag{2.31}$$

Substituting Θ_{mlt} in this expression we get

$$x_l = \frac{(1 - R_{\text{liquid}})P}{2\pi k_0 \Theta_{\text{mlt}}} \tag{2.32}$$

For a typical case of $P = 3.5$ W and $\Theta_{\text{mlt}} = 410$ K (pertaining to silicon at room temperature), using the value $R = 0.724$ (a multi-mode argon laser; cf. Figure 2-1), we obtain $x_l = 2.6\mu$m. For any other realistic beam radius, the maximum value of x_{mlt} will vary between this value and x_s. (For high values of x_e, $x_{\text{mlt}} \to 0$.)

The value of the melt's depth may also be obtained analytically. Recall the result given by Eq. 2.23. Taking the limit $x_e \to 0$ as before, we obtain

$$\Theta(z) = \frac{(1-R)P}{2\pi k_0 z} \tag{2.33}$$

from which we get an expression for the melt's depth

$$z_l = \frac{(1 - R_{\text{liquid}})P}{2\pi k_0 \Theta_{\text{mlt}}} \tag{2.34}$$

which is exactly the same result as obtained above for x_l. This is not surprising, of course, since taking the limit $x_e \to 0$ is equivalent to assuming a point source for which the resulting temperature distribution is radial.

The conclusion from this discussion is that for a laser pulse having a realistic radius the melt front should extend from a depth of about z_l to a surface point found a distance x_s from the origin. This is indeed the situation that emerges from the use of the algorithm for the reflectivity described above. Figure 2-2b displays the position of the melt front for the two limiting cases, as dictated by the solid and liquid values of the reflectivity, along with the resulting melt front for the dynamically varying reflectivity.

3. EXPERIMENTAL

The laser system used in the WSI applications consists of a 5 W argon ion laser running all lines for maximum possible power. The laser beam, mechanically or electrooptically chopped to yield 1 μs to 1 ms pulses, is directed using dielectric mirrors through a microscope system similar to those used in mask repair. The beam is focused via a 50X objective lens with a 0.6 numerical aperture onto the wafer surface. A video camera system is used to observe the wafer, and the signal from it is processed for an autofocus system by maximizing the contrast on the horizontal scan lines. This is required because a packaged wafer does not have a very planar surface. The wafer sits on a tilt table which is used to manually level the system and give an approximate rotational orientation. A computer controlled stepper motor z-axis drive adjusts the table height for the autofocus system. This, in turn, is mounted on a linear induction motor X-Y table with laser interferometry position control (accurate to < 0.5 μm). The whole system is controlled by a minicomputer. Figure 3-1 depicts the essential components of the LIDL process system.

The two most important parameters of the laser are the apparent power level, and the beam diameter. Only a fraction of the output power actually reaches the wafer, due mainly to losses in the various optical pathways. In our system we have found that 70% of the power delivered by the laser actually reaches the target. This fraction is constant, independent of the power level. Unlike the case in laser annealing or recrystallization processes, in the LIDL process exact control of the size of the molten zone must be guaranteed. As discussed earlier, this is so because the laser is applied at a late stage when most other processing steps have been completed. Any deviation from designed melt features could be detrimental to the integrity of the devices around the LIDL structure. Thus, in addition to controlling the power level we need also to determine the precise value of the beam diameter. As evident from the theoretical results of the previous section, this parameter influences the geometry of the molten zone. For the LIDL application the value of the beam spot diameter usually falls below 6 μm, and has to be measured accurately.

The spot size of the CW argon ion laser system has been measured by using a photodetector partially occluded by a "knife edge," positioned in the beam on the translation stage. The detector measures the two-dimensional definite integral of the beam from the edge of the half-space occluded by the knife edge to (effectively) infinity. If the beam is a two-dimensional Gaussian, the integral parallel to the knife edge is a constant, and the one perpendicular is the error function. The technique used is to move the detector and knife edge across the spot in precise increments, measuring the intensity at each point, from a full to totally shadowed beam. These data are then fitted to an analytic approximation to the error function, thereby extracting the beam width. The statistical goodness-of-fit provides a check of the assumed Gaussian shape of the beam, and measurements along several directions allow one to verify the rotational symmetry of the beam.

The unfocused beam (diameter of the order of a millimeter) can be measured using a thermopile laser power meter for the detector and a razor blade for the knife edge. These measurements show that for the range of powers used here the laser spot-size varies by less than $\pm 5\%$ as a function of power. For the measurement of the focused spot (diameter of the order of a micron), a planar pn

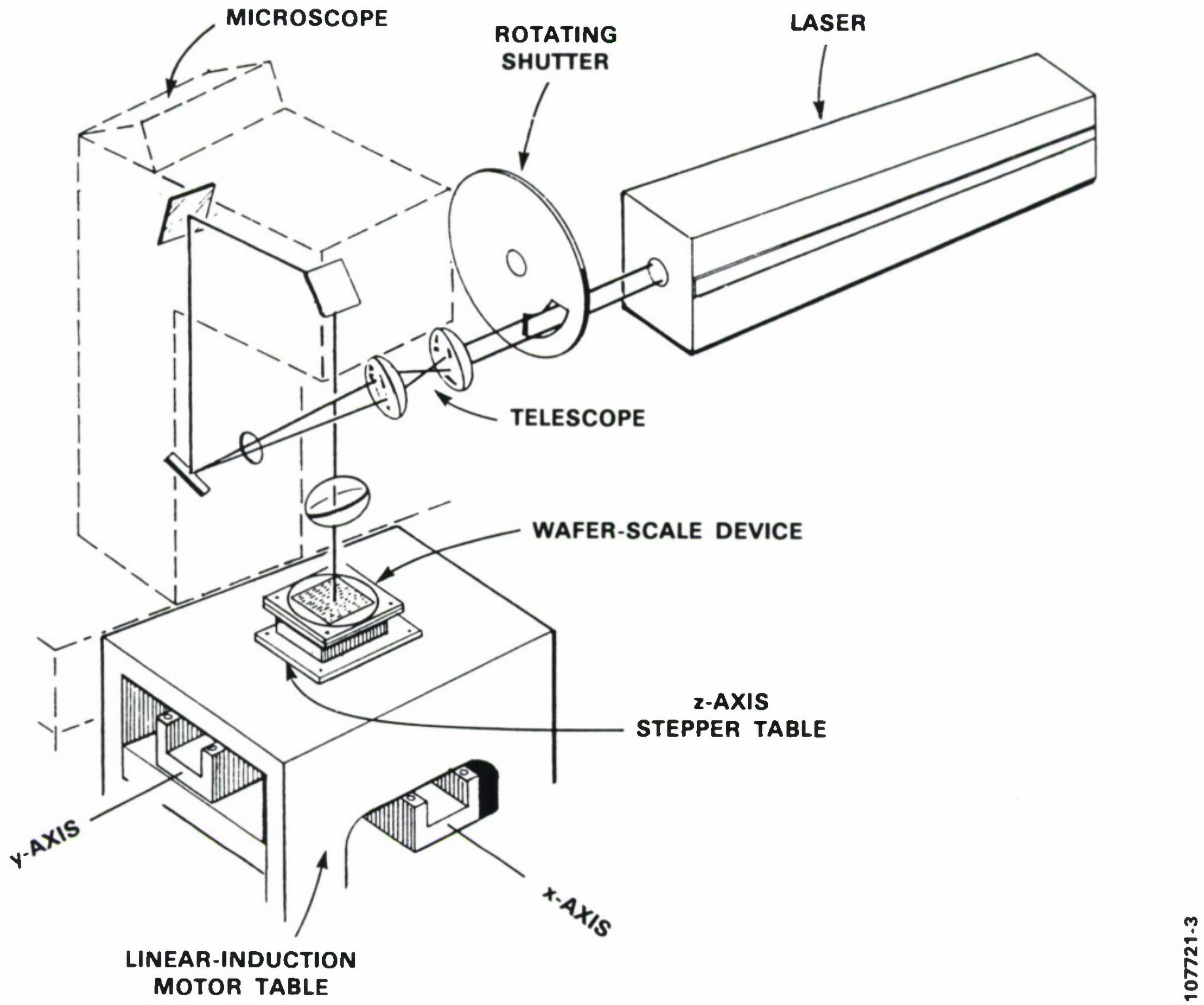

Figure 3-1. The LIDL process laser system.

junction has been fabricated on a chip, with a metallization layer partially masking its surface. The edge of the metallization is smooth enough for our purposes; its roughness is estimated to be of the order of $\pm$ 0.2 μm. It is necessary to use neutral density filters in the beam when measuring the focused spot to avoid damage to the measuring device. However, even at the minimum regulated power one can obtain from these lasers, a few hundred milliwatts, both absorptive and metal-reflective filters have been found to elastically deform under the thermal load of the CW beam, leading to a substantial distortion of the beam. This occurs at power levels well below the threshold for permanent damage. The problem can be avoided by using a dichroic filter (e.g., a mirror designed for the front of the laser cavity) to reduce the beam power to tens of milliwatts, below the onset of this distortion, or by using a low duty-cycle pulsed beam.

4. RESULTS AND DISCUSSIONS

In Section 2 we detailed the theory of heat diffusion in homogeneous solids and discussed the important issue of reflectivity. We shall now present the results of the calculations, and compare them to available experimental data. We have examined the effects owing to varying the beam parameters, i.e., the power, the diameter, and the pulse duration. In addition, the effect of the initial substrate temperature was studied. As discussed in what follows, the link properties are virtually independent of the laser pulse duration, beyond some limiting value that depends on the gap separation. In most of the experimental work reported here the pulse length was 1 ms, and the power ranged between 1 W and 4 W. These parameters mean that the absorbed energy in the substrate was of the order of several millijoules. The beam diameter could be varied in the range of 2 to 8 μm. The thermal parameters of silicon (ρ, k, c, D) are such that the volume of the melt that forms under such conditions happens to be under 3×10^{-10} cm^3. We can, therefore, disregard the negligible contribution owing to the latent heat of melting in all of the following calculations.

4.1 THE CASE OF INFINITELY LARGE ABSORPTION COEFFICIENT

We shall first discuss the results obtained using the argon ion laser. As discussed above, the absorption coefficient for this radiation in silicon is rather large. In the theoretical calculations we shall assume it to be infinitely large.

The theoretical predictions regarding the melt's lateral extension and depth were confirmed experimentally. Figure 4-1 depicts the results of a SIMS study following the application of laser pulses of same characteristics as above. By examining the dopant's concentration profile after the laser application we can infer on the depth position of the melt front. If we assume that the dopant diffusivity is such that during the pulse duration the dopants were able to diffuse all the way to the bottom of the melt's puddle, we may consider the agreement between theory and experiment to be very good. The SEM micrograph shown in Figure 4-2 depicts the lateral extent of the molten zone. The diameter of the melt at the surface in this case ($P = 2.5$ W, $x_e = 2.5$ μm) is in good agreement with the calculated result. In order to delineate the melt's lateral extension, x_{mlt}, a thin (250 nm) layer of undoped polycrystalline silicon was deposited on top of a boron doped silicon wafer (boron dose of 2×10^{15} cm^{-2}, at an energy of 40 keV). The laser was applied to this structure and the spots were stained by dipping in a buffered HF solution. The dark area clearly marks the extent to which boron has diffused in the recrystallized polysilicon film, thus indicating the lateral extension of the melt.

Figures 4-3 and 4-4 depict a successive variation of the temperature profiles as a function of the applied power. Note in particular the advance of the melt front (heavy line), and that of the "boiling front". The boiling temperature of silicon is not well known. In the literature values ranging from 2558 K to 3540 K are quoted [37]-[44], but most agree on a value in the narrower range between 2600 K and 2900 K. The importance of the melt front is, of course, in that it determines to a large extent the range in which the dopant redistribution may take place. The boiling front determines the size of the craters that may form in bare silicon, due to boiling and vaporization.

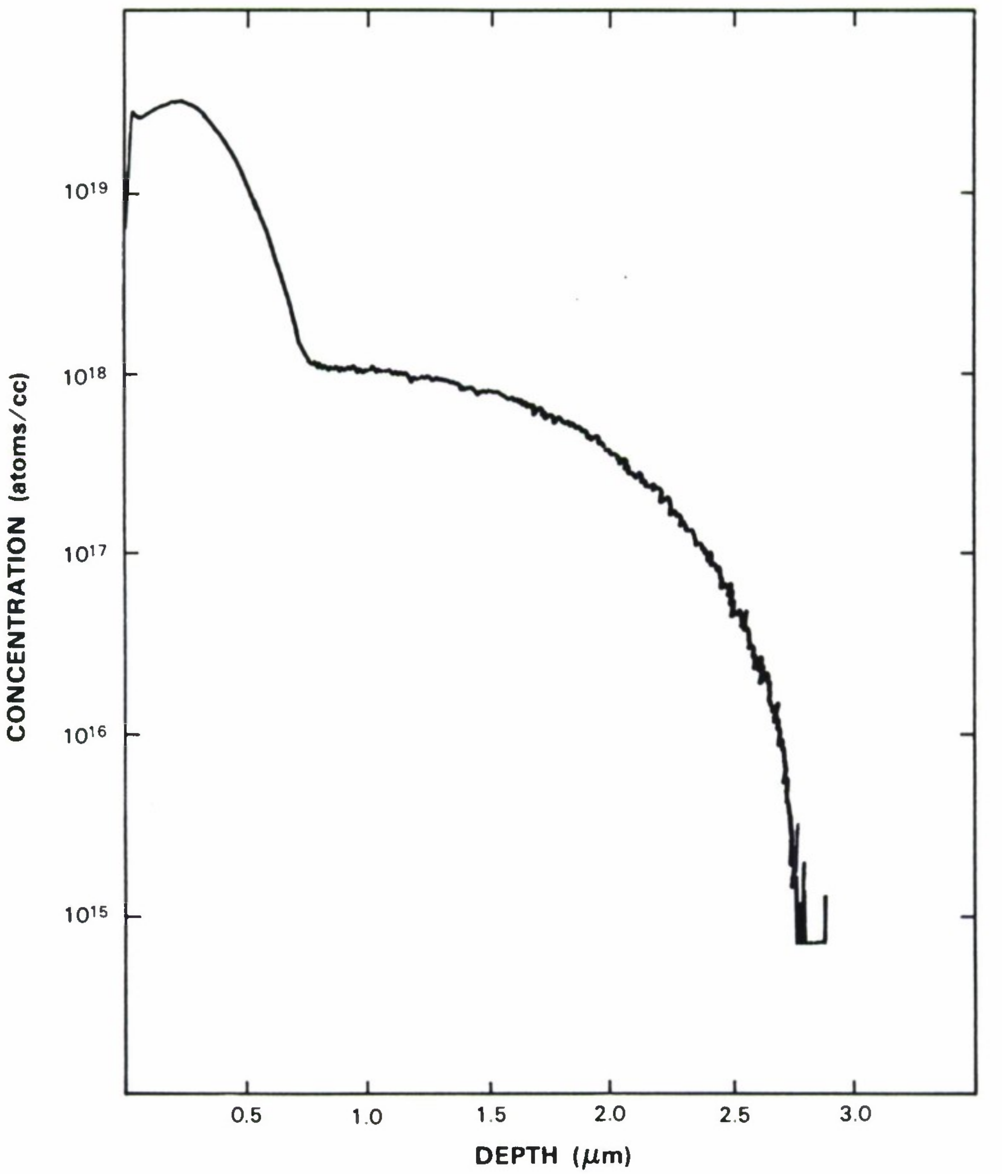

Figure 4-1. SIMS depth profile of boron following the laser application. The laser parameters are as specified in Figure 2-2a. The sample was covered with an oxide film during the laser application. The 15% discrepancy in the value of the melt's depth may be due to this oxide layer acting as an antireflecting film.

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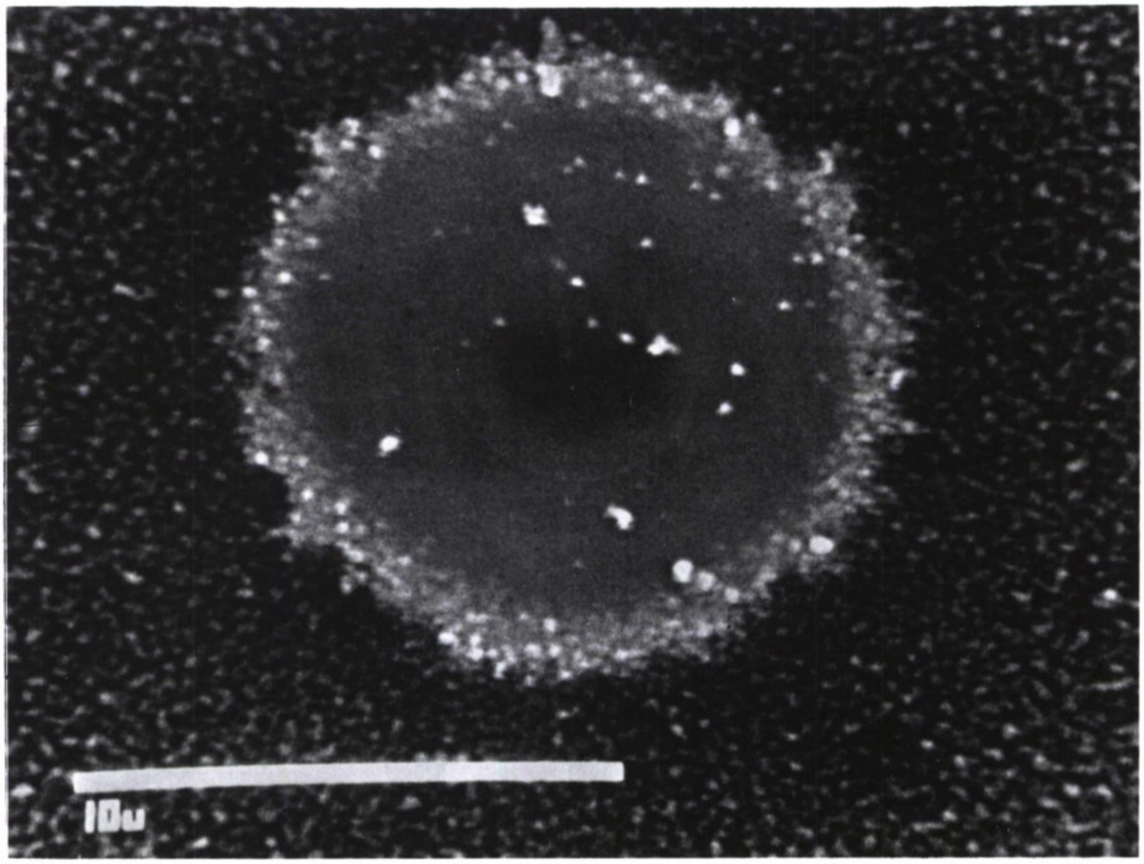

Figure 4-2. An SEM micrograph depicting a typical melt pattern following the laser application onto a bare silicon substrate. Note the polycrystalline silicon grain structure where resolidification did not take place. The laser power was 2.5 W, and the beam radius was 2.5 μm.

In Figures 4-3 and 4-4 we see how the position of these two isotherms gradually advances with the increasing power. Figure 4-5 depicts the measured and calculated results for the melt's lateral extension as a function of the power. Overall, a very good agreement has been obtained between theory and experiment.

SEM micrographs were also utilized in determining the depth of the boiling zone. In such an experiment an array of densely positioned gaps was fractured and examined. Figure 4-6 depicts a side view of a fracture through one such gap. Here, the laser power was 3 W, and its diameter was 5 μm. A top view SEM of this crater (Figure 4-6) reveals that the break line runs very close to its center, hence the dimensions measured on the SEM of Figure 4-7 are close to their maximum value. Assuming 2600 K to be the actual boiling temperature, the agreement between theory and experiment is satisfactory (cf. Figure 4-4a).

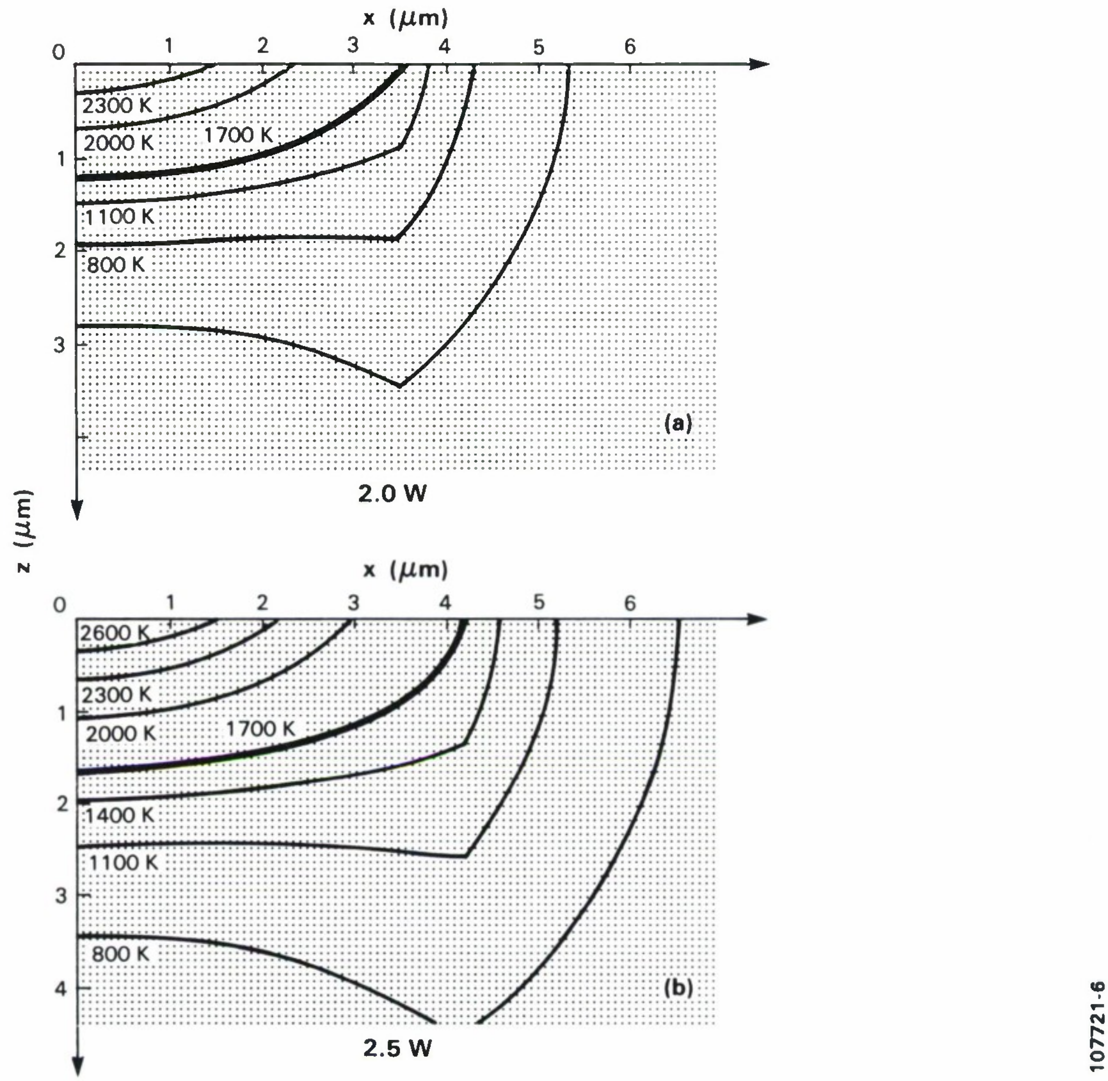

Figure 4-3. Temperature profiles in silicon as a function of applied power of (a) 2.0 W and (b) 2.5 W. In both cases the beam radius was taken to be 2.1 μm, and $T_0 = 295$ K was assumed.

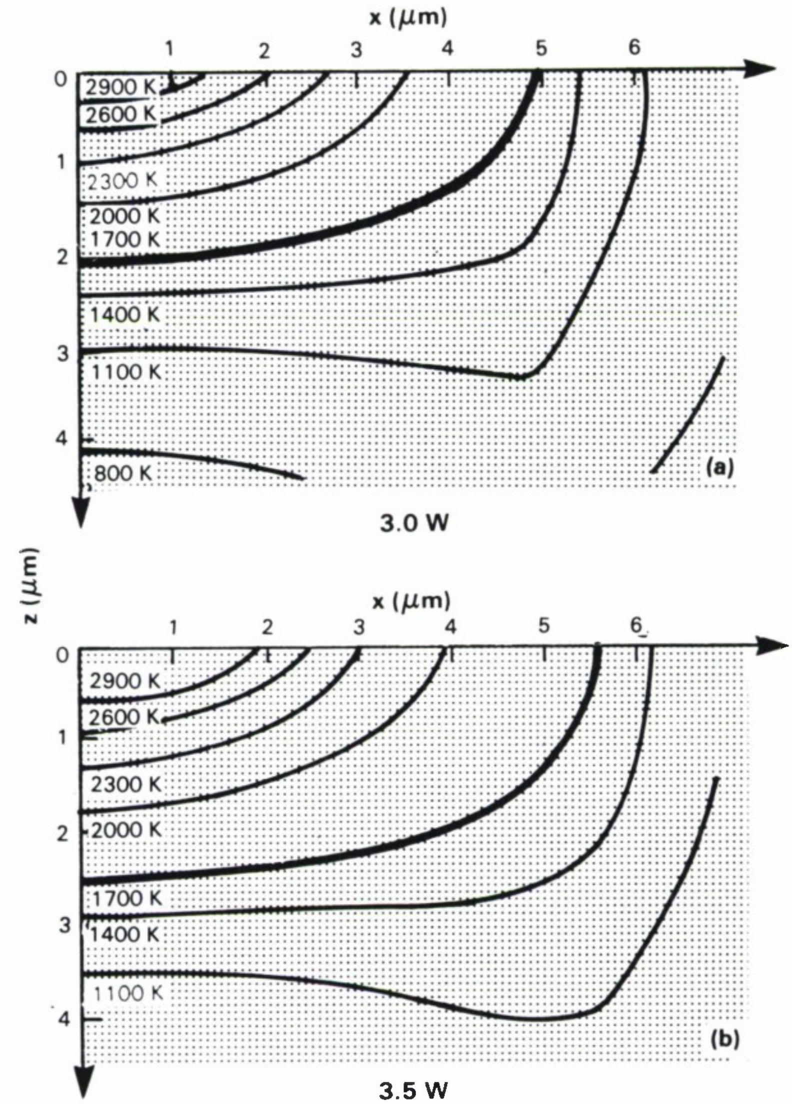

Figure 4-4. Temperature profiles in silicon as a function of applied power of (a) 3.0 W and (b) 3.5 W. In both cases the beam radius was taken to be 2.1 μm, and $T_0 = 295$ *K was assumed.*

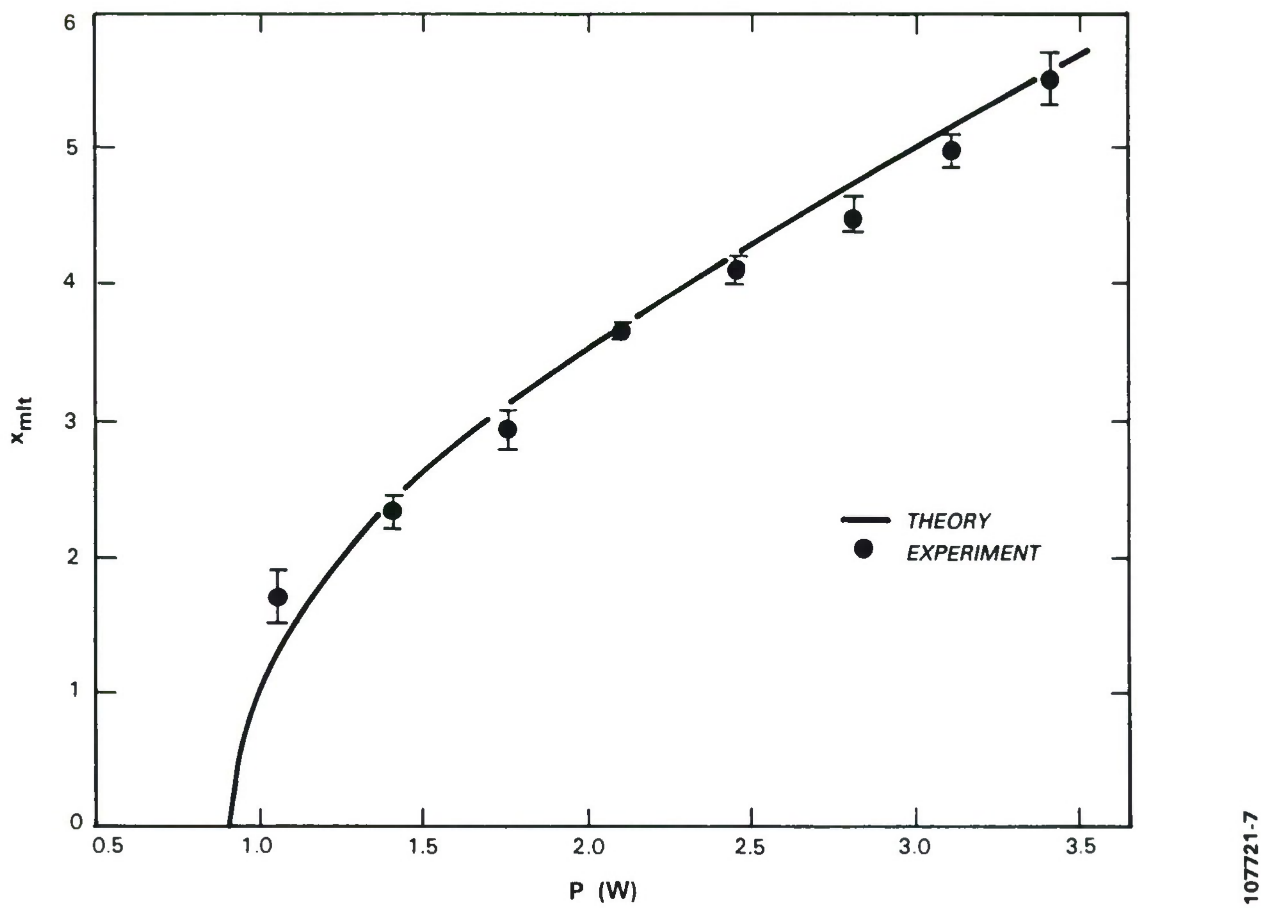

Figure 4-5. Measured (full circles) and calculated results for the melt's lateral extension as a function of power. The beam radius is 2.5 μm, and the ambient temperature is 295 K.

According to the theory outlined in section 2, both the melt front and the boiling front positions will depend on the initial temperature of the substrate, T_0. Hence, let us examine the situation in which the power and/or the beam diameter are maintained constants and the substrate temperature is varied. The calculation shows that at the range of powers utilized here, the dependence on power is seen to be nearly linear. At the commonly used power of 3.5 W, an increase of 128 K in the substrate temperature, is seen to lead to $\approx$ 25% increase in the lateral extension of the melt and over 30% in its depth. The relative change becomes smaller for lower applied powers.

The effect owing to the substrate temperature was also examined experimentally. The micrograph depicted in Figure 4-8 shows some of the results obtained. The two rows of laser gaps were performed at 20 C and 150 C (P = 2.1 W, x_e = 2.5 μm). The size difference between the evaporated regions of silicon in the two cases is clear.

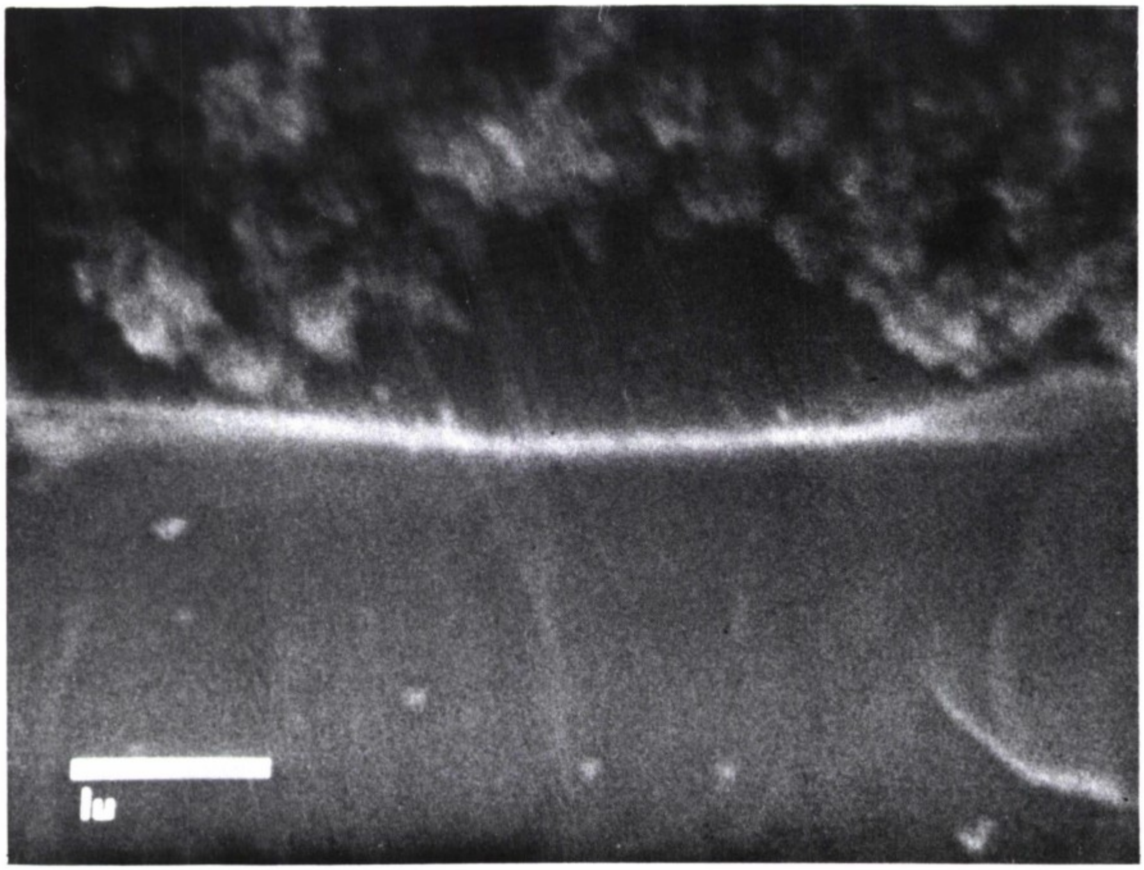

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Figure 4-6. SEM micrograph depicting the features of the superheated zone following the application of 3 W laser pulse (x_e = 2.5 μm). In this top view the scribe line is seen to run roughly through the center of the spot. This was one of many adjacent applications of the laser, explaining the large amount of "sputtered" silicon that covered most of the area, except for the deep evaporated zone.

Figures 4-9, 4-10, and 4-11 show how the melt and boiling front isotherms vary with the substrate temperature for a given power and beam radius. Note, in particular, how the position of the boiling front changes, in agreement with the experimental results mentioned above. The effect owing to variations in the ambient temperature may be utilized in actual device fabrication. One could lower the applied power necessary to achieve the same melt front position by moderately elevating the ambient temperature. For instance, a calculation shows that roughly the same melt front characteristics are obtained for the combination ($P = 3.5$ W, $T_0 = 295$ K, $x_e = 2.1$ μm) and ($P = 2.5$ W, $T_0 = 450$ K, $x_e = 2.1$ μm). Thus, a moderate change in the substrate temperature allows lowering the value of the applied power considerably, thereby helping to minimize any detrimental effect that the laser gap may have on the structural or physical integrity of the device. A related benefit is the reduction in size and maximum temperature seen in the superheated or boiling

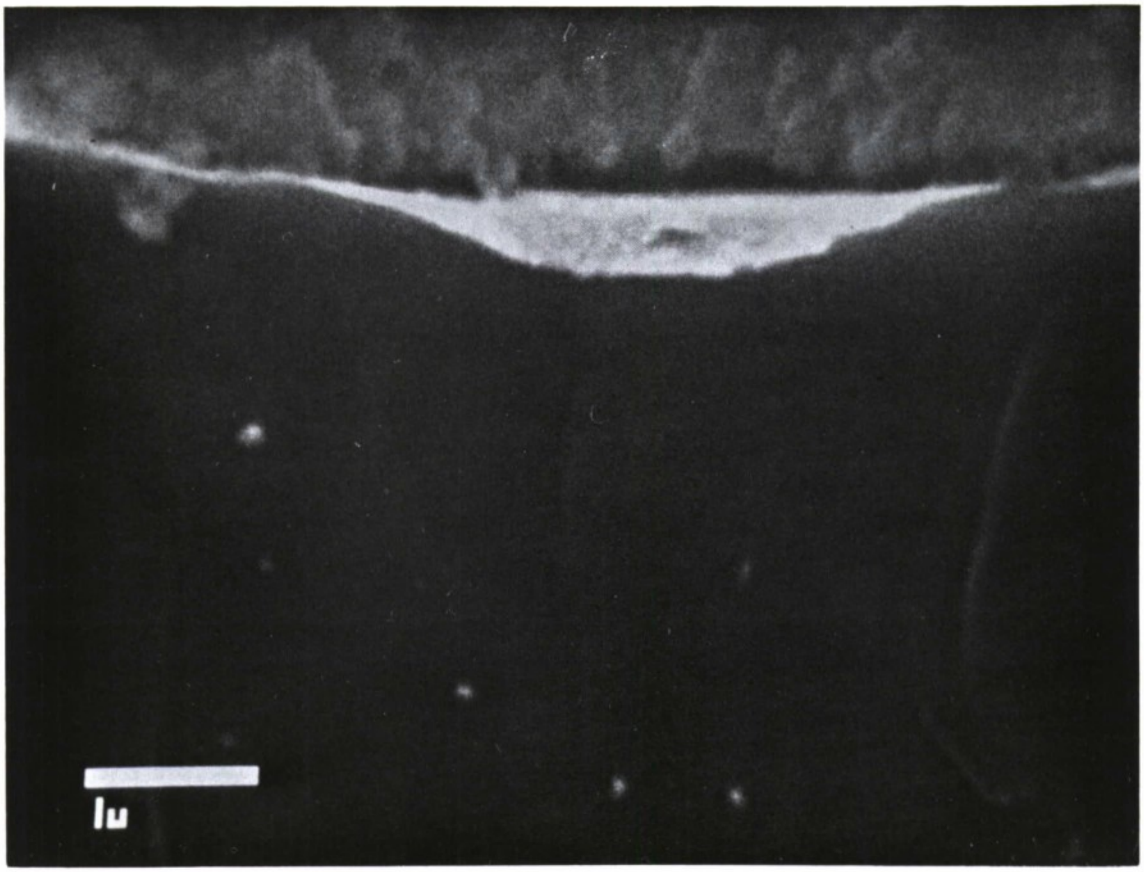

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Figure 4-7. SEM micrograph depicting the features of the superheated zone following the application of 3 W laser pulse ($x_e = 2.5$ μm). In this side view the depth and lateral extension of the superheated zone are seen to closely match the 2600 K temperature profile of Figure 4-4a.

zone, which reduces the chance of breaking the passivating glass layer. For example, a comparison of Figures 4-4b, and 4-9, 4-10, and 4-11 shows roughly the same melt front isotherms, but the volume of the boiling zone is considerably smaller for the lower power case. This is obtained by a mere increase of 78 C in the substrate temperature.

4.2 THE CASE OF A FINITE ABSORPTION COEFFICIENT

An Nd:YAG laser was used to test the adequacy of a long-wavelength laser for melting silicon. For the Nd:YAG at its normal operating mode, the wavelength is 1.064 μm. At room temperature the absorption coefficient is 10 cm^{-1} [36], meaning a penetration depth for the laser of 0.1 cm. This is a very large value compared with that for the argon laser. However, α for the Nd:YAG

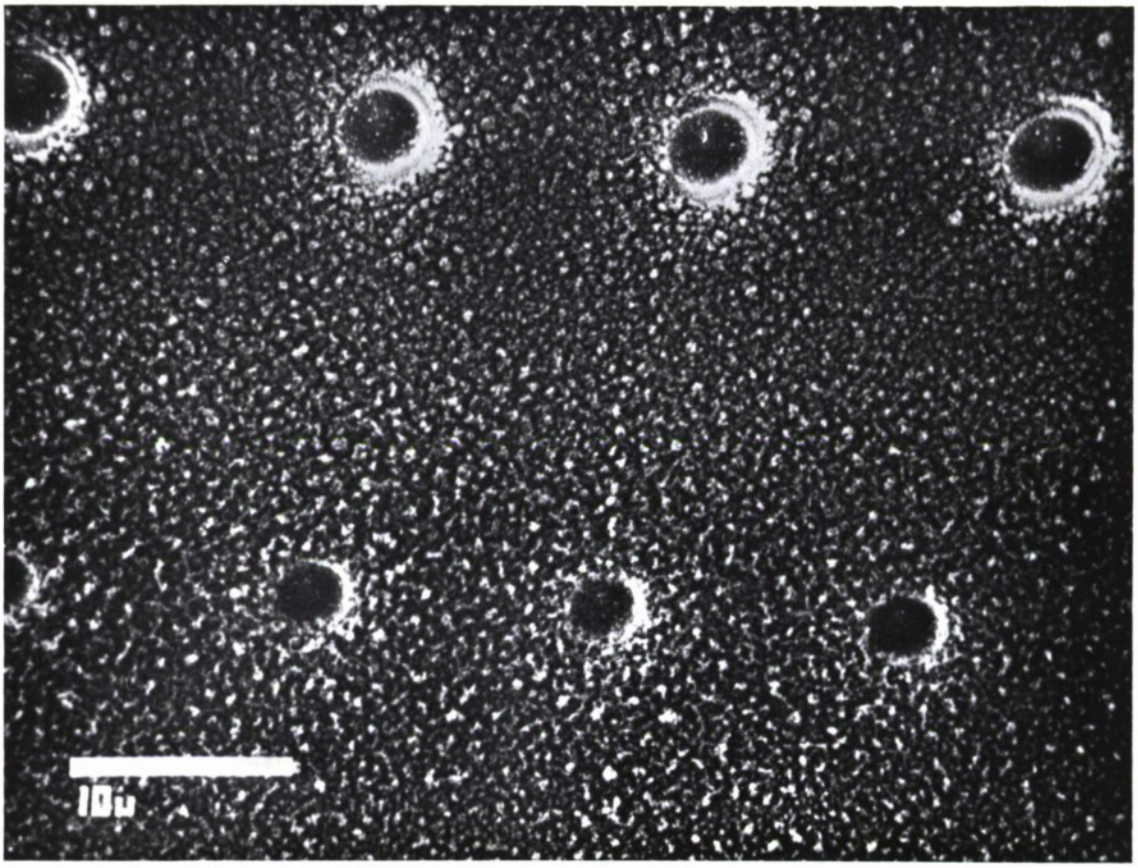

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Figure 4-8. This SEM micrograph depicts two sets of holes created by a 3 W, $x_e = 2.5$ μm laser pulse. The top row was obtained when the ambient temperature was 423 K, while the bottom row belongs to room temperature 295 K. The debris that was created by the many laser applications is seen to cover the entire surface, leaving only the deep evaporated zones visible.

laser shows a rather strong temperature dependence, increasing to 10^2 cm^{-1} at about 600 K, and to better than 10^3 cm^{-1} at 900 K.

Figures 4-12 and 4-13 depict typical results obtained by using this Nd:YAG laser. The melt radius at the surface is seen to be close to 17 μm, and the radius of the superheated zone is about 4 μm. Unfortunately, for the commercial system used in these experiments, we were unable to directly measure the beam parameters that pertain to these results. Nevertheless, we attempted to simulate these results by using Eq. 2.28 to determine the linear temperature prior to melting. It should be noted that once a melt forms the absorption coefficient increases so much, that for all practical purposes it may be taken to be infinitely large. Hence, we divided the calculation into two parts.

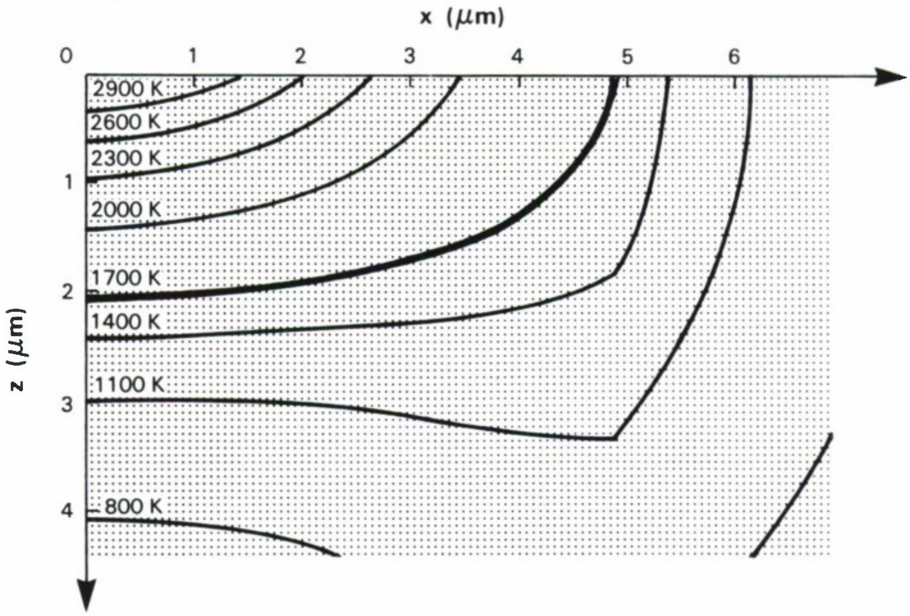

Figure 4-9. Temperature distribution profiles in silicon at steady state. The melt front is emphasized by the heavy curve. Note $P = 3$ W, $x_e = 2.1$ μm, and $T_0 = 295$ K.

First, we used Eq. 2.28 to calculate the contribution to the linear temperature owing to the laser absorption in the solid. As it turns out, this calculation is very (machine) time consuming. For this reason we did not attempt to evaluate Eq. 2.28 in a progressive manner, allowing for α to vary as the temperature in the solid rises. The assumption of a constant value for α of the solid leads to an overestimate of the power required to reach melting. In the numerical integration most of the time is spent evaluating refinements for the integrand at midpoints, caused by high values of the composite parameter $\alpha\xi/2$ that determines the contribution of the probability integral. Once the melt had been reached, we continued the calculation by utilizing Eq. 2.12.

Results of the calculated isothermal distribution profiles are shown in Figure 4-14. We assumed the beam diameter to be 10 μm, and varied the power to obtain reasonable agreement with experiment for the melt lateral extension and the boiling radius. Perhaps the most important result is the value of the power needed to reach the melting stage. In this calculation we find $P_{\text{mlt}} = 37$ W, much higher than needed when the argon laser is used.

The conclusion is that the Nd:YAG laser in its normal operating mode is not a viable source for the diode linking application. It is obvious that relatively small variations in the beam parameters

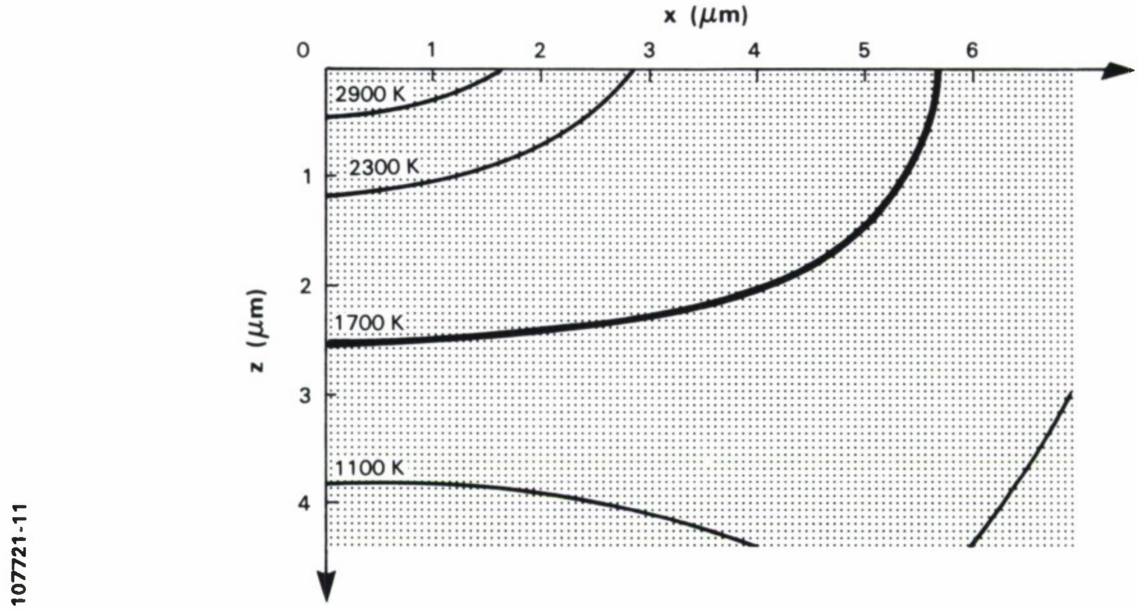

Figure 4-10. Temperature distribution profiles in silicon at steady state. The melt front is emphasized by the heavy curve. Note $P = 3$ W, $x_e = 2.1$ μm, and $T_0 = 373$ K.

could lead to large variations in the resulting melt characteristics.

4.3 DOPANT REDISTRIBUTION AND THE LINK RESISTANCE

In the LIDL process a low resistance electrical connection results from dopant diffusion during the lifetime of the melt. This diffusion proceeds from the implanted regions into the molten gap region (cf. Figures 1-1 and 1-2). Hence, we attempted to model the temperature dependence of the diffusion coefficient, $D(T)$, and apply this model to study the dopant redistribution during the time the laser melting process is on. We are particularly interested in boron as a dopant. Its diffusion coefficient in molten silicon is not known accurately, and the temperature dependence was not discussed previously.

Strictly speaking, we have to consider the nonequilibrium dopant segregation in order to obtain an accurate model for the dopant redistribution when subject to laser melting. When the recrystallization process is very slow, allowing for a local equilibrium to be maintained in the vicinity of

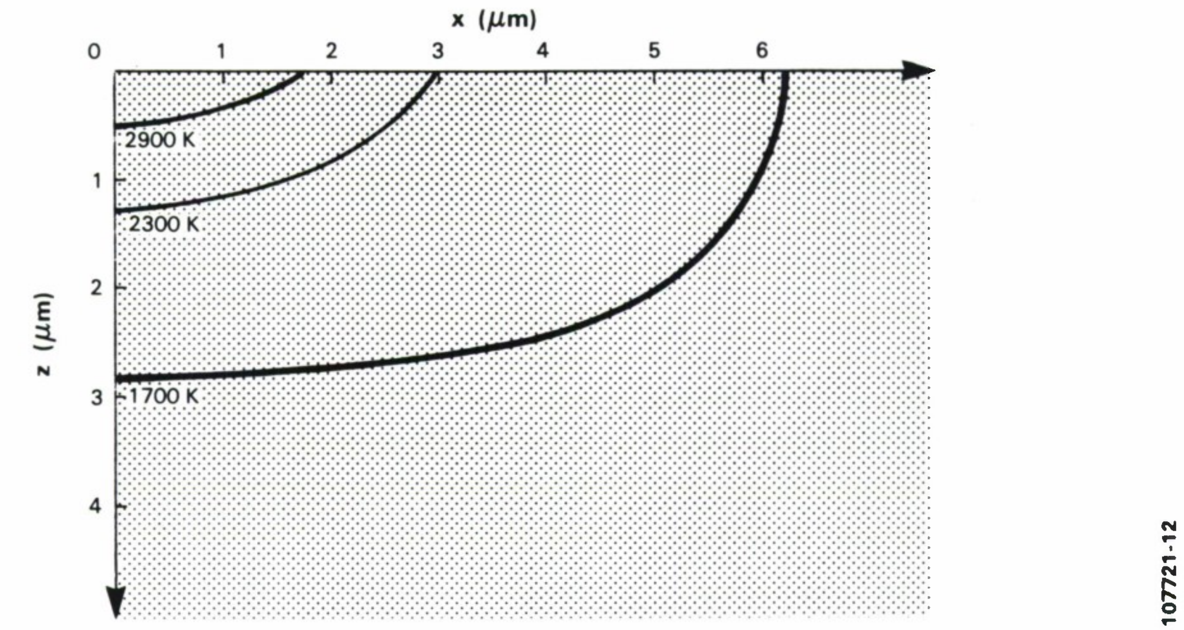

Figure 4-11. Temperature distribution profiles in silicon at steady state. The melt front is emphasized by the heavy curve. Note $P = 3$ W, $x_e = 2.1$ μm, and $T_0 = 423$ K.

the melt-front, redistribution in silicon is a significant effect for dopants such as As, and P but less so for B [45]. However, when the recrystallization velocity is high the effect is small. Measurements have revealed that for all three dopants the segregation coefficient falls very close to unity under most laser melting conditions [46].

All that is said here assumes the laser temporal profile to exhibit infinitely small rise and decline times. Only then will the velocity of the (advancing or receding) melt front be governed by physical heat transfer mechanisms in the solid. If, however, the rise and fall times are finite (i.e., a trapezoidal rather than a square wave pattern is characteristic of the $P-t$ relation), the velocity of the melt front will depend on the slope of the $P(t)$ function during the initial and terminal phases of the laser pulse. Based on the melting model we can calculate the quantity dz_{mlt}/dP, which describes the change of the melt depth with the applied power (similar quantities may be obtained for any direction). Since, as mentioned above, on the time scale of a typical pulse used in WSI applications the power rises to its maximum value rather slowly, its variation determines the melt front velocity as

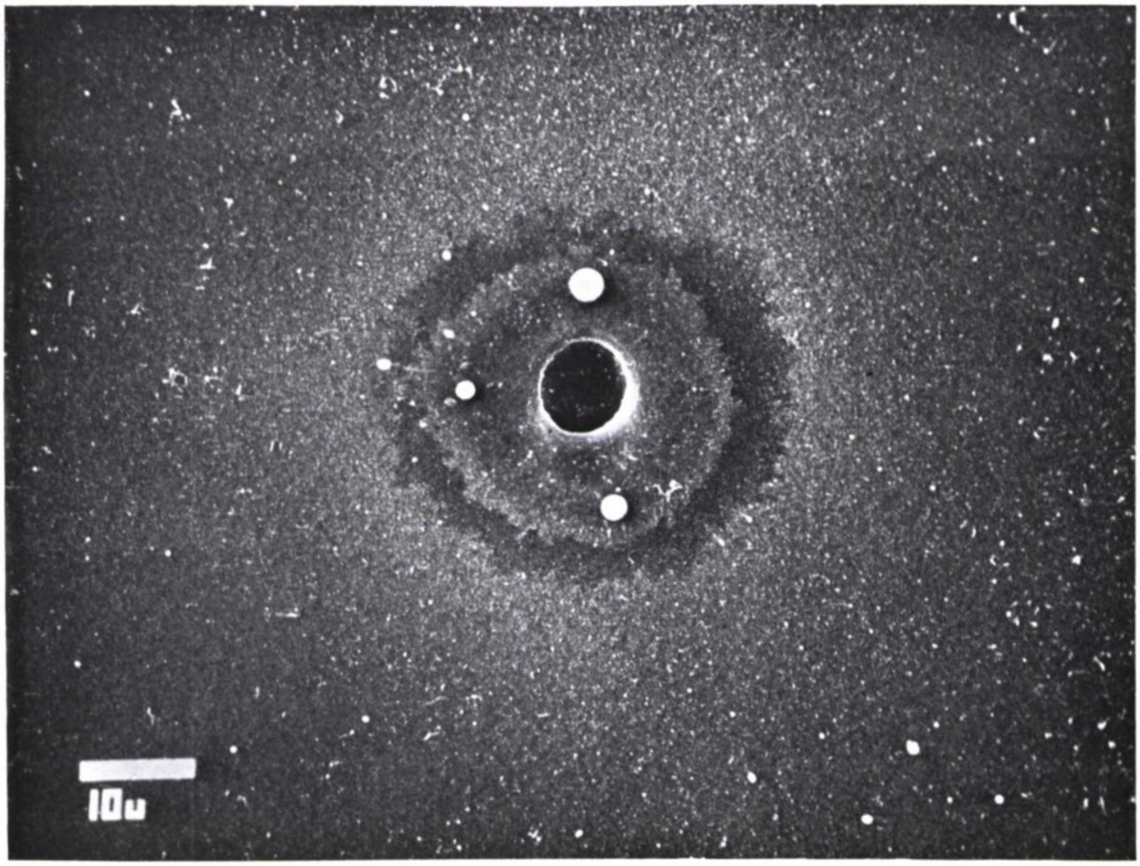

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Figure 4-12. The surface appearance of silicon following the application of an Nd:YAG laser pulse. The exact power is not known, but the beam diameter was estimated to be 20 μm.

$$v = \frac{dz_{\mathrm{mlt}}}{dt} = \frac{dz_{\mathrm{mlt}}}{dP}\frac{dP}{dt} \tag{4.1}$$

For the argon laser we obtained a slope $(dz_{\mathrm{mlt}}/dP) \approx 8 \times 10^{-5}$ cm/W (for room temperature). For the mechanical shutter we found that the power rises "slowly" at an average rate of 9×10^4 W/sec. Thus, in this argon system the melt front advances at an estimated speed $v = 7.2$ cm/sec. A similar value is expected for the speed of the receding front at the final stages of the pulse application. This value is considerably lower than measured in certain other cases. For instance, the velocity is of the order of 5 to 20 m/sec when short (10 to 100 nsec) excimer laser pulses are used [47]. Nevertheless, we believe that this velocity is high enough to assume that at least for boron the segregation coefficient is practically unity.

We now assume that the mass-diffusion coefficient may be expressed by an Arrhenius form

$$D(T) = D_\infty e^{-E_a/k_B T} \tag{4.2}$$

where D_∞ is the limiting value as $T \to \infty$. This Arrhenius model for the diffusivity was confirmed to represent the process of dopant diffusion in solids. We expect it to also represent the situation in the melt. We need, however, to determine a meaningful value for the activation energy and that of the pre-exponential parameter. Some data are found in Wolf [48]. The values given there for boron are $E_a = 3.51$ eV and $D_\infty = 25$ cm^2/sec. Unfortunately, this value of the activation energy pertains to the solid state and does not represent the situation in molten silicon. Kodera [49] measured a value for the diffusivity at the melting temperature. His result is in good agreement with the result obtained by Shashkov and Gurevich [50]. Assuming that the value of D_∞ quoted by Wolf [48] is indeed the value of the diffusivity at an extremely high temperature, we can calculate the activation energy in the melt by means of Eq. 4.2. Thus, using Kodera's value for the diffusion coefficient at

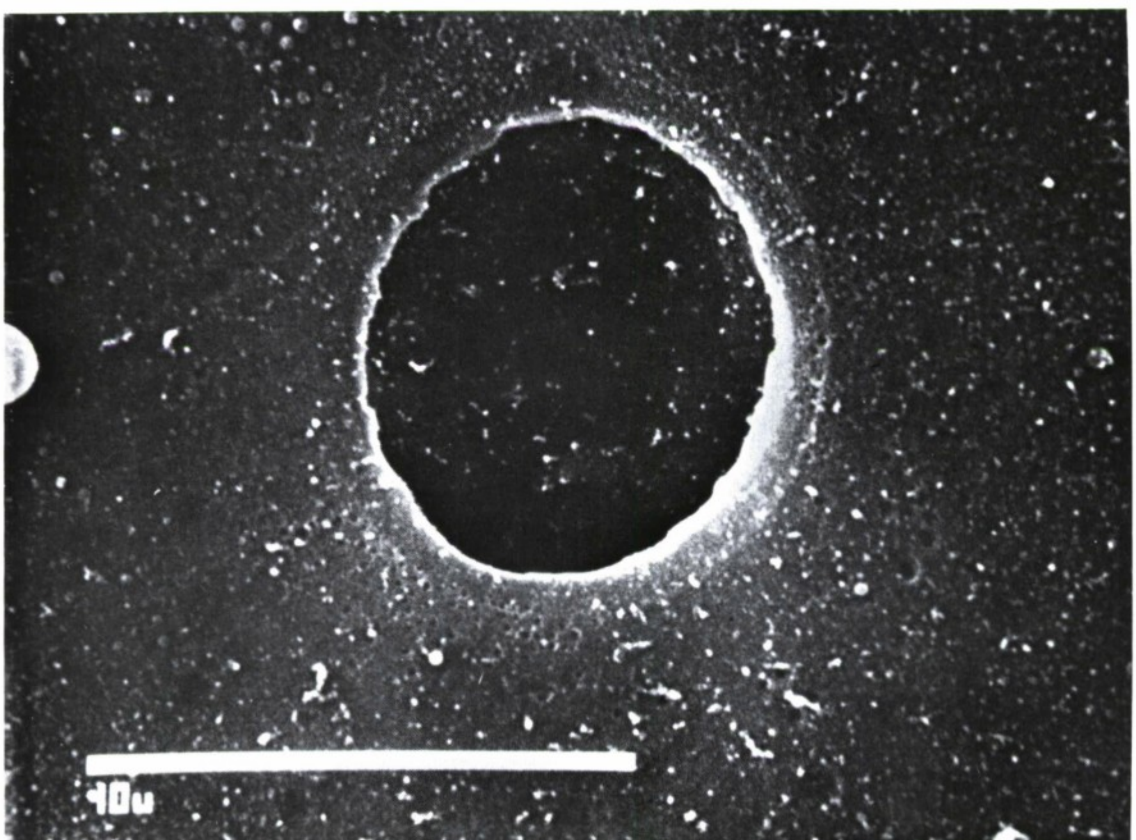

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Figure 4-13. The hole remaining in silicon following the evaporation of material from the superheated zone. This SEM micrograph describes the inner hot zone of the molten region depicted in Figure 4-12.

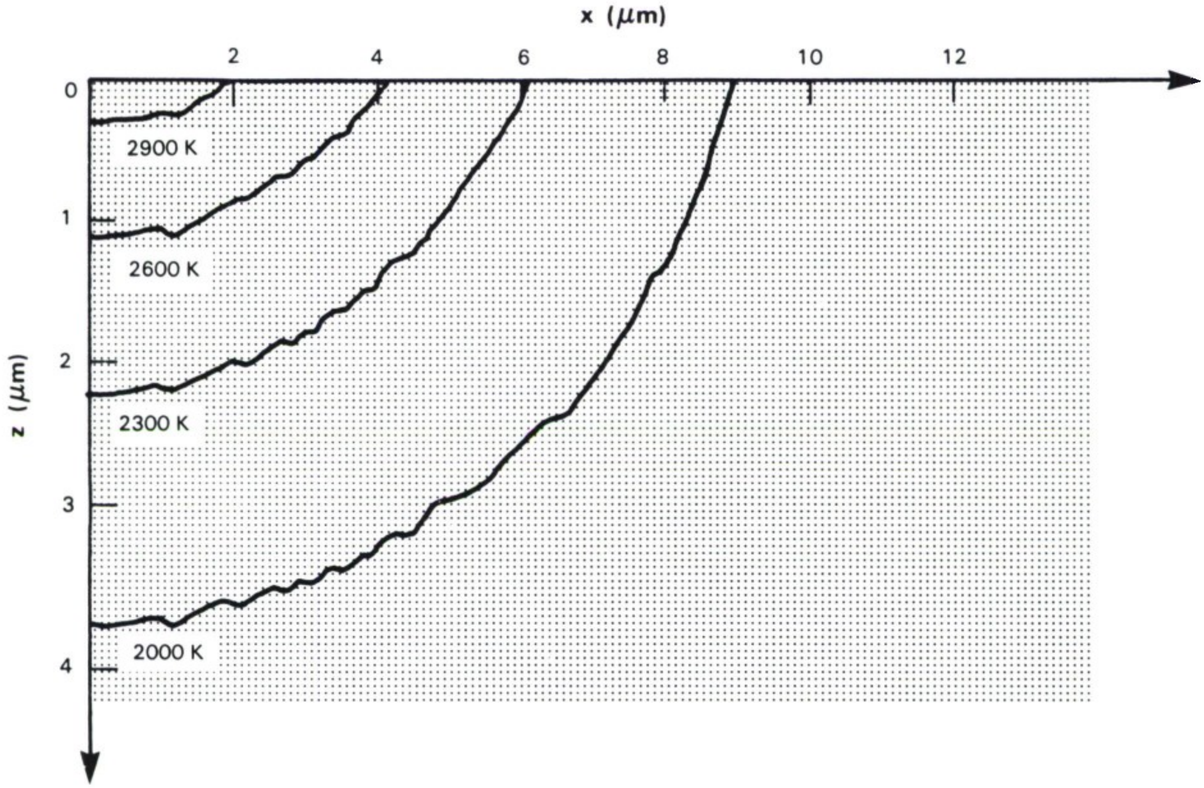

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Figure 4-14. Results of the calculation for the application involving the Nd:YAG laser. The power was adjusted to result in a value to x_{mlt} that agrees with the experimental result shown in Figure 4-12. Here, $P = 44$ W, $X_e = 5$ μm, and $T_{\mathrm{mlt}} = 295$ K. The absorption coefficient was assumed to be $\alpha = 10\ \mathrm{cm}^{-1}$. The threshold power to melting was obtained as 37 W, and the lateral melt extension at the surface is 18 μm.

the melting temperature ($2.4 \times 10^{-4}\ \mathrm{cm}^2/\mathrm{sec}$), and Wolf's value for D_∞ ($25.0\ \mathrm{cm}^2/\mathrm{sec}$) we find for boron diffusion in molten silicon an activation energy value $E_a = 1.68$ eV.

We shall now examine the issue of dopant distribution in the melt prior to recrystallization. The physical situation is the following: a molten region has formed instantaneously at the onset of the laser pulse; the melt extends much deeper than the original extent of the dopant region; in fact, we assume the dopant to be confined to the surface and hence its concentration to be given by $C(z) = Q\delta(z)$. As obvious from this definition, Q represents the total dopant dose per unit area. The laser continues to be on "indefinitely," meaning that the melt lives on and the plane source at the surface supplies the dopants that migrate inwards; at any given later time the dopant distribution in the melt may be obtained by solving the appropriate mass-diffusion equation. The dopant concentration in the melt is obtained as

$$C(z,t) = \frac{Q}{[\pi D(0)t]^{1/2}} e^{-z^2/4D(0)t} \tag{4.3}$$

where $D(0)$ is the value of the diffusivity at the position where all the dopants are concentrated prior to the start of the diffusion process (the surface, $z = 0$, in this case). The pre-factor in Eq. 4.3 is simply the dopant concentration at the surface at time t; hence we may write

$$C(z,t) = C(0,t)e^{-z^2/4D(0)t} \tag{4.4}$$

This relation will enable us to estimate the minimum time (i.e., the laser duration) required for significant dopant migration to affect electrical connectivity.

The results so far were presented for the z-coordinate which is directed inward from the surface into the substrate. Being one-dimensional solutions, these results formally represent the dopant migration in the lateral directions as well. In evaluating the lateral dopant migration from the edge of a diffusion we shall assume that the molten part of the diffused region supplies the total dose available for migration. Obviously, the larger is this molten zone the more dopants will be available for migration into the gap region during the pulse duration, and hence the lower will the resistance of the link be.

An important question that one must ask is how short the laser pulse can be and still result in an effective link. Laser pulses that are several picoseconds long are sufficient to bring about melting, provided the power is appropriate. The quest for a short pulse duration stems from the experimental fact that considerably less physical damage to the device is caused when such pulses are used. On the other hand, the pulse length also determines the time during which the melt exists, and hence the time available for the dopants to diffuse.

The simplest approach possible in studying the effect of the pulse duration on the link resistance is to utilize the expression given in Eq. 4.4, with the simplifying assumption that all the dopant atoms are located at the edge of the gap. For a gap separation value of $2l = 4\mu$m and $D = 2.4 \times 10^{-4}$ cm^2/sec (Kodera's melt value) we obtain

$$\frac{C(2,t)}{C(0,t)} = e^{-4.2\times 10^{-5}/t} \tag{4.5}$$

Thus for $t = 1$ ms the exponent term is essentially unity and connectivity is assured (the concentration at midgap is twice that remaining at the original edge of the diffusion). Lowering the pulse duration by an order of magnitude to 100 μs results in a ratio of concentrations of 0.65. This, meaning a midgap concentration that is 30% higher than the diffusion's edge (since the dopant is diffusing from both directions), is again plenty for assuring a good electrical contact. Further shortening the pulse duration to a mere 10 μs leads to a ratio of concentrations of 0.015. In this case less than 2% of the dopants had chance to migrate from the edge of the diffusion all the way to the middle of the gap. While this might still provide some degree of conduction, we expect the connection to be marginal. The exponential factor above drops rapidly for shorter times, meaning that electrical connectivity will not be feasible by utilizing such pulses. This simple calculation is

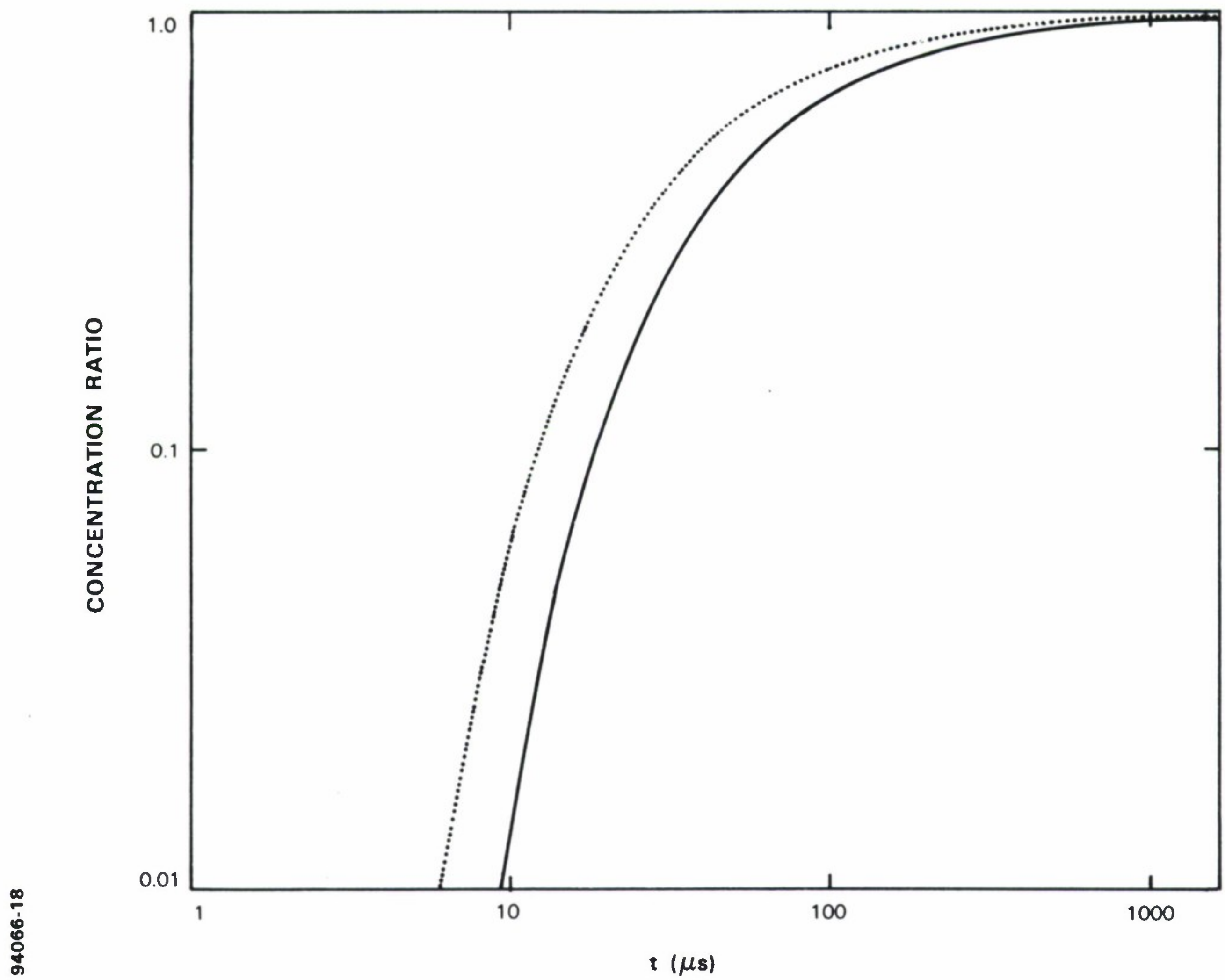

Figure 4-15. Midgap concentration ratio as a function of pulse duration. The solid line refers to $D = 2.4 \times 10^{-4}$ cm^2/sec, and the dotted line refers to $D = 3.6 \times 10^{-4}$ cm^2/sec.

summarized in Figure 4-15. We included in Figure 4-15 the results for two different values of the diffusivity. The solid line represent the $D = 2.4 \times 10^{-4}$ cm^2/sec case whereas the dotted line belongs to the $D = 3.6 \times 10^{-4}$ cm^2/sec case. As is seen here, this 50% increase in D matters very little for the long-time cases, but the difference for the short time (< 20 μs) is large. This emphasizes the strong dependence of the linking process on the actual melt temperature due to its effect on the dopant diffusivity.

A more qualitative estimate of the link properties is possible by invoking an average model for the conductivity. Let us start by considering the substrate's conductivity at a distance x from the edge of the diffusion. Assume for the sake of simplicity that at this point the dopant concentration is constant with depth, up to the extent to which the dopants diffused. On average we may take this depth to equal the diffusion length $2\sqrt{Dt}$. The specific conductivity is given by

$$\sigma(x,t) = q\mu C(x,t) \tag{4.6}$$

where q is the electronic charge and μ is the carrier mobility. Since the specific conductivity varies with distance from the diffusion edge, we shall define an average conductivity by

$$\overline{\sigma}(t)\int_0^l dx = \int_0^l \sigma(x,t)dx \tag{4.7}$$

We have

$$\overline{\sigma}(t) = \frac{q\mu Q}{l\sqrt{\pi Dt}}\int_0^l e^{-x^2/4Dt}dx = \frac{q\mu Q}{l}\Phi\Big(\frac{l}{2\sqrt{Dt}}\Big) \tag{4.8}$$

Thus, the average resistivity in the gap will be given by

$$\overline{\rho}(t) = \frac{l}{q\mu Q}\Big[\Phi\Big(\frac{l}{2\sqrt{Dt}}\Big)\Big]^{-1} \tag{4.9}$$

The resistance of the gap may then be calculated as $R = \overline{\rho}(l/A)$, where the gap's cross-section A is given by its width (W, cf. Figure 1-2) and its average depth $2\sqrt{Dt}$. We obtain

$$R(t) = \frac{l^2}{q\mu QW\sqrt{Dt}}\Big[\Phi\Big(\frac{l}{2\sqrt{Dt}}\Big)\Big]^{-1} \tag{4.10}$$

We see that the resistance of the gap is a function of the pulse duration both through the term defining the probability integral and directly through the $t^{-1/2}$ dependence. For large arguments the probability integral approaches unity very fast and $R(t)$ will then simply vary as $t^{-1/2}$. For typical gap sizes (few microns long) and the value of the diffusivity used above, this occurs at times shorter than 1 μs. For longer times, a straightforward calculation shows that for a 4 μm gap and 1 ms pulse duration the resistance amounts to 142 in units of $l^2/q\mu QW\sqrt{D}$. For the shorter time of 100 μs the value is not much different at 165 units, but it increases considerably for a pulse of 10 μs (347 units). For a pulse 5 μs long the result is 469 units thereafter increasing as the inverse square root of time. We thus see that the "average" gap resistance agrees with the variation in the dopant concentration values discussed earlier. The numbers given above for $R(t)$ may be converted into meaningful resistance values by scaling. If we equate the long-time (100 μs) value to the best experimentally measured resistance for that pulse length (93Ω) we get the following values: 80Ω (1 ms), 93Ω (0.1 ms), 227Ω (10 μs), and 360Ω (5 μs). These results are displayed graphically in Figure 4-16.

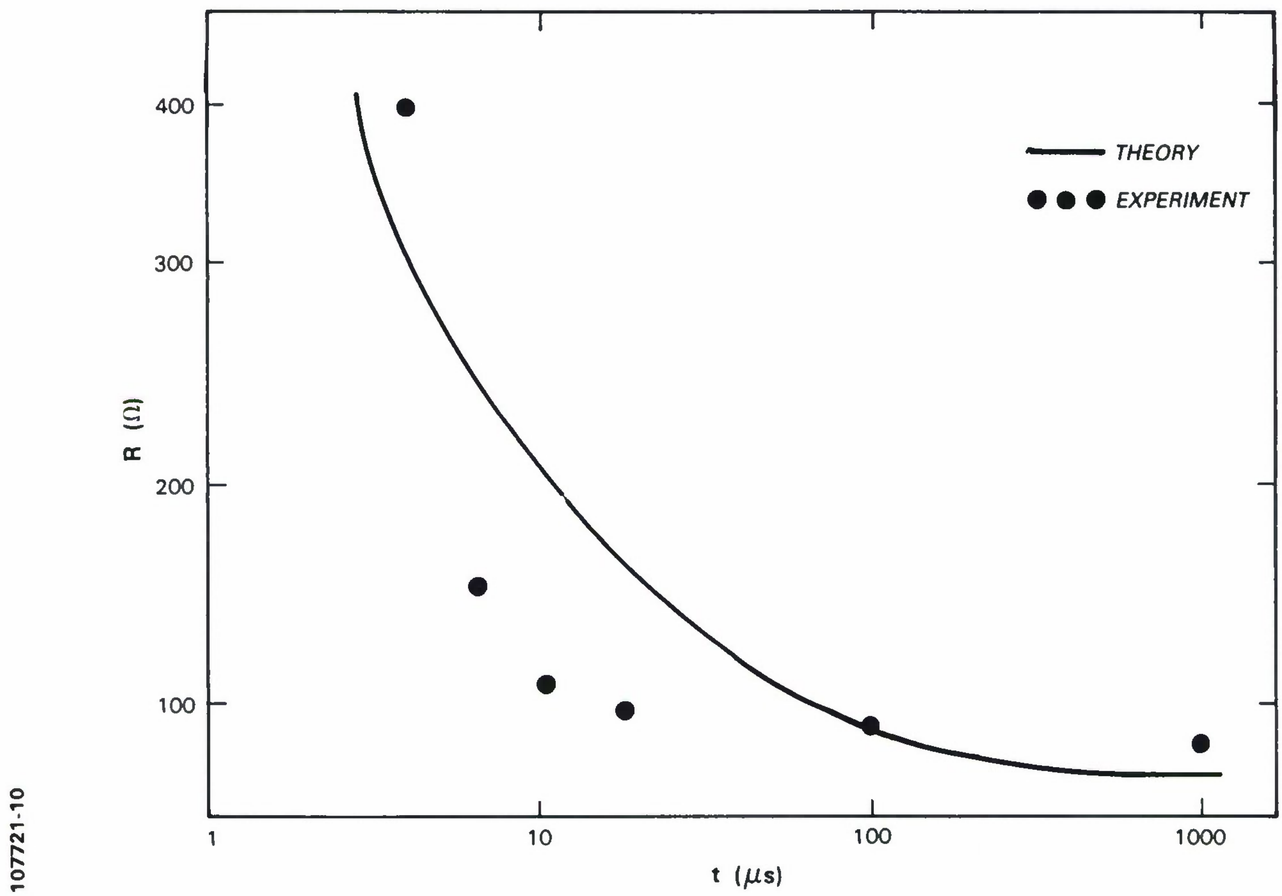

Figure 4-16. The gap resistance as a function of the pulse duration for a 4 μm gap, as shown in Figures 1-1 and 1-2. The solid line represents the result of the calculation using Eq. 4.10.

5. SUMMARY

Wafer-scale integration is an exciting development that would allow the realization of the "system on a chip" concept. Laser-beam processing has proved to be important in achieving this goal. Laser beams are used for both cutting and connecting different levels of interconnect runs. More recently the technique of laser-induced connections in the substrate has been added as another option. We have reviewed the theory of substrate heating and melting by a laser beam, and used it to calculate accurate values for the relevant parameters of the system. In particular, we paid attention to the important issue of reflectivity, hitherto not accounted for properly. These theoretical results have been compared with careful measurements of the geometrical features of the region affected by the laser beam. The agreement between theory and experiment is very good. Apart from the importance of having a well controlled process, this agreement also proves the validity of our dynamical model for the reflectivity.

Additional measurements were made to elucidate the electrical properties of the links. In particular, we were interested to explore the resistance of the diode links as a function of laser pulse duration. This is an important issue because the laser is applied after most other processing steps have been completed. A long laser pulse inevitably means a larger amount of energy being deposited for a given level of power. The latter is dictated by the need for a particular geometrical size of the molten region. A higher energy can spell trouble, as delicate features of nearby devices may be affected. Hence, the quest for an as short a pulse as possible, while maintaining an acceptable low value for the resistance. We have developed a simple theoretical approach to this problem. Assuming an average conductivity for the dopant distribution in the affected gap region, we were able to calculate the value of the resistance as a function of the pulse duration. The overall experimental behavior is reproduced, although the agreement between theory and experiment is not satisfactory throughout the measured range. We hope to develop a more accurate model for the resistance in a future study.

Finally, we note that our attempt to fit the observed quantities has shed more light on material parameters that so far have not been determined accurately. We have thus obtained a better indication on the realistic value of the boiling temperature of silicon. Our results support the lower value measured of 2600 K, whereas other claims go as high as 3500 K. In addition, we have provided a simple expression for the temperature dependence of the diffusion coefficient of boron in molten silicon. This is not known experimentally, and would be necessary in developing a more realistic model for the resistance of the links.

REFERENCES

1. A. Antonenko, N.N. Gerasimenko, A. Bvarechenskii, L.A. Smirnov, and G.M. Tseitlin, Sov. Phys. Semicond. **10**, 81 (1976).

2. G.A. Kachurin, E.V. Nadaev, A.V. Khodyachikh, and L.A. Kovaleva, Sov. Phys. Semicond. **10**, 1128 (1976).

3. M. von Allmen, W. Luthy, and K. Affolter, Appl. Phys. Lett. **33**, 824 (1978).

4. *Semiconductors and Semimetals*, Vol.17, J.F. Gibbons, Editor (Academic Press, Orlando, 1984).

5. *Semiconductors and Semimetals*, Vol. 23, R.F. Wood, C.W. White, and R.T. Young, Editors (Academic Press, Orlando, 1984).

6. K. Nishiyama, M. Arai, and N. Watanabe, Jpn. J. Appl. Phys. **19**, 10 (1980).

7. K.F. Lee, J.F.Gibbons, K.C. Saraswart, and T. Kamins, Appl. Phys. Lett. **35**, 173 (1979).

8. S.L. Garverick and E.A. Pierce, IEEE Proc. Custom IC Conf., May 1983, p. 244.

9. J.I. Raffel, A.H. Anderson, G.H. Chapman, K.H. Konkle, B. Mathur, A.M. Soares, and P.W. Wyatt, IEEE J. Solid State Circuits **SD-20**, 399 (1985).

10. S.E. Schuster and P.W. Cook, *Industrial Applications of High Power Laser Technology*, SPIE, Vol. 86, 1976, p. 102.

11. J.C Logue, W.J. Kleinfelder, P. Lowy, J.R. Moulic, and W.W. Wu, Proc. of IEEE Int. Conf. on Circuits and Computers, 248, Port Chester, NY (1980).

12. P.W. Cook, S.E. Schuster, and R.J. von Gutfeld, Appl. Phys. Lett. **26**, 3, 125 (1975).

13. C. Jesshope and W. Moore, Editors (Adam Hilger, Bristol, England, 1986).

14. G. Saucier and J.Trilhe, Editors (Elsevier North-Holland, Amsterdam, 1986).

15. Proceedings of the I.F.I.P. International Workshop on Wafer-Scale Integration, Brunel University, England, September 23-25, 1987, to be published.

16. H.S. Carslaw and T.C. Jaeger (Oxford University Press, Oxford, 1959).

17. H.E. Cline and T.R Anthony, J. Appl. Phys. **48**, 3895 (1977).

18. M. Lax, J. Appl. Phys. **48**, 3919 (1977); Appl. Phys. Lett. **33**, 786 (1978).

19. Y.I. Nissim, A. Lietoila, R.B. Gold, and J.F. Gibbons, J. Appl. Phys. **51**, 274 (1980).

20. A. Kokorowski, G.L. Olson, and L.D. Hess, in *Proceedings of the Annual MRS Meeting*, J.F. Gibbons, L.D. Hess, and T.W. Sigmon, Editors (Elsevier North-Holland, New York, 1980), p. 139.

21. M.L. Burgener and R.E. Reedy, J. Appl. Phys. **53**, 4357 (1982).

22. J.E. Moody and R.H. Hendel, J. Appl. Phys. **53**, 4364 (1982).

23. I.D. Calder and R. Sue, J. Appl. Phys. **53**, 7545 (1982).

24. I. Chen and S. Lee, J. Appl. Phys. **54**, 1062 (1983).

25. F. Ferrieu and G. Auvert, J. Appl. Phys. **54**, 2646 (1983).

26. P. Schvan and R.E. Thomas, J. Appl. Phys. **57**, 4738 (1985).

27. S.D. Allen, J.A. Goldstone, J.P. Stone, and R.Y. Yan, J. Appl. Phys. **59**, 1653 (1986).

28. D. Waechter, P. Schvan, R.E. Thomas, and N.G. Tarr, J. Appl. Phys. **59**, 3371 (1986).

29. V.N. Abakumov, V.N. Guman, and V.S. Yuferev, Sov. Phys. Semicond. **20**, 1386 (1986).

30. C.P. Grigoropoulos and R.H. Buckholz, J. Appl. Phys. **60**, 2304 (1986).

31. E. Abraham and J.M. Halley, Appl. Phys. **A42**, 279 (1987).

32. G.E. Jellison and F.A. Modine, Appl. Phys. Lett. **41**, 180 (1982).

33. V.M. Glazov, S.N. Chizhevskaya, and N.N. Glagoleva, *Liquid Semiconductors* (Plenum Press, New York, 1969).

34. C. Kittel, *Introduction Solid State Physics* (John Wiley & Sons, New York, 1971).

35. M. Born and E. Wolf, *Principles of Optics* (Pergamon Press, New York, 1959).

36. G.E. Jellison, Jr., in *Semiconductors and Semimetals*, Vol. 23, Chapter 3, R.F. Wood, C.W. White, and R.T. Young, Editors (Academic Press, Orlando, 1984).

37. O. Ruff and M.Z. Konschak, Elektrochem. **32**, 515 (1926).

38. E. Baur and R. Brunner, Helv. Chim. Acta **17**, 958 (1934).

39. D.S. Gates and G. Thodos, AIChE J. **6**, 50 (1960).

40. R.E Honig, RCA Rev. **23**, 567 (1962).

41. W.R. Runyan, *Silicon Semiconductor Technology* (McGraw-Hill, New York, 1965).

42. S. Ohe, *Computer Aided Data Book of Vapor Pressure* (Data Book Publishing, Tokyo, Japan, 1976).

43. D.R. Stull and H. Prophet, *JANAF Thermochemical Tables*, MSRDS-NBS37 (National Bureau of Standards, Washington, DC, 1971).

44. C.L. Yaws, R. Lutwak, L.L. Dickens, and G. Hsu, Solid State Technol. (January 1981).

45. F.A. Trumbore, Bell Sys. Tech. J. **39**, 205 (1960).

46. J.C. Wang, R.F. Wood, and P.P. Pronko, Appl. Phys. Lett. **33**, 455 (1978).

47. R.F. Wood and G.E. Jellison, Jr., in *Semiconductors and Semimetals*, Vol. 23, Chapter 4, R.F. Wood, C.W. White, and R.T. Young, Editors (Academic Press, Orlando, 1984).

48. H.F. Wolf, *Silicon Semiconductor Data* (Pergamon Press, New York, 1969).

49. H. Kodera, Jpn. J. Appl. Phys. **2**, 212 (1963).

50. Y.M. Shashkov and V.M. Gurevich, Russ. J. Phys. Chem. **42**, 1082 (1968).

APPENDIX A
ESSENTIAL RESULTS OF BORN AND WOLF

Figure A-1 depicts the stratified structure which interests us here. We assume that both phases of the silicon film are conductive. Following the method described in Born and Wolf [35] we define the complex indices of refraction for the conductive media, $\overline{n}_i$, as

$$\overline{n}_2 \cos\theta_2 = u_2 + iv_2 \tag{A.1}$$

and

$$\overline{n}_3 \cos\theta_3 = u_3 + iv_3 \tag{A.2}$$

Squaring these relations and using the law of refraction $\overline{n}_2 \sin\theta_2 = n_1 \sin\theta_1$ we obtain for the first interface (air/melt)

$$(u_2 + iv_2)^2 = \overline{n}_2^2 - n_1^2 \sin^2\theta_1 \tag{A.3}$$

At the second interface the law of refraction reads $\overline{n}_3 \sin\theta_3 = \overline{n}_2 \sin\theta_2$. Hence, a similar result is obtained here

$$(u_3 + iv_3)^2 = \overline{n}_3^2 - n_1^2 \sin^2\theta_1 \tag{A.4}$$

On equating real and imaginary parts for both equations we obtain the following relations

$$u_i^2 - v_i^2 = n_i^2(1 - \kappa_i^2) - n_1^2 \sin^2\theta_1 \tag{A.5}$$

and

$$u_i v_i = n_i^2 \kappa_i \tag{A.6}$$

where $n_i\kappa_i$ is the imaginary part of the complex number $\overline{n}_i$, defined as $\overline{n}_i = n_i(1 + i\kappa_i)$. From Eqs. A.5 and A.6 we may write explicit expressions for the real quantities u_i and v_i.

For the stratified structure shown in Figure A-1, the following results are obtained for the relative amplitudes of the beam in the different regions

$$\overline{r}_{12} = \frac{n_1 \cos\theta_1 - (u_2 + iv_2)}{n_1 \cos\theta_1 + (u_2 + iv_2)} = \rho_{12} e^{i\phi_{12}} \tag{A.7}$$

where ρ_{12} is the real part of the relative amplitude and ϕ_{12} is the phase change that the reflected beam suffers. Similarly, for $\overline{r}_{23}$ we have

$$\overline{r}_{23} = \frac{(u_2 + iv_2) - (u_3 + iv_3)}{(u_2 + iv_2) + (u_3 + iv_3)} = \rho_{23} e^{i\phi_{23}} \tag{A.8}$$

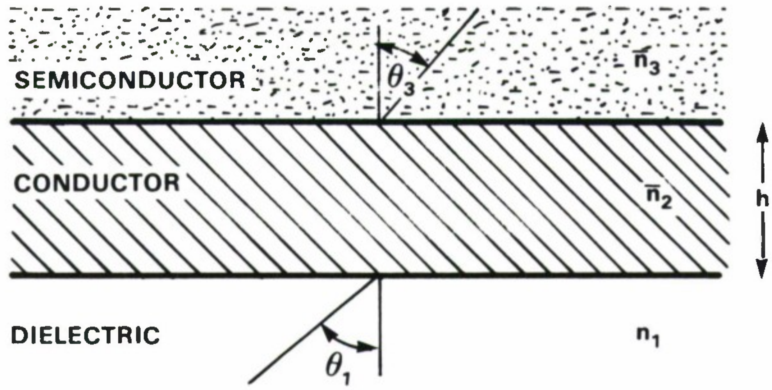

Figure A-1. Beam propagation through three media that include a conducting film.

The amplitude of the reflected beam $\bar{r}$ is then given by

$$\bar{r} = \rho e^{i\delta_r} = \frac{\rho_{12}e^{i\phi_{12}} + \rho_{23}e^{i(\phi_{23}+2\beta)}}{1 + \rho_{12}\rho_{23}e^{i(\phi_{12}+\phi_{23}+2\beta)}} \tag{A.9}$$

where the angle β is defined as $\beta = (2\pi/\lambda_0)\bar{n}_2 h \cos\theta_2 = (u_2 + iv_2)\gamma$, with $\gamma = (2\pi/\lambda_0)h$; here h stands for the thickness of the molten film as indicated in Figure A-1, and λ_0 is the wavelength of the beam. Substituting for β in Eq. A.9 we get

$$\bar{r} = \rho e^{i\delta_r} = \frac{\rho_{12}e^{i\phi_{12}} + \rho_{23}e^{-2v_2\gamma}e^{i(\phi_{23}+2u_2\gamma)}}{1 + \rho_{12}\rho_{23}e^{-2v_2\gamma}e^{i(\phi_{12}+\phi_{23}+2u_2\gamma)}} \tag{A.10}$$

Finally, the reflectivity is obtained as the square of the absolute value of the amplitude

$$R = \mid \rho \mid^2 = \frac{\rho_{12}^2 e^{2v_2\gamma} + \rho_{23}^2 e^{-2v_2\gamma} + 2\rho_{12}\rho_{23}\cos(\phi_{23} - \phi_{12} + 2u_2\gamma)}{e^{2v_2\gamma} + \rho_{12}^2\rho_{23}^2 e^{-2v_2\gamma} + 2\rho_{12}\rho_{23}\cos(\phi_{12} + \phi_{23} + 2u_2\gamma)} \tag{A.11}$$

This result shows how the reflectivity depends directly on the physical and geometrical properties of the films. A knowledge of the complex refractive indices is all that is needed for calculating the variation of the reflectivity with the film's thickness. Note that for the case of normal incidence the expressions of the relative amplitudes ρ_{ij}, and the phase shifts ϕ_{ij}, simplify somewhat owing to the vanishing of θ_1.

APPENDIX B
PROGRAMS AND DATA FILES FOR THEORETICAL MODELING OF THE LASER LINKING PROCESS

The wafer-scale integrated circuits built at Lincoln Laboratory [8,9] utilize laser microwelding techniques which were developed empirically. This report details a theoretical analysis of one type of laser link, which provides much improved understanding of the linking process. In the interest of encouraging progress in such research at other laboratories, some of the programs and data files associated with that theory are appended to this report as examples. The full range of programs and data files which represent numerical variations on the main theme is available to all interested parties upon request.

The theoretical model is centered around Eq. 2.12 reported here, which describes the linear temperature as a function of space and time

$$\Theta(x,y,z;t) = \frac{(1-R)P}{\pi^{3/2}k_0} \int_0^{2\sqrt{Dt}} d\xi \frac{\exp\left(-\frac{x^2+y^2}{\xi^2+x_e^2}\right)\exp\left(-\frac{z^2}{\xi^2}\right)}{\xi^2+x_e^2} \tag{B.1}$$

This result may be written (for the case of a steady state) as

$$\Theta(x,y,z) = \frac{(1-R)P}{\pi^{3/2}k_0} I(x,y,z) \tag{B.2}$$

where $I(x,y,z)$ stands for the integral which is independent of system parameters (i.e., power, absorptivity, reflectivity, or ambient temperature). Hence, this integral stands alone. Since its calculation is time consuming, we have generated data files that contain its results for certain combinations of beam radius and space extension. In order to avoid repetition and save on CPU time (some calculations last for over 10 h), these various data files are available upon request.

The calculation of this integral and its variants (note that the theory outlined in Ref.1 calls for different expressions for I for different regimes of the absorptivity parameter and/or different geometrical constraints) required development of appropriate software. All programs were written in FORTRAN, and in part were based on published routines.

In the following the main FORTRAN programs necessary to carry out the calculations are listed and briefly discussed. The same programs are attached as Appendix C. One of the data files representing $I(x,y,z)$ for a particular set of conditions is attached as an example as Appendix D. Many other programs that represent minor variations of these and that were intended for particular calculations were also written and are available.

TTHETA: This program calculates the integral $I(x,z)$ given above.

REFLECT: This program calculates the reflectivity as a function of the molten film thickness, based on the known refractive indices.

TPROFILE: This program reads in the integral calculated in TTHETA and generates the temperature profiles in the substrate.

GAP: This program calculates the integral that determines the gap resistance.

YAGSOL.F: This program is essentially that named TTHETA above, except that it assumes a long wavelength laser source such as the Nd:YAG.

TOOR.F: This program calculates the gap resistance according to a simplified model described in the first reference given above.

REFLALU.F: Same as REFLECT but for the parameters of aluminum.

REFAVE.F: Same as REFLECT but averaged for the multi-mode case.

MELT: This program calculates the energy used up during the phase transition.

VARIANTS: Used to calculate the maximum temperature.

QINTEG: An older version of TTHETA; it contains the original code before various modifications were made.

YAGVER.F: A variation on YAGSOL.F.

SHORTAL.F: A shortened version of TTHETA adapted for a thin film.

TETAL.F: A fuller version of SHORTAL.F.

TETALX.F: Same as TETAL.X but limited to the x-direction.

HOMDIF1.F: This program calls the subroutines of SHORTAL.F for thin film calculations.

HOMDIF2.F: A modification of HOMDIF1.F to accommodate different mesh point distribution.

HOMDIFX.F: Same as above for the x-direction.

APPENDIX C
A COLLECTION OF FORTRAN PROGRAMS USED FOR DETERMINING THE TEMPERATURE DISTRIBUTION FOLLOWING THE LASER APPLICATION

```
      PROGRAM TTHETA
C
C     THIS PROGRAM CALCULATES THE INTEGRAL THAT
C     DETERMINES THE LINEAR TEMPERATURE.
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD.
C
      COMMON /ABC/X,Y,Z
      COMMON /DEF/XSUBE
      DOUBLE PRECISION X,Y,Z,A,B,PI,XSUBE,SS
      PARAMETER (PI=3.1415927)
  100 FORMAT (4F14.6)
  101 FORMAT('READ IN:B,XSUBE')
  102 FORMAT (4D12.3,I5)
  103 FORMAT (4D16.4)
  104 FORMAT ('MELTING TEMP. =',F8.1,5X,
     1'POWER FOR MELTING =',F8.2)
C
C     A AND B ARE THE LIMITS OF INTEGRATION.
C     XSUBE IS THE 1/e BEAM RADIUS.
C
      PRINT 101
      READ 102,B,XSUBE
      XSUBE=XSUBE*1.D-4
      PRINT 102,B,XSUBE
C
      A=0.0
      B=2.*SQRT(B)
      X=0.0
      Y=0.0
      Z=0.0
      OPEN(1,FILE='data',FORM='PRINT')
C
C     data IS THE FILE CONTAINING THE INTEGRATION RESULTS.
C
      IY=1
      DO 1 IX=1,70
      X=(IX-1)*1.D-5
C     DO 1 IY=1,70
C     Y=(IY-1)*1.D-5
      DO 1 IZ=1,70
      IF(IZ.LE.26) THEN
      Z=(IZ-1)*2.D-7
      ELSE
      Z=(IZ-26)*1.D-5
      ENDIF
      CALL QROMB(A,B,SS)
      WRITE(1,103) X,Z,SS
    1 CONTINUE
C
      CLOSE(1)
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
```

```
C
      SUBROUTINE QROMB(A,B,SS)
C
      DOUBLE PRECISION EPS,A,B,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,B,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT.
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,B,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      B=SQRT(BB-AA)
      A=0.0
      IF (N.EQ.1) THEN
      S=(B-A)*FUNC(0.5*(A+B))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(B-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(B-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
      END
C
```

```
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,D,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),D(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      D(I)=YA(I)
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-D(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      D(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=D(NS)
      NS=NS-1
      ENDIF
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND.
C
      FUNCTION GRAL(TAU)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED.
C     TAU IS A DUMMY INTEGRATION VARIABLE.
C
      DOUBLE PRECISION PI,TAU
      PARAMETER (PI=3.1415927)
      DOUBLE PRECISION GRAL,DENO1,DENO2,
     1ARGU1,ARGU2
      DOUBLE PRECISION X,Y,Z,XSUBE
      COMMON /DEF/XSUBE
      COMMON /AEC/X,Y,Z
      DENO1=TAU*TAU
      DENO2=TAU*TAU+XSUBE*XSUBE
```

```
      ARGU1=EXP(-(X*X+Y*Y)/DENO2)
      ARGU2=EXP(-(Z*Z)/DENO1)
      GRAL=ARGU1*ARGU2/DENO2
      RETURN
      END
```

```
      PROGRAM REFLECT
C
C    THIS PROGRAM CALCULATES THE REFLECTIVITY AS A FUNCTION
C    OF THE FILM(S) REFRACTION INDICES AND IT'S THICKNESS
C
      EN1=1.0
      U2=1.45
      V2=0.0
      U3=4.633
      V3=0.096
      PI=3.1415927
C
      OPEN(1,FILE='reflect',FORM='PRINT')
C
      ROSQ12=((EN1-U2)**2+V2**2)/((EN1+U2)**2+V2**2)
      RO12=SQRT(ROSQ12)
      TANPH12=2.*EN1*V2/(U2**2+V2**2-EN1**2)
      PHI12=ATAN(TANPH12)
      ROSQ23=((U2-U3)**2+(V2-V3)**2)/((U2+U3)**2+(V2+V3)**2)
      RO23=SQRT(ROSQ23)
      TANPH23=2.*(U3*V2-U2*V3)/(U2**2+V2**2-U3**2-V3**2)
      PHI23=PI+ATAN(TANPH23)
C
      AMBDA=5140.0
      AA=COS(PHI23-PHI12)
      BB=COS(PHI23+PHI12)
      PRINT*,ROSQ12,PHI12,ROSQ23,PHI23,AA,BB,AMBDA
      READ*,ORIGINAL,TOSEFET
      H=ORIGINAL-TOSEFET
      DO 1 I=1,200
      H=H+TOSEFET
      GAMMA=2.*PI*H/AMBDA
      ENUM=ROSQ12*EXP(2.*V2*GAMMA)+ROSQ23*EXP(-2.*V2*GAMMA)+
     12.*RO12*RO23*COS(PHI23-PHI12+2.*U2*GAMMA)
      DENOM=EXP(2.*V2*GAMMA)+ROSQ12*ROSQ23*EXP(-2.*V2*GAMMA)+
     12.*RO12*RO23*COS(PHI12+PHI23+2.*U2*GAMMA)
      REF=ENUM/DENOM
      WRITE(1,100)H,REF
    1 CONTINUE
  100 FORMAT(5F10.3)
      CLOSE(1)
      END
```

```
      PROGRAM TPROFILE
C
C     THIS PROGRAM READS IN THE INTEGRAL THAT DEFINES
C     THETA, AND USES IT TO CALCULATE THE TEMPERATURE
C     PROFILES IN ANY PRESCRIBED POSITION IN THE SUBSTRATE.
C     IT ALSO READS IN THE CALCULATED REFLECTIVITY AS A
C     FUNCTION OF THE DEPTH FROM THE SURFACE, AND USES IT IN
C     A SUCCESIVE EVALUATION OF THE ABSORBED POWER.
C
      DOUBLE PRECISION X,Y,Z,TO,TEMP,PI,RR,CMELT,SEC,
     1P,XSUBE,R,TMELT,PMELT,DELP
     2,TETMLT,TINT,COEFF,TET,TBOIL
C
C     TO IS THE INITIAL SUBSTRATE TEMPERATURE (AMBIENT)
C     THE ARRAY TEMP CONTAINS THE INTERMEDIATE AND FINAL
C     RESULTS OF THE TEMPERATURE CALCULATIONS.
C     THE ARRAY RR CONTAINS THE Z-DEPENDENCE REFLECTIVITY.
C     THE ARRAY R CONTAINS THE VARYING REFLECTIVITY AS A
C     FUNCTION OF THE POSITION OF THE MELT FRONT FOR A
C     GIVEN (X,Y) POSITION ON THE SURFACE.
C     CMELT IS THE THERMAL CONDUCTIVITY OF THE MELT.
C     SEC IS THE NUMBER OF SECTIONS INTO WHICH THE EXCESS
C     (ABOVE THRESHOLD) POWER IS SLICED.
C     XSUBE IS THE 1/e RADIUS OF THE BEAM.
C     DELP IS THE VALUE OF THE POWER SLICE.
C     TETMELT IS THE VALUE OF THETA AT MELTING.
C     TINT IS THE READ-IN INTEGRAL THAT DEFINES THETA.
C     COEFF IS THE PREFACTOR FOR THE THETA INTEGRAL.
C     TET IS THE ARRAY THAT CONTAINS THE VARYING VALUE OF THETA.
C
      PARAMETER (PI=3.1415927D0)
      DIMENSION RR(70),R(70,70),TINT(70,70)
      DIMENSION TEMP(70,70),TET(70,70)
  100 FORMAT (4F14.6)
  101 FORMAT('READ IN:TO,POWER,XSUBE,NSEC')
  102 FORMAT (3D12.3,I5)
  103 FORMAT (3F16.3)
  104 FORMAT ('MELTING TEMP. =',F8.1,5X,
     1'POWER FOR MELTING =',F8.2)
  105 FORMAT (4D16.3)
C
      PRINT 101
      READ 102,TO,P,XSUBE,NSEC
      XSUBE=XSUBE*1.D-4
      PRINT 102,TO,P,XSUBE,NSEC
C
      OPEN(2,FILE='ref170',FORM='PRINT')
C
C     ref170 IS THE NAME OF THE FILE CONTAINING THE ARRAY RR(z).
C
      READ(2,*) (RR(I),I=1,70)
      PRINT*, (RR(I),I=1,70)
      OPEN(3,FILE='dataint.xz',FORM='PRINT')
C
C     dataint.xz IS THE FILE THAT CONTAINS THE THETA INTEGRAL
```

```
C     CALCULATED SEPARATELY, AND TO BE READ IN HERE.
C
      J=1
      DO 7 I=1,70
C     DO 7 J=1,70
      DO 7 K=1,70
      TEMP(I,K)=T0
      TET(I,K)=0.0
      READ(3,105) X,Z,TINT(I,K)
    7 CONTINUE
C
      TMELT=1690.D0
      TBOIL=2890.D0
C
C     TMELT=1417C; SILICON DATA HANDBOOK; PERGAMON 1969
C     TBOIL=2600C; FROM SAME SOURCE
C
      PMELT=598.*XSUBE*SQRT(PI)/(1.-RR(1))*
     1LOG((TMELT-99.)/(T0-99.))
C
C     PMELT IS THE THRESHOLD POWER FOR MELTING
C
      PRINT 104,TMELT,PMELT
      SEC=NSEC
      DELP=(P-PMELT)/SEC
      TETMLT=(T0-99.)*LOG((TMELT-99.)/(T0-99.))
C
C     TETMLT IS THE VALUE OF THETA AT THE ONSET OF MELTING.
C     IT IS EQUAL TO TETMAX FOR A POWER VALUE OF PMELT.
C
      CMELT=0.5D0
C
C     CMELT IS THE THERMAL CONDUCTIVITY OF THE MELT
C
      X=0.D0
      Y=0.D0
      Z=0.D0
      OPEN(1,FILE='cmelt.xz',FORM='PRINT')
C
C     cmelt.xz IS THE NAME OF THE FILE CONTAINING THE
C     FINAL RESULTS OF THE CALCULATION.
C
      DO 9 IX=1,70
      DO 9 IY=1,70
      TET(IX,IY)=0.D0
    9 R(IX,IY)=RR(1)
C
C     IN THE FOLLOWING DO LOOP THE INITIAL TEMPERATURE
C     DISTRIBUTION IS OBTAINED FOR THE THRESHOLD POWER.
C
      IY=1
      DO 20 IX=1,70
      COEFF=(1.-R(IX,IY))*PMELT*(T0-99.)/((PI**1.5)*299.)
C     DO 20 IY=1,70
      DO 20 IZ=1,70
      TET(IX,IZ)=COEFF*TINT(IX,IZ)
```

```
      TEMP(IX,IZ)=99.+(T0-99.)*
     1EXP(TET(IX,IZ)/(T0-99.))
   20 CONTINUE
C
C     IN THE FOLLOWING DO LOOP AN ITERATIVE CALCULATION OF
C     THETA IS CARRIED, ADJUSTING THE REFLECTIVITY AT EACH
C     SURFACE POINT AFTER EACH CYCLE. AT COMPLETION THE SUMMED-UP
C     VALUE OF THETA IS OBTAINED AND A FINAL TEMPERATURE PROFILE
C     IS CALCULATED.
C
      DO 3 IS=1,NSEC
C
C     CALCULATION OF THE REFLECTIVITY AS DETERMINED
C     BY THE DEPTH OF THE MELT FRONT
C
      JY=1
      DO 11 JX=1,70
      J=2
    8 IF(TEMP(JX,J).GE.TMELT.AND.J.LE.69) THEN
      J=J+1
      GOTO 8
      ELSE
      R(JX,JY)=RR(J-1)
      ENDIF
   11 CONTINUE
C
      DO 2 IX=1,70
      COEFF=(1.-R(IX,JY))*DELP*(T0-99.)/((PI**1.5)*299.)
C     DO 2 IY=1,70
      DO 2 IZ=1,70
      TET(IX,IZ)=TET(IX,IZ)+COEFF*TINT(IX,IZ)
      IF(TET(IX,IZ).LE.TETMLT) THEN
      TEMP(IX,IZ)=99.+(T0-99.)*
     1EXP(TET(IX,IZ)/(T0-99.))
      ELSE
      TEMP(IX,IZ)=TMELT+299.*(TET(IX,IZ)-TETMLT)
     1/(CMELT*(T0-99.))
      ENDIF
    2 CONTINUE
    3 CONTINUE
C
      DO 4 IX=1,70
      X=(IX-1)*1000.
C     DO 4 IY=1,70
C     Y=(IY-1)*1000.
      DO 4 IZ=1,70
      IF(IZ.LE.26) THEN
      Z=(IZ-1)*20.
      ELSE
      Z=(IZ-26)*1000.
      ENDIF
      IF(IZ.LT.27.AND.IZ.GT.1) THEN
      GOTO 4
      ENDIF
      WRITE(1,103) X,Z,TEMP(IX,IZ)
    4 CONTINUE
```

```
      CLOSE(3)
      CLOSE(2)
      CLOSE(1)
      END
```

```
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      PROGRAM GAP
C     THIS PROGRAM CALCULATES THE INTEGRAL THAT
C     DETERMINES THE GAP RESISTANCE
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD
      DIMENSION TIM(11)
      COMMON /ABC/T,DIF,EL
      DOUBLE PRECISION T,TIM,DIF,EL,A,B,SS
  100 FORMAT (4E16.4)
  102 FORMAT (7D16.3)
C
C     A AND B ARE THE LIMITS OF INTEGRATION
  101 FORMAT('READ IN:B; DIF')
      PRINT 101
      READ 102,B,DIF
      PRINT 102,B,DIF
C
      TIM(2)=100.
      TIM(3)=80.
      TIM(4)=60.
      TIM(5)=40.
      TIM(6)=20.
      TIM(7)=10.
      TIM(8)=5.
      TIM(9)=3.
      TIM(10)=2.
      TIM(11)=1.
      EL=B
      A=0.0
      EMU=140.0
      WIDTH=1.6E-3
      D=3.7E-4
      ELMAX=5.7E-4
      HALFGAP=2.E-4
      DOSE=2.E15
      DOP=DOSE*WIDTH*D*(HALFGAP/ELMAX)
      DENO=1.6E-19*EMU*DOP
      OPEN(1,FILE='resist',FORM='PRINT')
      DO 1 N=2,11
      T=TIM(N)*1.E-6
      DIFUT=2.*SQRT(DIF*T)
      CALL QROMB(A,B,SS)
      SS=SS*SQRT(3.1415)*DIFUT/DENO
      WRITE(1,100) TIM(N),SS
      PRINT 100,TIM(N),SS
    1 CONTINUE
      CLOSE(1)
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,B,SS)
C
      DOUBLE PRECISION EPS,A,B,SS,S,H,DSS
```

```
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,B,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,B,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      B=SQRT(BB-AA)
      A=0.0
      IF (N.EQ.1) THEN
      S=(B-A)*FUNC(0.5*(A+B))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(B-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(B-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,D,DIF,DIFT,
     1HO,HP,W,DEN
```

```
      DIMENSION XA(N),YA(N),C(NMAX),D(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      D(I)=YA(I)
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-D(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      D(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=D(NS)
      NS=NS-1
      ENDIF
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND
C
      FUNCTION GRAL(TT)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED
C     TT IS THE TIME VARIABLE
C
      DOUBLE PRECISION TT
      DOUBLE PRECISION GRAL,ARGU1,DENO1,DENO2
      DOUBLE PRECISION T,DIF,EL
      COMMON /ABC/T,DIF,EL
      DENO1=EXP(EL*TT/(2.*DIF*T))
      DENO2=EXP(-EL*TT/(2.*DIF*T))
      ARGU1=EXP((EL*EL+TT*TT)/(4.*DIF*T))
      GRAL=ARGU1/(DENO1+DENO2)
      RETURN
      END
```

```
      PROGRAM TTHETA
C
C     THIS PROGRAM CALCULATES THE INTEGRAL THAT
C     DETERMINES THE LINEAR TEMPERATURE FOR THE CASE OF
C     A FINITE ABSORPTION COEFFICIENT.
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD.
C
      DOUBLE PRECISION X,Y,Z,A,B,PI,XSUBE,SS,ALPHA,FHI
      DIMENSION FHI(10000)
      COMMON /ABC/X,Y,Z
      COMMON /DEF/XSUBE,FHI,ALPHA
      PARAMETER (PI=3.1415927)
  100 FORMAT (4F14.6)
  101 FORMAT('READ IN:B,XSUBE,ALPHA')
  102 FORMAT (3D12.3)
  103 FORMAT (4D16.4)
  104 FORMAT ('MELTING TEMP. =',F8.1,5X,
     1'POWER FOR MELTING =',F8.2)
C
C     A AND B ARE THE LIMITS OF INTEGRATION.
C     XSUBE IS THE 1/e BEAM RADIUS.
C
      PRINT 101
      READ 102,B,XSUBE,ALPHA
      XSUBE=XSUBE*1.D-4
      PRINT 102,B,XSUBE,ALPHA
C
      A=0.0
      B=2.*SQRT(B)
      X=0.0
      Y=0.0
      Z=0.0
      OPEN(1,FILE='data.yagsol',FORM='PRINT')
      OPEN(2,FILE='phi',FORM='PRINT')
C
C     data.yagsol IS THE FILE CONTAINING THE
C     INTEGRATION RESULTS FOR THE NdYAG APPLICATION TO SOLID SILICON.
C     phi IS THE FILE THAT CONTAINS THE PROBABILITY INTEGRAL
C
      READ(2,*) (FHI(K),K=1,10000)
      IY=1
      DO 1 IX=1,70
      X=(IX-1)*2.D-5
C     DO 1 IY=1,70
C     Y=(IY-1)*1.D-5
      DO 1 IZ=1,70
      IF(IZ.LE.26) THEN
      Z=(IZ-1)*4.D-7
      ELSE
      Z=(IZ-25)*1.D-5
      ENDIF
      CALL QROMB(A,B,SS)
      SS=SS*ALPHA
      WRITE(1,103) X,Z,SS
    1 CONTINUE
C
```

```
      CLOSE(1)
      CLOSE(2)
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,B,SS)
C
      DOUBLE PRECISION EPS,A,B,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,B,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT.
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,B,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      B=SQRT(BB-AA)
      A=0.0
      IF (N.EQ.1) THEN
      S=(B-A)*FUNC(0.5*(A+B))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(B-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
```

```
      V=V+DEL
   12 CONTINUE
      S=(S+(B-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,D,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),D(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      D(I)=YA(I)
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-D(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      D(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=D(NS)
      NS=NS-1
      ENDIF
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND.
C
      FUNCTION GRAL(TAU)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED.
C     TAU IS A DUMMY INTEGRATION VARIABLE.
C
      DOUBLE PRECISION PI,TAU,FI1,FI2,COREM1,COREM2
```

```
      DOUBLE PRECISION X,Y,Z,XSUBE,ALPHA
      PARAMETER (PI=3.1415927)
C     PARAMETER (ALPHA=10.)
C     THIS VALUE OF ALPHA IS FOR THE 1064 NdYAG LASER
C     AND SOLID SILICON. SOURCE: p.110, Semi. and Semi. Vol.23 (1984)
      DOUBLE PRECISION GRAL,DENO1,DENO2,
     1ARGU1,ARGU2,FHI
      DIMENSION FHI(10000)
      COMMON /DEF/XSUBE,FHI,ALPHA
      COMMON /ABC/X,Y,Z
      DENO1=TAU*TAU
      DENO2=DENO1+XSUBE*XSUBE
      ARGU1=EXP(-(X*X+Y*Y)/DENO2)
      ARGU=SQRT(PI)*TAU*EXP(ALPHA*ALPHA*DENO1/4.)/2.
      GOREM1=ALPHA*TAU/2.-Z/TAU
      GOREM2=ALPHA*TAU/2.+Z/TAU
      MEROG1=GOREM1*10000
      MEROG2=GOREM2*10000
      IF(MEROG1.LE.0) THEN
      FI1=0.0
      GOTO 1
      ENDIF
      IF(MEROG1.GT.10000) THEN
      FI1=1.0
      ELSE
      FI1=FHI(MEROG1)
      ENDIF
    1 IF(MEROG2.LE.0) THEN
      FI1=0.0
      GOTO 2
      ENDIF
      IF(MEROG2.GT.10000) THEN
      FI2=1.0
      ELSE
      FI2=FHI(MEROG2)
      ENDIF
    2 ARGU2=ARGU*(EXP(-ALPHA*Z)*(1.-FI1)+EXP(ALPHA*Z)*(1.-FI2))
      GRAL=ARGU1*ARGU2/DENO2
      RETURN
      END
```

```
      PROGRAM TOOR
  100 FORMAT(3E16.6,I6)
  101 FORMAT('READ IN EL,TIME,DIF, AND THE UPPER BOUND ON THE SUM')
      PRINT 101
    4 READ 100,EL,T,DIF,NU
      PRINT *,EL,T,DIF,NU
      DIFUT=2.*SQRT(DIF*T)
      U=EL*EL/(DIFUT*DIFUT)
      SUM=1.0
      S=1
      DO 1,K=1,NU
      S=S*(1+2*K)
      SUM=SUM+(-2*U)**K/S
      PRINT *,S,SUM
    1 CONTINUE
      IF(DIFUT.GE.2.E-4) THEN
      DIFUT=2.E-4
      ENDIF
      SU=SUM*SQRT(U)*EXP(U)*4*DIF*T/DIFUT
C     SU=SUM*SQRT(U)*EXP(U)*SQRT(T)
      PRINT 102,SU
  102 FORMAT('THE "RESISTANCE" IS:'E12.4)
      PAUSE
      GOTO 4
      END
```

```
      PROGRAM REFLECT
C
C     THIS PROGRAM CALCULATES THE REFLECTIVITY AS A FUNCTION
C     OF THE FILM(S) REFRACTION INDICES AND IT'S THICKNESS
C     THE CONSTANTS HERE PERTAIN TO ALUMINUM AND THE 546nm Ar LASER
C
C      OPTICAL DATA FOR THE 546nm Ar BAND
      EN1=1.0
      U2=2.68
      V2=6.52
      U3=.88
      V3=5.54
      PI=3.1415927
C
      OPEN(1,FILE='alumin',FORM='PRINT')
C
      ROSQ12=((EN1-U2)**2+V2**2)/((EN1+U2)**2+V2**2)
      RO12=SQRT(ROSQ12)
      TANPH12=2.*EN1*V2/(U2**2+V2**2-EN1**2)
      PHI12=ATAN(TANPH12)
      ROSQ23=((U2-U3)**2+(V2-V3)**2)/((U2+U3)**2+(V2+V3)**2)
      RO23=SQRT(ROSQ23)
      TANPH23=2.*(U3*V2-U2*V3)/(U2**2+V2**2-U3**2-V3**2)
      PHI23=PI+ATAN(TANPH23)
C
      AMBDA=5460.0
      AA=COS(PHI23-PHI12)
      BB=COS(PHI23+PHI12)
      PRINT*,ROSQ12,PHI12,ROSQ23,PHI23,AA,BB,AMBDA
      READ*,TOSEFET
      H=-TOSEFET
      DO 1 I=1,101
      H=H+TOSEFET
      GAMMA=2.*PI*H/AMBDA
      ENUM=ROSQ12*EXP(2.*V2*GAMMA)+ROSQ23*EXP(-2.*V2*GAMMA)+
     12.*RO12*RO23*COS(PHI23-PHI12+2.*U2*GAMMA)
      DENOM=EXP(2.*V2*GAMMA)+ROSQ12*ROSQ23*EXP(-2.*V2*GAMMA)+
     12.*RO12*RO23*COS(PHI12+PHI23+2.*U2*GAMMA)
      REF=ENUM/DENOM
      WRITE(1,100)H,REF
    1 CONTINUE
  100 FORMAT(5F10.3)
      CLOSE(1)
      END
```

```
      PROGRAM REFLECT
C
C     THIS PROGRAM CALCULATES THE REFLECTIVITY AS A FUNCTION
C     OF THE FILM(S) REFRACTION INDICES AND IT'S THICKNESS
C
      DIMENSION AMBDA(10),W(10),U3(10),V3(10)
      EN1=1.0
      U2=1.45
      U3(1)=4.21
      U3(2)=4.24
      U3(3)=4.27
      U3(4)=4.31
      U3(5)=4.36
      U3(6)=4.43
      U3(7)=4.5
      U3(8)=4.57
      U3(9)=4.64
      U3(10)=4.71
      V3(1)=0.04
      V3(2)=0.046
      V3(3)=0.052
      V3(4)=0.058
      V3(5)=0.064
      V3(6)=0.071
      V3(7)=0.078
      V3(8)=0.085
      V3(9)=0.096
      V3(10)=0.102
      PI=3.1415927
C
      OPEN(1,FILE='reflect',FORM='PRINT')
      V2=0.0
      READ*,H
C
      ROSQ12=((EN1-U2)**2+V2**2)/((EN1+U2)**2+V2**2)
      RO12=SQRT(ROSQ12)
      TANPH12=2.*EN1*V2/(U2**2+V2**2-EN1**2)
      PHI12=ATAN(TANPH12)
C
      AMBDA(1)=5287.0
      AMBDA(2)=5140.0
      AMBDA(3)=5107.0
      AMBDA(4)=4965.0
      AMBDA(5)=4880.0
      AMBDA(6)=4765.0
      AMBDA(7)=4272.0
      AMBDA(8)=4658.0
      AMBDA(9)=4579.0
      AMBDA(10)=4545.0
      W(1)=.34
      W(2)=2.0
      W(3)=.4
      W(4)=.7
      W(5)=1.5
      W(6)=.75
      W(7)=.3
```

```
      W(8)=.2
      W(9)=.35
      W(10)=.12
      WW=0.0
      DO 5 J=1,10
    5 WW=WW+W(J)
      AA=COS(PHI23-PHI12)
      BB=COS(PHI23+PHI12)
      DO 2 K=1,100
      HH=(K-1)*H
      REF=0.0
      DO 1 I=1,10
      ROSQ23=((U2-U3(I))**2+(V2-V3(I))**2)/((U2+U3(I))**2+(V2+V3(I))**2)
      RO23=SQRT(ROSQ23)
      TANPH23=2.*(U3(I)*V2-U2*V3(I))/(U2**2+V2**2-U3(I)**2-V3(I)**2)
      PHI23=ATAN(TANPH23)
      GAMMA=2.*PI*HH/AMBDA(I)
      ENUM=ROSQ12*EXP(2.*V2*GAMMA)+ROSQ23*EXP(-2.*V2*GAMMA)+
     12.*RO12*RO23*COS(PHI23-PHI12+2.*U2*GAMMA)
      DENOM=EXP(2.*V2*GAMMA)+ROSQ12*ROSQ23*EXP(-2.*V2*GAMMA)+
     12.*RO12*RO23*COS(PHI12+PHI23+2.*U2*GAMMA)
      REF=REF+W(I)/WW*(ENUM/DENOM)
    1 CONTINUE
      WRITE(1,100) HH,REF
    2 CONTINUE
  100 FORMAT(5F10.3)
      CLOSE(1)
      END
```

```
      PROGRAM MELT
      DIMENSION T(3000)
      REAL PI
      PARAMETER (PI=3.1415,TM=1690,RHO=2.3296,LATH=3280.0)
C     LATH IS THE LATENT HEAT IN JOULS PER GRAM
      READ*,HP,COND,XE
      R=0.8
      RR=0.0
      DELT=0.001
      RM=(1.0-R)*HP/(2.0*PI*COND*TM)
      DO 1 I=1,300
      RR=RR+0.01
      T(I)=(1.0-R)*HP/(2.0*COND*PI*(RR+XE)*0.0001)
    1 CONTINUE
  100 FORMAT(5X,F10.4,5X,F10.2)
      DO 2 I=1,3000
      RR=0.001*I
      PRINT 100, RR,T(I)
    2 CONTINUE
      STOP
      END
```

```
      PROGRAM VARIANTS
C
      OPEN(1,FILE='PTx1',FORM='PRINT')
C
      P1=3.5
      R=.37
      XE1=1.665E-4
      T01=299.
      PI=3.1415927
      SPI=SQRT(PI)
      ZETA=(1.-R)/(SPI*598.)
      REF1=(T01-99.)*EXP(ZETA*P1/XE1)
      DO 1 I=1,10
      XE2=1.1+I*.1
      XE2=XE2*1.E-4
      DO 2 J=1,10
      T02=199.+50.*J
      RAT=LOG(REF1/(T02-99.))
      P2=RAT*XE2/ZETA
      WRITE(1,100)T02,P2,XE2
    2 CONTINUE
    1 CONTINUE
  100 FORMAT(2F12.3,E12.3)
      CLOSE(1)
      END
```

```
      PROGRAM QINTEG
C     THIS PROGRAM CALCULATES THE INTEGRAL THAT
C     DETERMINES THE TEMPERATURE
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD
      COMMON /ABC/X,Y,Z
      COMMON /DEF/DIFUCO,CONDCO,P,XSUBE,R
      DOUBLE PRECISION X,Y,Z,A,B,DIFUCO,CONDCO,
     1P,XSUBE,R,SS
  100 FORMAT (4F14.6)
  102 FORMAT (7D16.3)
C
C     A AND B ARE THE LIMITS OF INTEGRATION
  101 FORMAT('READ IN:B,REFLECT,POWER')
      PRINT 101
      READ 102,B,R,P
      PRINT 102,B,R,P
C
      A=0.0
      DIFUCO=0.1
      CONDCO=0.25
      XSUBE=2.58D-4
      X=0.0
      Y=0.0
      Z=0.0
      OPEN(1,FILE='data.eq5',FORM='PRINT')
      DO 1 IX=1,12
      X=(IX-1)*2.D-5
C     DO 1 IY=1,12
C     Y=(IY-1)*2.D-5
      DO 1 IZ=1,12
      Z=(IZ-1)*2.D-5
      CALL QROMB(A,B,SS)
      WRITE(1,100) X,Z,SS
    1 CONTINUE
      CLOSE(1)
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,B,SS)
C
      DOUBLE PRECISION EPS,A,B,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,B,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
```

```
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,B,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      B=SQRT(BB-AA)
      A=0.0
      IF (N.EQ.1) THEN
      S=(B-A)*FUNC(0.5*(A+B))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(B-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(B-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,D,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),D(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      D(I)=YA(I)
```

```
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-D(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      D(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=D(NS)
      NS=NS-1
      ENDIF
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND
C
      FUNCTION GRAL(TT)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED
C     TT IS THE TIME VARIABLE
C
      DOUBLE PRECISION PI,TT
      PARAMETER (PI=3.1415927)
      DOUBLE PRECISION GRAL,COEFF,DENO1,DENO2,DENO3,
     1ARGU1,ARGU2
      DOUBLE PRECISION X,Y,Z,DIFUCO,CONDCO,P,XSUBE,R
      COMMON /DEF/DIFUCO,CONDCO,P,XSUBE,R
      COMMON /ABC/X,Y,Z
      COEFF=(1.-R)*P*DIFUCO/CONDCO
      DENO1=4.*DIFUCO*TT
      DENO2=DENO1+XSUBE*XSUBE
      DENO3=SQRT((DENO1/4.)*(PI*PI*PI))
      ARGU1=EXP(-(X*X+Y*Y)/DENO2)
      ARGU2=EXP(-(Z*Z)/DENO1)
      GRAL=COEFF*ARGU1*ARGU2/(DENO3*DENO2)
      RETURN
      END
```

```
      PROGRAM TTHETA
C
C     THIS PROGRAM CALCULATES THE INTEGRAL THAT
C     DETERMINES THE LINEAR TEMPERATURE.
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD.
C
      DOUBLE PRECISION X,Y,Z,A,B,PI,XSUBE,SS,ALPHA
      COMMON /ABC/X,Y,Z
      COMMON /DEF/XSUBE,ALPHA
      PARAMETER (PI=3.1415927)
  100 FORMAT (4F14.6)
  101 FORMAT('READ IN:B,XSUBE,ALPHA')
  102 FORMAT (3D12.3)
  103 FORMAT (4D16.4)
  104 FORMAT ('MELTING TEMP. =',F8.1,5X,
     1'POWER FOR MELTING =',F8.2)
C
C     A AND B ARE THE LIMITS OF INTEGRATION.
C     XSUBE IS THE 1/e BEAM RADIUS.
C
      PRINT 101
      READ 102,B,XSUBE,ALPHA
      XSUBE=XSUBE*1.D-4
      PRINT 102,B,XSUBE,ALPHA
C
      A=0.0
      B=2.*SQRT(B)
      X=0.0
      Y=0.0
      Z=0.0
      OPEN(1,FILE='data.yagver',FORM='PRINT')
      OPEN(2,FILE='phi',FORM='PRINT')
C
C     data.yagsol IS THE FILE CONTAINING THE
C     INTEGRATION RESULTS FOR THE NdYAG APPLICATION TO SOLID SILICON.
C     phi IS THE FILE THAT CONTAINS THE PROBABILITY INTEGRAL
C
      IY=1
      DO 1 IX=1,70
      X=(IX-1)*1.D-5
C     DO 1 IY=1,70
C     Y=(IY-1)*1.D-5
      DO 1 IZ=1,70
      IF(IZ.LE.26) THEN
      Z=(IZ-1)*4.D-7
      ELSE
      Z=(IZ-25)*1.D-5
      ENDIF
      CALL QROMB(A,B,SS)
      SS=SS*ALPHA
      WRITE(1,103) X,Z,SS
    1 CONTINUE
C
      CLOSE(1)
      CLOSE(2)
      END
```

```
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,B,SS)
C
      DOUBLE PRECISION EPS,A,B,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,B,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT.
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,B,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      B=SQRT(BB-AA)
      A=0.0
      IF (N.EQ.1) THEN
      S=(B-A)*FUNC(0.5*(A+B))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(B-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(B-A)*SUM/TNM)/3.
```

```
      IT=3*IT
      ENDIF
      RETURN
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,D,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),D(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      D(I)=YA(I)
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-D(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      D(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=D(NS)
      NS=NS-1
      ENDIF
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND.
C
      FUNCTION GRAL(TAU)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED.
C     TAU IS A DUMMY INTEGRATION VARIABLE.
C
      DOUBLE PRECISION PI,TAU
      DOUBLE PRECISION X,Y,Z,XSUBE,ALPHA
      PARAMETER (PI=3.1415927)
C     PARAMETER (ALPHA=10.)
```

```
C      THIS VALUE OF ALPHA IS FOR THE 1064 NdYAG LASER
C      AND SOLID SILICON. SOURCE: p.110, Semi. and Semi. Vol.23 (1984)
       DOUBLE PRECISION GRAL,DENO1,DENO2,
      1ARGU1,ARGU2
       COMMON /DEF/XSUBE,ALPHA
       COMMON /ABC/X,Y,Z
       DENO1=TAU*TAU
       DENO2=TAU*TAU+XSUBE*XSUBE
       ARGU1=EXP(-(X*X+Y*Y)/DENO2)
       ARGU=EXP(-ALPHA*Z+ALPHA*ALPHA*DENO1/4.)
       ARGU2=ARGU*TAU*SQRT(PI)
       GRAL=ARGU1*ARGU2/DENO2
       RETURN
       END
```

```
      SUBROUTINE TETA(D,TETXZ)
C
C     THIS SUBROUTINE AND THE ONES THAT IT CALLS CALCULATE THE INTEGRAL
C     THAT DETERMINES THE LINEAR TEMPERATURE IN A THIN FILM.
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD.
C     IN THIS VERSION THE MESH SIZE HAS BEEN REDUCED.
C
      COMMON /ABC/X,Z,B,D
      COMMON /DEF/XSUBE,DEPTH
      DOUBLE PRECISION X,Y,Z,A,B,PI,XSUBE,SS,DEPTH,D,BB
      PARAMETER (PI=3.1415927)
  100 FORMAT (4F14.6)
  102 FORMAT (4D12.3,I5)
  103 FORMAT (4D16.4)
C
C     A AND B ARE THE LIMITS OF INTEGRATION.
C     XSUBE IS THE 1/e BEAM RADIUS.
C
      DEPTH=0.75D-4
C     DEPTH IS THE THICKNESS OF THE FILM IN CENTIMETERS
C
      A=0.0
      BB=2.*SQRT(B*D)
      CALL QROMB(A,BB,SS)
      TETXZ=SS
      RETURN
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,BB,SS)
C
      DOUBLE PRECISION EPS,A,BB,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,BB,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BBB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT.
C     WHEN CALLED WITH N=1
```

```
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BBB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,BB,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      BB=SQRT(BBB-AA)
      A=0.0
      IF (N.EQ.1) THEN
      S=(BB-A)*FUNC(0.5*(A+BB))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(BB-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(BB-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,DD,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),DD(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      D(I)=YA(I)
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-DD(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
```

```
      DEN=W/DEN
      DD(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=D(NS)
      NS=NS-1
      ENDIF
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND.
C
      FUNCTION GRAL(TAU)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED.
C     TAU IS A DUMMY INTEGRATION VARIABLE.
C
      DOUBLE PRECISION PI,TAU,SUMZ,A,B,DDD,E
      PARAMETER (PI=3.1415927)
      DOUBLE PRECISION GRAL,DENO2,
     1ARGU1,ARGU2,DEPTH
      DOUBLE PRECISION X,Y,Z,XSUBE
      COMMON /DEF/XSUBE,DEPTH
      COMMON /ABC/X,Y,Z,B,D
      DENO2=TAU*TAU+XSUBE*XSUBE
C     ARGU1=EXP(-(X*X+Y*Y)/DENO2)
      ARGU1=EXP(-X*X/DENO2)
      SUMZ=0.0
      DO 1 K=1,1000000
      D=SUMZ
      A=EXP(-((2.*DEPTH*(K-1)-Z)/TAU)**2)
     1+EXP(-((-2.*DEPTH*(K-1)-Z)/TAU)**2)
C     THE SECOND TERM ABOVE ACCOUNTS FOR THE SUM FROM MINUS INFINITY
      IF(K.EQ.1) A=A/2.
      SUMZ=SUMZ+A
      E=DDD/SUMZ
C     THE FOLLOWING LIMIT IS THE CHOSEN TEST OF CONVERSION OF THE SERIES
C     THIS LIMIT IS HIGHLY SENSITIVE TO THE VALUE OF THE DEPTH PARAMETER
C     THE VALUE GIVEN HERE IS ADEQUATE FOR A DEPTH VALUE OF NO
C     LESS THAN 1/2 MICRON.
C     THE THICKER IS THE DEPTH THE
C     SMALLER CAN THIS LIMIT BE. IT MUST BE ADJUSTED WHENEVER THE DEPTH IS
C     LOWERED.
      IF(E.GT.0.999) GOTO 2
    1 CONTINUE
    2 ARGU2=SUMZ
C     PRINT*,K,SUMZ,TAU,Z,E
      GRAL=ARGU1*ARGU2/DENO2
      RETURN
      END
```

```
      PROGRAM THETALU
C
C     THIS PROGRAM CALCULATES THE INTEGRAL THAT
C     DETERMINES THE LINEAR TEMPERATURE IN A THIN FILM.
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD.
C
      COMMON /ABC/X,Y,Z
      COMMON /DEF/XSUBE,DEPTH
      DOUBLE PRECISION X,Y,Z,A,B,PI,XSUBE,SS,DEPTH
      PARAMETER (PI=3.1415927)
  100 FORMAT (4F14.6)
  101 FORMAT('READ IN:B,XSUBE')
  102 FORMAT (4D12.3,I5)
  103 FORMAT (4D16.4)
  104 FORMAT ('MELTING TEMP. =',F8.1,5X,
     1'POWER FOR MELTING =',F8.2)
C
C     A AND B ARE THE LIMITS OF INTEGRATION.
C     XSUBE IS THE 1/e BEAM RADIUS.
C
      PRINT 101
      READ 102,B,XSUBE
      XSUBE=XSUBE*1.D-4
      DEPTH=0.75D-4
C     DEPTH IS THE THICKNESS OF THE FILM IN CENTIMETERS
      PRINT 102,B,XSUBE,DEPTH
C
      A=0.0
      B=2.*SQRT(B)
      X=0.0
      Y=0.0
      Z=0.0
      OPEN(1,FILE='data',FORM='PRINT')
C
C     data IS THE FILE CONTAINING THE INTEGRATION RESULTS.
C
      IY=1
      DO 1 IX=1,100
      X=(IX-1)*1.D-5
C     DO 1 IY=1,100
C     Y=(IY-1)*1.D-5
      DO 1 IZ=1,40
      IF(IZ.LE.26) THEN
      Z=(IZ-1)*2.D-7
      ELSE
      Z=(IZ-26)*1.D-5
      ENDIF
      CALL QROMB(A,B,SS)
      WRITE(1,103) X,Z,SS
    1 CONTINUE
C
      CLOSE(1)
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
```

```
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,B,SS)
C
      DOUBLE PRECISION EPS,A,B,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,B,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT.
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,B,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      B=SQRT(BB-AA)
      A=0.0
      IF (N.EQ.1) THEN
      S=(B-A)*FUNC(0.5*(A+B))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(B-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(B-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
```

```
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,D,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),D(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      D(I)=YA(I)
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-D(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      D(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=D(NS)
      NS=NS-1
      ENDIF
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND.
C
      FUNCTION GRAL(TAU)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED.
C     TAU IS A DUMMY INTEGRATION VARIABLE.
C
      DOUBLE PRECISION PI,TAU,SUMZ,A,D,E
      PARAMETER (PI=3.1415927)
      DOUBLE PRECISION GRAL,DENO1,DENO2,
     1ARGU1,ARGU2,DEPTH
      DOUBLE PRECISION X,Y,Z,XSUBE
      COMMON /DEF/XSUBE,DEPTH
      COMMON /ABC/X,Y,Z
```

```
      DENO1=TAU*TAU
      DENO2=TAU*TAU+XSUBE*XSUBE
C     ARGU1=EXP(-(X*X+Y*Y)/DENO2)
      ARGU1=EXP(-X*X/DENO2)
      SUMZ=0.0
      DO 1 K=1,1000000
      D=SUMZ
      A=EXP(-((2.*DEPTH*(K-1)-Z)/TAU)**2)
     1+EXP(-((-2.*DEPTH*(K-1)-Z)/TAU)**2)
C     THE SECOND TERM ABOVE ACCOUNTS FOR THE SUM FROM MINUS INFINITY
C     THE FOLLOWING IF STATEMENT ASSURES COUNTING THE ZEROTH TERM ONCE.
      IF(K.EQ.1) A=A/2.
      SUMZ=SUMZ+A
      E=D/SUMZ
C     THE FOLLOWING LIMIT IS THE CHOSEN TEST OF CONVERSION OF THE SERIES
C     THIS LIMIT IS HIGHLY SENSITIVE TO THE VALUE OF THE DEPTH PARAMETER
C     THE VALUE GIVEN HERE IS MORE THAN ADEQUATE FOR A DEPTH VALUE OF NO
C     LESS THAN 1/2 MICRON. IN FACT IT IS TOO MUCH AND A SMALLER VALUE
C     (LESS ONE OR TWO NINES), COULD BE USED. THE THICKER IS THE DEPTH THE
C     SMALLER CAN THIS LIMIT BE. IT MUST BE ADJUSTED WHENEVER THE DEPTH IS
C     LOWERED.
      IF(E.GT.0.9999) GOTO 2
    1 CONTINUE
    2 ARGU2=SUMZ
C     PRINT*,K,SUMZ,TAU,Z,E
      GRAL=ARGU1*ARGU2/DENO2
      RETURN
      END
```

```
      PROGRAM TETAX
C
C     THIS PROGRAM CALCULATES THE INTEGRAL THAT
C     DETERMINES THE LINEAR TEMPERATURE IN A THIN FILM.
C     THE INTEGRATION IS LIMITED TO THE X COORDINATE.
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD.
C     IN THIS VERSION THE MESH SIZE HAS BEEN REDUCED.
C
      COMMON /ABC/X
      COMMON /DEF/XSUBE,DEPTH
      DOUBLE PRECISION X,A,B,PI,XSUBE,SS,DEPTH
      PARAMETER (PI=3.1415927)
  100 FORMAT (4F14.6)
  101 FORMAT('READ IN:B,XSUBE')
  102 FORMAT (4D12.3,I5)
  103 FORMAT (4D16.4)
  104 FORMAT ('MELTING TEMP. =',F8.1,5X,
     1'POWER FOR MELTING =',F8.2)
C
C     A AND B ARE THE LIMITS OF INTEGRATION.
C     XSUBE IS THE 1/e BEAM RADIUS.
C
      PRINT 101
      READ 102,B,XSUBE
      XSUBE=XSUBE*1.D-4
      DEPTH=0.75D-4
C     DEPTH IS THE THICKNESS OF THE FILM IN CENTIMETERS
      PRINT 102,B,XSUBE,DEPTH
C
      A=0.0
      B=2.*SQRT(B)
      X=0.0
      OPEN(1,FILE='datax',FORM='PRINT')
C
C     datax IS THE FILE CONTAINING THE INTEGRATION RESULTS.
C
      IY=1
      DO 1 IX=1,21
      X=(IX-1)*5.D-5
      CALL QROMB(A,B,SS)
      WRITE(1,103) X,SS
    1 CONTINUE
C
      CLOSE(1)
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,B,SS)
C
      DOUBLE PRECISION EPS,A,B,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
```

```
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,B,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT.
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,B,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      B=SQRT(BB-AA)
      A=0.0
      IF (N.EQ.1) THEN
      S=(B-A)*FUNC(0.5*(A+B))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(B-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(B-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,D,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),D(NMAX)
      NS=1
```

```
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      D(I)=YA(I)
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-D(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      D(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=D(NS)
      NS=NS-1
      ENDIF
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND.
C
      FUNCTION GRAL(TAU)
C
C     X IS THE COORDINATE IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED.
C     TAU IS A DUMMY INTEGRATION VARIABLE.
C
      DOUBLE PRECISION PI,TAU,SUMZ,A,D,E
      PARAMETER (PI=3.1415927)
      DOUBLE PRECISION GRAL,DENO2,
     1ARGU1,ARGU2,DEPTH
      DOUBLE PRECISION X,XSUBE
      COMMON /DEF/XSUBE,DEPTH
      COMMON /ABC/X
      DENO2=TAU*TAU+XSUBE*XSUBE
      ARGU1=EXP(-X*X/DENO2)
      SUMZ=0.0
      DO 1 K=1,1000000
      D=SUMZ
      A=2.*EXP(-(2.*DEPTH*(K-1)/TAU)**2)
      IF(K.EQ.1) A=A/2.
      SUMZ=SUMZ+A
```

```
      E=D/SUMZ
C     THE FOLLOWING LIMIT IS THE CHOSEN TEST OF CONVERSION OF THE SERIES
C     THIS LIMIT IS HIGHLY SENSITIVE TO THE VALUE OF THE DEPTH PARAMETER
C     THE VALUE GIVEN HERE IS ADEQUATE FOR A DEPTH VALUE OF NO
C     LESS THAN 1/2 MICRON.
C     THE THICKER IS THE DEPTH THE
C     SMALLER CAN THIS LIMIT BE. IT MUST BE ADJUSTED WHENEVER THE DEPTH IS
C     LOWERED.
      IF(E.GT.0.9999) GOTO 2
    1 CONTINUE
    2 ARGU2=SUMZ
      GRAL=ARGU1*ARGU2/DENO2
      RETURN
      END
```

```
      PROGRAM TDIF
C
C     THIS PROGRAM calculates THE INTEGRAL THAT DEFINES
C     THETA interactively, AND USES THE RESULT TO COMPUTE THE
C     TEMPERATURE IN ANY PRESCRIBED POSITION IN THE FILM.
C     THIS PRESCRIPTION IS NEEDED IN ORDER TO ACCOUNT FOR
C     THE CHANGING VALUE OF THE DIFFUSIVITY WITH THE TEMPERATURE
C     AT EACH POINT. THE TEMPERATURE BUILDS UP AS THE POWER RAISES
C     TO ITS MAXIMUM VALUE, AND BOTH THE REFLECTIVITY AND THE
C     DIFFUSIVITY CHANGE WITHIT. NOTE THAT THE PULSE LENGTH IS
C     VERY IMPORTANT AS EACH INCREMENT OF POWER IS VISUALISED
C     AS BEING APPLIED FOR THAT LENGTH OF TIME.
C     IT ALSO READS IN THE CALCULATED REFLECTIVITY AS A
C     FUNCTION OF THE DEPTH FROM THE SURFACE, AND USES IT IN
C     A SUCCESIVE EVALUATION OF THE ABSORBED POWER.
C
      DOUBLE PRECISION X,Z,TO,TEMP,PI,RR,SEC,
     1P,XSUBE,R,TMELT,DELP,FIT,DEPTH
     2,TETMLT,COEFF,TET,TBOIL,B,D
C
C     B IS THE TIME LENGTH OF THE PULSE (IN SECONDS)
C     D IS THE DIFFUSIVITY. THE INTEGRAL THAT DEFINES THETA
C     HAS AN UPPER INTEGRATION LIMIT OF 2*SQRT(DB).
C     TO IS THE INITIAL SUBSTRATE TEMPERATURE (AMBIENT)
C     THE ARRAY TEMP CONTAINS THE INTERMEDIATE AND FINAL
C     RESULTS OF THE TEMPERATURE CALCULATIONS.
C     THE ARRAY RR CONTAINS THE Z-DEPENDENCE REFLECTIVITY.
C     THE ARRAY R CONTAINS THE VARYING REFLECTIVITY AS A
C     FUNCTION OF THE POSITION OF THE MELT FRONT FOR A
C     GIVEN (X,Y) POSITION ON THE SURFACE.
C     SEC IS THE NUMBER OF SECTIONS INTO WHICH THE POWER
C     IS SLICED.
C     XSUBE IS THE 1/e RADIUS OF THE BEAM.
C     DELP IS THE VALUE OF THE POWER SLICE.
C     TETMELT IS THE VALUE OF THETA AT MELTING.
C     COEFF IS THE PREFACTOR FOR THE THETA INTEGRAL.
C     TET IS THE ARRAY THAT CONTAINS THE VARYING VALUE OF THETA.
C
      COMMON /ABC/X,Z
      COMMON /DEF/XSUBE,DEPTH
      PARAMETER (PI=3.1415927D0)
      DIMENSION RR(20),R(20,20)
      DIMENSION TEMP(21,20),TET(21,20),FIT(90000)
  100 FORMAT (4F14.6)
  101 FORMAT('READ IN:TO,POWER,XSUBE,B,NSEC')
  102 FORMAT (4D12.3,I5)
  103 FORMAT (I5,4D14.4)
  105 FORMAT (4D16.3)
C
      DEPTH=0.75D-4
      PRINT 101
      READ 102,TO,P,XSUBE,B,NSEC
      XSUBE=XSUBE*1.D-4
      PRINT 102,TO,P,XSUBE,B,NSEC
C
```

```
      OPEN(2,FILE='refal20',FORM='PRINT')
C
C     refal20 IS THE NAME OF THE FILE CONTAINING THE ARRAY RR(z).
C
      READ(2,*) (RR(I),I=1,20)
      PRINT*, (RR(I),I=1,20)
C
      TMELT=933.5
      TBOIL=2740.D0
C
C     TETMLT IS THE VALUE OF THETA AT THE ONSET OF MELTING.
C
      CONDO=1.85+175./(TO+50.)
C     CONDO IS THE VALUE OF THE THERMAL CONDUCTIVITY AT TO
      TETMLT=(1.85*(TMELT-TO)+175.*LOG((TMELT+50.)/(TO+50.)))/CONDO
      D=0.221+83.46/TO
C     THIS EXPRESSION FOR D IS TAKEN FROM: M.M. MEBED, H.A. KHALEK, AND M.A.
C     ABED ELNAIEM, PROC. CONDENSED PAPERS 16TH SOUTHEASTERN SEMINAR ON THER:
C     SCIENCES, P.21-28, APRIL 1982, MIAMI FL. (UNIV. MIAMI, CORAL GABLES FL
C     THE EXPRESSION IS FOR PURE(!) ALUMINUM. IT VARIES MUCH FOR ALLOYED AL.
C
      DO 31 NT=1,90000
      T=NT/10.
      IF(T.GT.TMELT) GOTO 32
      AA=(1.85*(T-TO)+175.*LOG((T+50.)/(TO+50.)))/CONDO
      NN=AA*10.
      FIT(NT)=NN
      GOTO 31
   32 AA=TETMLT+0.5*(T-TMELT)*(1.+1.E-4*(T+TMELT))/CONDO
      NN=AA*10.
      FIT(NT)=NN
   31 CONTINUE
C
      SEC=NSEC
      DELP=P/SEC
C
      X=0.D0
      Y=0.D0
      Z=0.D0
      OPEN(1,FILE='dist1.xz',FORM='PRINT')
C
C     dist.xz IS THE NAME OF THE FILE CONTAINING THE
C     FINAL RESULTS OF THE CALCULATION.
C
      DO 9 IX=1,21
      DO 9 IZ=1,20
      TEMP(IX,IZ)=TO
      TET(IX,IZ)=0.D0
    9 R(IX,IZ)=RR(1)
C
C     IN THE FOLLOWING DO LOOP A STEPWISE CALCULATION OF THE
C     TEMPERATURE IS CARRIED OUT, ADJUSTING THE REFLECTIVITY AT EACH
C     SURFACE POINT AFTER EACH CYCLE, AS WELL AS THE DIFFUSIVITY.
C     AT COMPLETION THE SUMMED-UP
C     VALUE OF THETA IS OBTAINED AND A FINAL TEMPERATURE PROFILE
C     IS CALCULATED.
```

```
C
      IXSE=1+3.*XSUBE/5.D-5
      IF(IXSE.GT.21) THEN
      IXSE=21
      ENDIF
      DO 3 IS=1,NSEC
C
C     CALCULATION OF THE REFLECTIVITY AS DETERMINED
C     BY THE DEPTH OF THE MELT FRONT
C
      JY=1
      DO 11 JX=1,21
      J=2
    8 IF(TEMP(JX,J).GE.TMELT.AND.J.LE.20) THEN
      J=J+1
      GOTO 8
      ELSE
      R(JX,JY)=RR(J-1)
      ENDIF
   11 CONTINUE
C
      DO 2 IX=1,21
      X=(IX-1)*5.D-5
      COEFF=(1.-R(IX,JY))*DELP/(PI**1.5*CONDO)
C     DO 2 IY=1,21
      DO 2 IZ=1,20
      IF(IZ.LE.13) THEN
      Z=(IZ-1)*2.D-7
      ELSE
      Z=(IZ-13)*1.D-5
      ENDIF
      D=0.221+83.46/TEMP(IX,IZ)
      CALL TETA(B,D,TETXZ)
      MM=(TET(IX,IZ)+COEFF*TETXZ)*10.
      TET(IX,IZ)=MM
      DO 71 NT=1,90000
      T=NT/10.
      DIF=TET(IX,IZ)-FIT(NT)
      IF(DIF.EQ.0.0) GOTO 72
   71 CONTINUE
   72 TEMP(IX,IZ)=T
      TET(IX,IZ)=TET(IX,IZ)/10.
      WRITE(1,103) IS,X,Z,TEMP(IX,IZ)
    2 CONTINUE
    3 CONTINUE
      CLOSE(1)
      CLOSE(2)
      END
C
      SUBROUTINE TETA(B,D,TETXZ)
C
C     THIS SUBROUTINE AND THE ONES THAT IT CALLS CALCULATE THE INTEGRAL
C     THAT DETERMINES THE LINEAR TEMPERATURE IN A THIN FILM.
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD.
C     IN THIS VERSION THE MESH SIZE HAS BEEN REDUCED.
C
```

```
      COMMON /ABC/X,Z
      COMMON /DEF/XSUBE,DEPTH
      DOUBLE PRECISION X,Z,A,B,PI,XSUBE,SS,DEPTH,D,BB
      PARAMETER (PI=3.1415927)
C
C     A AND B ARE THE LIMITS OF INTEGRATION.
C     XSUBE IS THE 1/e BEAM RADIUS.
C
C     DEPTH IS THE THICKNESS OF THE FILM IN CENTIMETERS
C
      A=0.0
      BB=2.*SQRT(B*D)
      CALL QROMB(A,BB,SS)
      TETXZ=SS
C     PRINT*,TETXZ
      RETURN
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,BB,SS)
C
      DOUBLE PRECISION EPS,A,BB,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,BB,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BBB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT.
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BBB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,BB,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      BB=SQRT(BBB-AA)
      A=0.0
```

```
      IF (N.EQ.1) THEN
      S=(BB-A)*FUNC(0.5*(A+BB))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(BB-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(BB-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,DD,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),DD(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      DD(I)=YA(I)
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-DD(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      DD(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=DD(NS)
      NS=NS-1
      ENDIF
```

```
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND.
C
      FUNCTION GRAL(TAU)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED.
C     TAU IS A DUMMY INTEGRATION VARIABLE.
C
      DOUBLE PRECISION PI,TAU,SUMZ,AT,DDD,E
      PARAMETER (PI=3.1415927)
      DOUBLE PRECISION GRAL,DENO2,
     1ARGU1,ARGU2,DEPTH
      DOUBLE PRECISION X,Z,XSUBE,DZ,TTAU,DEP,ZZ,Q1,Q2
      COMMON /ABC/X,Z
      COMMON /DEF/XSUBE,DEPTH
      DENO2=TAU*TAU+XSUBE*XSUBE
C     ARGU1=EXP(-(X*X+Y*Y)/DENO2)
      ARGU1=EXP(-X*X/DENO2)
      SUMZ=0.0
      TTAU=TAU*TAU
      DEP=4.*DEPTH**2/TTAU
      ZZ=Z*Z/TTAU
      DZ=4.*DEPTH*Z/TTAU
      DO 1 K=1,1000000
      Q1=DEP*(K-1.)**2+ZZ+DZ*(K-1.)
      Q2=DEP*(K-1.)**2+ZZ-DZ*(K-1.)
      DDD=SUMZ
      AT=EXP(-Q1)+EXP(-Q2)
C     THE SECOND TERM ABOVE ACCOUNTS FOR THE SUM FROM MINUS INFINITY
      IF(K.EQ.1) AT=AT/2.
      SUMZ=SUMZ+AT
      E=DDD/SUMZ
      IF(DDD.EQ.0.0.AND.SUMZ.EQ.0.0) GOTO 2
C     THE FOLLOWING LIMIT IS THE CHOSEN TEST OF CONVERSION OF THE SERIES
C     THIS LIMIT IS HIGHLY SENSITIVE TO THE VALUE OF THE DEPTH PARAMETER
C     THE VALUE GIVEN HERE IS ADEQUATE FOR A DEPTH VALUE OF NO
C     LESS THAN 1/2 MICRON.
C     THE THICKER IS THE DEPTH THE
C     SMALLER CAN THIS LIMIT BE. IT MUST BE ADJUSTED WHENEVER THE DEPTH IS
C     LOWERED.
      IF(E.GT.0.999) GOTO 2
    1 CONTINUE
    2 ARGU2=SUMZ
C     PRINT*,K,SUMZ,TAU,Z,E
      GRAL=ARGU1*ARGU2/DENO2
      RETURN
      END
```

```
      PROGRAM TDIF
C
C     THIS PROGRAM calculates THE INTEGRAL THAT DEFINES
C     THETA interactively, AND USES THE RESULT TO COMPUTE THE
C     TEMPERATURE IN ANY PRESCRIBED POSITION IN THE FILM.
C     THIS PRESCRIPTION IS NEEDED IN ORDER TO ACCOUNT FOR
C     THE CHANGING VALUE OF THE DIFFUSIVITY WITH THE TEMPERATURE
C     AT EACH POINT. THE TEMPERATURE BUILDS UP AS THE POWER RAISES
C     TO ITS MAXIMUM VALUE, AND BOTH THE REFLECTIVITY AND THE
C     DIFFUSIVITY CHANGE WITHIT. NOTE THAT THE PULSE LENGTH IS
C     VERY IMPORTANT AS EACH INCREMENT OF POWER IS VISUALISED
C     AS BEING APPLIED FOR THAT LENGTH OF TIME.
C     IT ALSO READS IN THE CALCULATED REFLECTIVITY AS A
C     FUNCTION OF THE DEPTH FROM THE SURFACE, AND USES IT IN
C     A SUCCESIVE EVALUATION OF THE ABSORBED POWER.
C
      DOUBLE PRECISION X,Z,TO,TEMP,PI,RR,SEC,
     1P,XSUBE,R,TMELT,DELP,FIT,DEPTH
     2,TETMLT,COEFF,TET,TBOIL,B,D
C
C     B IS THE TIME LENGTH OF THE PULSE (IN SECONDS)
C     D IS THE DIFFUSIVITY. THE INTEGRAL THAT DEFINES THETA
C     HAS AN UPPER INTEGRATION LIMIT OF 2*SQRT(DB).
C     TO IS THE INITIAL SUBSTRATE TEMPERATURE (AMBIENT)
C     THE ARRAY TEMP CONTAINS THE INTERMEDIATE AND FINAL
C     RESULTS OF THE TEMPERATURE CALCULATIONS.
C     THE ARRAY RR CONTAINS THE Z-DEPENDENCE REFLECTIVITY.
C     THE ARRAY R CONTAINS THE VARYING REFLECTIVITY AS A
C     FUNCTION OF THE POSITION OF THE MELT FRONT FOR A
C     GIVEN (X,Y) POSITION ON THE SURFACE.
C     SEC IS THE NUMBER OF SECTIONS INTO WHICH THE POWER
C     IS SLICED.
C     XSUBE IS THE 1/e RADIUS OF THE BEAM.
C     DELP IS THE VALUE OF THE POWER SLICE.
C     TETMELT IS THE VALUE OF THETA AT MELTING.
C     COEFF IS THE PREFACTOR FOR THE THETA INTEGRAL.
C     TET IS THE ARRAY THAT CONTAINS THE VARYING VALUE OF THETA.
C
      COMMON /ABC/X,Z
      COMMON /DEF/XSUBE,DEPTH
      PARAMETER (PI=3.1415927D0)
      DIMENSION RR(20),R(20,20)
      DIMENSION TEMP(21,20),TET(21,20),FIT(90000)
  100 FORMAT (4F14.6)
  101 FORMAT('READ IN:TO,POWER,XSUBE,B,NSEC')
  102 FORMAT (4D12.3,I5)
  103 FORMAT (I5,4D14.4)
  105 FORMAT (4D16.3)
C
      DEPTH=0.75D-4
      PRINT 101
      READ 102,TO,P,XSUBE,B,NSEC
      XSUBE=XSUBE*1.D-4
      PRINT 102,TO,P,XSUBE,B,NSEC
C
```

```
      OPEN(2,FILE='refal20',FORM='PRINT')
C
C     refal20 IS THE NAME OF THE FILE CONTAINING THE ARRAY RR(z).
C
      READ(2,*) (RR(I),I=1,20)
      PRINT*, (RR(I),I=1,20)
C
      TMELT=933.5
      TBOIL=2740.DO
C
C     TETMLT IS THE VALUE OF THETA AT THE ONSET OF MELTING.
C
      CONDO=1.85+175./(TO+50.)
C     CONDO IS THE VALUE OF THE THERMAL CONDUCTIVITY AT TO
      TETMLT=(1.85*(TMELT-TO)+175.*LOG((TMELT+50.)/(TO+50.)))/CONDO
      D=0.221+83.46/TO
C     THIS EXPRESSION FOR D IS TAKEN FROM: M.M. MEBED, H.A. KHALEK, AND M.A.
C     ABED ELNAIEM, PROC. CONDENSED PAPERS 16TH SOUTHEASTERN SEMINAR ON THER
C     SCIENCES, P.21-28, APRIL 1982, MIAMI FL. (UNIV. MIAMI, CORAL GABLES FL
C     THE EXPRESSION IS FOR PURE(!) ALUMINUM. IT VARIES MUCH FOR ALLOYED AL.
C
      DO 31 NT=1,90000
      T=NT/10.
      IF(T.GT.TMELT) GOTO 32
      AA=(1.85*(T-TO)+175.*LOG((T+50.)/(TO+50.)))/CONDO
      NN=AA*10.
      FIT(NT)=NN
      GOTO 31
   32 AA=TETMLT+0.5*(T-TMELT)*(1.+1.E-4*(T+TMELT))/CONDO
      NN=AA*10.
      FIT(NT)=NN
   31 CONTINUE
C
      SEC=NSEC
      DELP=P/SEC
C
      X=0.DO
      Y=0.DO
      Z=0.DO
      OPEN(1,FILE='dist2.xz',FORM='PRINT')
C
C     dist2.xz IS THE NAME OF THE FILE CONTAINING THE
C     FINAL RESULTS OF THE CALCULATION.
C
      DO 9 IX=1,21
      DO 9 IZ=1,20
      TEMP(IX,IZ)=TO
      TET(IX,IZ)=0.DO
    9 R(IX,IZ)=RR(1)
C
C     IN THE FOLLOWING DO LOOP A STEPWISE CALCULATION OF THE
C     TEMPERATURE IS CARRIED OUT, ADJUSTING THE REFLECTIVITY AT EACH
C     SURFACE POINT AFTER EACH CYCLE, AS WELL AS THE DIFFUSIVITY.
C     AT COMPLETION THE SUMMED-UP
C     VALUE OF THETA IS OBTAINED AND A FINAL TEMPERATURE PROFILE
C     IS CALCULATED.
```

```
C
      IXSE=1+3.*XSUBE/5.D-5
      IF(IXSE.GT.21) THEN
      IXSE=21
      ENDIF
      DO 3 IS=1,NSEC
C
C     CALCULATION OF THE REFLECTIVITY AS DETERMINED
C     BY THE DEPTH OF THE MELT FRONT
C
      JY=1
      DO 11 JX=1,21
      J=2
    8 IF(TEMP(JX,J).GE.TMELT.AND.J.LE.20) THEN
      J=J+1
      GOTO 8
      ELSE
      R(JX,JY)=RR(J-1)
      ENDIF
   11 CONTINUE
C
      DO 2 IX=1,21
      X=(IX-1)*5.D-5
      COEFF=(1.-R(IX,JY))*DELP/(PI**1.5*CONDO)
C     DO 2 IY=1,21
      DO 2 IZ=1,20
      IF(IZ.LE.13) THEN
      Z=(IZ-1)*2.D-7
      ELSE
      Z=(IZ-13)*1.D-5
      ENDIF
      D=0.221+83.46/TEMP(IX,IZ)
      CALL TETA(B,D,TETXZ)
      MM=(TET(IX,IZ)+COEFF*TETXZ)*10.
      TET(IX,IZ)=MM
      DO 71 NT=1,90000
      T=NT/10.
      DIF=TET(IX,IZ)-FIT(NT)
      IF(DIF.EQ.0.0) GOTO 72
   71 CONTINUE
   72 TEMP(IX,IZ)=T
      TET(IX,IZ)=TET(IX,IZ)/10.
      WRITE(1,103) IS,X,Z,TEMP(IX,IZ)
    2 CONTINUE
    3 CONTINUE
      CLOSE(1)
      CLOSE(2)
      END
C
      SUBROUTINE TETA(B,D,TETXZ)
C
C     THIS SUBROUTINE AND THE ONES THAT IT CALLS CALCULATE THE INTEGRAL
C     THAT DETERMINES THE LINEAR TEMPERATURE IN A THIN FILM.
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD.
C     IN THIS VERSION THE MESH SIZE HAS BEEN REDUCED.
C
```

```
      COMMON /ABC/X,Z
      COMMON /DEF/XSUBE,DEPTH
      DOUBLE PRECISION X,Z,A,B,PI,XSUBE,SS,DEPTH,D,BB
      PARAMETER (PI=3.1415927)
C
C     A AND B ARE THE LIMITS OF INTEGRATION.
C     XSUBE IS THE 1/e BEAM RADIUS.
C
C     DEPTH IS THE THICKNESS OF THE FILM IN CENTIMETERS
C
      A=0.0
      BB=2.*SQRT(B*D)
      CALL QROMB(A,BB,SS)
      TETXZ=SS
C     PRINT*,TETXZ
      RETURN
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,BB,SS)
C
      DOUBLE PRECISION EPS,A,BB,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,BB,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BBB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT.
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BBB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,BB,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      BB=SQRT(BBB-AA)
      A=0.0
```

```
      IF (N.EQ.1) THEN
      S=(BB-A)*FUNC(0.5*(A+BB))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(BB-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(BB-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,DD,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),DD(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      DD(I)=YA(I)
   13 CONTINUE
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-DD(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      DD(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=DD(NS)
      NS=NS-1
      ENDIF
```

```
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND.
C
      FUNCTION GRAL(TAU)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED.
C     TAU IS A DUMMY INTEGRATION VARIABLE.
C
      DOUBLE PRECISION PI,TAU,SUMZ,AT,DDD,E
      PARAMETER (PI=3.1415927)
      DOUBLE PRECISION GRAL,DENO2,
     1ARGU1,ARGU2,DEPTH
      DOUBLE PRECISION X,Z,XSUBE,DZ,TTAU,DEP,ZZ,Q1,Q2
      COMMON /ABC/X,Z
      COMMON /DEF/XSUBE,DEPTH
      DENO2=TAU*TAU+XSUBE*XSUBE
C     ARGU1=EXP(-(X*X+Y*Y)/DENO2)
      ARGU1=EXP(-X*X/DENO2)
      SUMZ=0.0
      TTAU=TAU*TAU
      DEP=4.*DEPTH**2/TTAU
      ZZ=Z*Z/TTAU
      DZ=4.*DEPTH*Z/TTAU
      DO 1 K=1,1000000
      Q1=DEP*(K-1.)**2+ZZ+DZ*(K-1.)
      Q2=DEP*(K-1.)**2+ZZ-DZ*(K-1.)
      DDD=SUMZ
      AT=EXP(-Q1)+EXP(-Q2)
C     THE SECOND TERM ABOVE ACCOUNTS FOR THE SUM FROM MINUS INFINITY
      IF(K.EQ.1) AT=AT/2.
      SUMZ=SUMZ+AT
      E=DDD/SUMZ
      IF(DDD.EQ.0.0.AND.SUMZ.EQ.0.0) GOTO 2
C     THE FOLLOWING LIMIT IS THE CHOSEN TEST OF CONVERSION OF THE SERIES
C     THIS LIMIT IS HIGHLY SENSITIVE TO THE VALUE OF THE DEPTH PARAMETER
C     THE VALUE GIVEN HERE IS ADEQUATE FOR A DEPTH VALUE OF NO
C     LESS THAN 1/2 MICRON.
C     THE THICKER IS THE DEPTH THE
C     SMALLER CAN THIS LIMIT BE. IT MUST BE ADJUSTED WHENEVER THE DEPTH IS
C     LOWERED.
      IF(E.GT.0.999) GOTO 2
    1 CONTINUE
    2 ARGU2=SUMZ
C     PRINT*,K,SUMZ,TAU,Z,E
      GRAL=ARGU1*ARGU2/DENO2
      RETURN
      END
```

```
      OPEN(2,FILE='refal20',FORM='PRINT')
C
C     refal20 IS THE NAME OF THE FILE CONTAINING THE ARRAY RR(z).
C
      READ(2,*) (RR(I),I=1,20)
      PRINT*, (RR(I),I=1,20)
C
      TMELT=797.0
      TBOIL=2740.D0
C
C     TETMLT IS THE VALUE OF THETA AT THE ONSET OF MELTING.
C
      CONDO=(1.85+175./(TO+50.))/2.
C     CONDO IS THE VALUE OF THE THERMAL CONDUCTIVITY AT TO
      TETMLT=(1.85*(TMELT-TO)+175.*LOG((TMELT+50.)/(TO+50.)))/
     1(2.*CONDO)
      D=0.221+83.46/TO
C     THIS EXPRESSION FOR D IS TAKEN FROM: M.M. MEBED, H.A. KHALEK, AND M.A.
C     ABED ELNAIEM, PROC. CONDENSED PAPERS 16TH SOUTHEASTERN SEMINAR ON THER
C     SCIENCES, P.21-28, APRIL 1982, MIAMI FL. (UNIV. MIAMI, CORAL GABLES FL
C     THE EXPRESSION IS FOR PURE(!) ALUMINUM. IT VARIES MUCH FOR ALLOYED AL.
C
      DO 31 NT=1,90000
      T=NT/10.
      IF(T.GT.TMELT) GOTO 32
      AA=(1.85*(T-TO)+175.*LOG((T+50.)/(TO+50.)))/(2.*CONDO)
      NN=AA*10.
      FIT(NT)=NN
      GOTO 31
   32 AA=TETMLT+0.5*(T-TMELT)*(1.+1.E-4*(T+TMELT))/(2.*CONDO)
      NN=AA*10.
      FIT(NT)=NN
   31 CONTINUE
C
      SEC=NSEC
      DELP=P/SEC
C
      X=0.D0
      Y=0.D0
      Z=0.D0
      OPEN(1,FILE='dist.x',FORM='PRINT')
C
C     dist.x IS THE NAME OF THE FILE CONTAINING THE
C     FINAL RESULTS OF THE CALCULATION.
C
      DO 9 IX=1,21
      DO 9 IZ=1,20
      TEMP(IX,IZ)=TO
      R(IX,IZ)=RR(1)
    9 TET(IX,IZ)=0.D0
C
C     IN THE FOLLOWING DO LOOP A STEPWISE CALCULATION OF THE
C     TEMPERATURE IS CARRIED OUT, ADJUSTING THE REFLECTIVITY AT EACH
C     SURFACE POINT AFTER EACH CYCLE, AS WELL AS THE DIFFUSIVITY.
C     AT COMPLETION THE SUMMED-UP
C     VALUE OF THETA IS OBTAINED AND A FINAL TEMPERATURE PROFILE
```

```
C     IS CALCULATED.
C
      IXSE=1+3.*XSUBE/5.D-5
      IF(IXSE.GT.21) THEN
      IXSE=21
      ENDIF
      CORREC=0.0
      TOXIDE=2./3.*TO
      DO 3 IS=1,NSEC
C
C     CALCULATION OF THE REFLECTIVITY AS DETERMINED
C     BY THE DEPTH OF THE MELT FRONT
C
      JY=1
      DO 11 JX=1,21
      IF(TEMP(JX,JY).GE.TMELT) THEN
      R(JX,JY)=RR(20)
      JMELT=JX
      ELSE
      R(JX,JY)=RR(1)
      ENDIF
   11 CONTINUE
C
      XMELT=(JMELT-1)*5.D-5
      IZ=1
      DO 2 IX=1,21
      X=(IX-1)*5.D-5
      COEFF=((1.-R(IX,JY))*DELP-CORREC)/(PI**1.5*CONDO)
C     DO 2 IY=1,21
C     DO 2 IZ=1,20
C     IF(IZ.LE.13) THEN
C     Z=(IZ-1)*2.D-7
C     ELSE
C     Z=(IZ-13)*1.D-5
C     ENDIF
      D=0.221+83.46/TEMP(IX,IZ)
      CALL TETA(B,D,TETXZ)
      MM=(TET(IX,IZ)+COEFF*TETXZ)*10.
      TET(IX,IZ)=MM
      DO 71 NT=1,90000
      T=NT/10.
      DIF=TET(IX,IZ)-FIT(NT)
      IF(DIF.EQ.0.0) GOTO 72
   71 CONTINUE
   72 TEMP(IX,IZ)=T
      TET(IX,IZ)=MM/10.
      PRINT*,IS,R(IX,JY),IX,TET(IX,IZ),TEMP(IX,IZ)
      WRITE(1,103) IS,X,Z,TEMP(IX,IZ)
C
    2 CONTINUE
      DELTAT=2./3.*TEMP(1,1)-TOXIDE
      OXIDE=1.D-4
      OXCON=.0171
      IF(XMELT.LT.XSUBE) THEN
      HRADIUS=XSUBE
      ELSE
```

```
      HRADIUS=XMELT
      ENDIF
      AREA=PI*HRADIUS**2
      CORREC=AREA*OXCON*DELTAT/OXIDE
      PRINT*,CORREC
      TOXIDE=2./3.*TEMP(1,1)
    3 CONTINUE
      CLOSE(1)
      CLOSE(2)
      END
C
      SUBROUTINE TETA(B,D,TETXZ)
C
C     THIS SUBROUTINE AND THE ONES THAT IT CALLS CALCULATE THE INTEGRAL
C     THAT DETERMINES THE LINEAR TEMPERATURE IN A THIN FILM.
C     THE INTEGRATION IS DONE BY ROMBERG'S METHOD.
C     IN THIS VERSION THE MESH SIZE HAS BEEN REDUCED.
C
      COMMON /ABC/X,Z
      COMMON /DEF/XSUBE,DEPTH
      DOUBLE PRECISION X,Z,A,B,PI,XSUBE,SS,DEPTH,D,BB
      PARAMETER (PI=3.1415927)
C
C     A AND B ARE THE LIMITS OF INTEGRATION.
C     XSUBE IS THE 1/e BEAM RADIUS.
C
C     DEPTH IS THE THICKNESS OF THE FILM IN CENTIMETERS
C
      A=0.0
      BB=2.*SQRT(B*D)
      CALL QROMB(A,BB,SS)
      TETXZ=SS
C     PRINT*,TETXZ
      RETURN
      END
C
C     THIS SUBROUTINE CARRIES THE INTEGRATION
C     EPS IS THE FRACTIONAL ACCURACY OF THE INTEGRATION
C     JMAX IS THE LIMIT FOR THE TOTAL NUMBER OF STEPS
C     K IS THE NUMBER OF POINTS USED IN THE EXTRAPOLATION
C
      SUBROUTINE QROMB(A,BB,SS)
C
      DOUBLE PRECISION EPS,A,BB,SS,S,H,DSS
      PARAMETER(EPS=1.D-6, JMAX=14, JMAXP=JMAX+1, K=5, KM=K-1)
      DIMENSION S(JMAXP),H(JMAXP)
C
      H(1)=1.0
      DO 11 J=1,JMAX
      CALL MIDSQL(A,BB,S(J),J)
      IF (J.GE.K) THEN
      CALL POLINT(H(J-KM),S(J-KM),K,0.0,SS,DSS)
      IF (ABS(DSS).LT.EPS*ABS(SS)) RETURN
      ENDIF
      S(J+1)=S(J)
      H(J+1)=H(J)/9.
```

```
   11 CONTINUE
      PAUSE 'TOO MANY STEPS'
      END
C
      SUBROUTINE MIDSQL(AA,BBB,S,N)
C
C     THIS SUBROUTINE COMPUTES THE N'TH STAGE OF REFINEMENT.
C     WHEN CALLED WITH N=1
C     THE ROUTINE RETURNS AS S, THE CRUDEST ESTIMATE OF THE
C     INTEGRAL. SUBSEQUENT CALLS WITH N=2,3,... WILL IMPROVE
C     THE ACCURACY OF S BY ADDING 2 TO THE POWER N-2 ADDITIONAL
C     INTERIOR POINTS.
C
      DOUBLE PRECISION S,AA,BBB,DEL,V,SUM,GRAL,
     1TNM,FUNC,A,BB,DDEL
      FUNC(V)=1.*V*GRAL(AA+V*V)
      BB=SQRT(BBB-AA)
      A=0.0
      IF (N.EQ.1) THEN
      S=(BB-A)*FUNC(0.5*(A+BB))
      IT=1
C     IT IS THE NUMBER OF POINTS TO BE ADDED ON THE NEXT CALL
      ELSE
      TNM=IT
      DEL=(BB-A)/(3.*TNM)
      DDEL=DEL+DEL
      V=A+0.5*DEL
      SUM=0.0
      DO 12 J=1,IT
      SUM=SUM+FUNC(V)
      V=V+DDEL
      SUM=SUM+FUNC(V)
      V=V+DEL
   12 CONTINUE
      S=(S+(BB-A)*SUM/TNM)/3.
      IT=3*IT
      ENDIF
      RETURN
      END
C
      SUBROUTINE POLINT(XA,YA,N,XB,YB,DY)
      PARAMETER (NMAX=10)
      DOUBLE PRECISION XA,YA,XB,YB,DY,C,DD,DIF,DIFT,
     1HO,HP,W,DEN
      DIMENSION XA(N),YA(N),C(NMAX),DD(NMAX)
      NS=1
      DIF=ABS(XB-XA(1))
      DO 13 I=1,N
      DIFT=ABS(XB-XA(I))
      IF (DIFT.LT.DIF) THEN
      NS=I
      DIF=DIFT
      ENDIF
      C(I)=YA(I)
      DD(I)=YA(I)
   13 CONTINUE
```

```
      YB=YA(NS)
      DO 15 M=1,N-1
      DO 14 I=1,N-M
      HO=XA(I)-XB
      HP=XA(I+M)-XB
      W=C(I+1)-DD(I)
      DEN=HO-HP
      IF (DEN.EQ.0.0) PAUSE
      DEN=W/DEN
      DD(I)=HP*DEN
      C(I)=HO*DEN
   14 CONTINUE
      IF (2*NS.LT.N-M) THEN
      DY=C(NS+1)
      ELSE
      DY=DD(NS)
      NS=NS-1
      ENDIF
      YB=YB+DY
   15 CONTINUE
      RETURN
      END
C
C     DECLARATION OF THE FUNCTION THAT DEFINES THE INTEGRAND.
C
      FUNCTION GRAL(TAU)
C
C     X,Y,Z ARE THE COORDINATES IN THE MAIN PROGRAM
C     AT WHICH LOCATION THE INTEGRAL IS BEING EVALUATED.
C     TAU IS A DUMMY INTEGRATION VARIABLE.
C
      DOUBLE PRECISION PI,TAU,SUMZ,AT,DDD,E
      PARAMETER (PI=3.1415927)
      DOUBLE PRECISION GRAL,DENO2,
     1ARGU1,ARGU2,DEPTH
      DOUBLE PRECISION X,Z,XSUBE,DZ,TTAU,DEP,ZZ,Q1,Q2
      COMMON /ABC/X,Z
      COMMON /DEF/XSUBE,DEPTH
      DENO2=TAU*TAU+XSUBE*XSUBE
C     ARGU1=EXP(-(X*X+Y*Y)/DENO2)
      ARGU1=EXP(-X*X/DENO2)
      SUMZ=0.0
      TTAU=TAU*TAU
      DEP=4.*DEPTH**2/TTAU
      ZZ=Z*Z/TTAU
      DZ=4.*DEPTH*Z/TTAU
      DO 1 K=1,1000000
      Q1=DEP*(K-1.)**2+ZZ+DZ*(K-1.)
      Q2=DEP*(K-1.)**2+ZZ-DZ*(K-1.)
      DDD=SUMZ
      AT=EXP(-Q1)+EXP(-Q2)
C     THE SECOND TERM ABOVE ACCOUNTS FOR THE SUM FROM MINUS INFINITY
      IF(K.EQ.1) AT=AT/2.
      SUMZ=SUMZ+AT
      E=DDD/SUMZ
      IF(DDD.EQ.0.0.AND.SUMZ.EQ 0.0) GOTO 2
```

```
C      THE FOLLOWING LIMIT IS THE CHOSEN TEST OF CONVERSION OF THE SERIES
C      THIS LIMIT IS HIGHLY SENSITIVE TO THE VALUE OF THE DEPTH PARAMETER
C      THE VALUE GIVEN HERE IS ADEQUATE FOR A DEPTH VALUE OF NO
C      LESS THAN 1/2 MICRON.
C      THE THICKER IS THE DEPTH THE
C      SMALLER CAN THIS LIMIT BE. IT MUST BE ADJUSTED WHENEVER THE DEPTH IS
C      LOWERED.
       IF(E.GT.0.999) GOTO 2
     1 CONTINUE
     2 ARGU2=SUMZ
C      PRINT*,K,SUMZ,TAU,Z,E
       GRAL=ARGU1*ARGU2/DENO2
       RETURN
       END
```

APPENDIX D
THE DATA GENERATED BY ONE OF THE TTHETA PROGRAMS AND USED BY ONE OF THE HOM*.F PROGRAMS FOR GENERATING THE TEMPERATURE DISTRIBUTION

$x_0 = 2.5 \times 10^{-4}$ cm

x	z	I(x,z)
0.0000d+00	0.0000d+00	0.6278d+04
0.0000d+00	0.2000d-06	0.6271d+04
0.0000d+00	0.4000d-06	0.6267d+04
0.0000d+00	0.6000d-06	0.6256d+04
0.0000d+00	0.8000d-06	0.6244d+04
0.0000d+00	0.1000d-05	0.6250d+04
0.0000d+00	0.1200d-05	0.6244d+04
0.0000d+00	0.1400d-05	0.6239d+04
0.0000d+00	0.1600d-05	0.6233d+04
0.0000d+00	0.1800d-05	0.6227d+04
0.0000d+00	0.2000d-05	0.6222d+04
0.0000d+00	0.2200d-05	0.6206d+04
0.0000d+00	0.2400d-05	0.6203d+04
0.0000d+00	0.2600d-05	0.6200d+04
0.0000d+00	0.2800d-05	0.6200d+04
0.0000d+00	0.3000d-05	0.6194d+04
0.0000d+00	0.3200d-05	0.6188d+04
0.0000d+00	0.3400d-05	0.6183d+04
0.0000d+00	0.3600d-05	0.6177d+04
0.0000d+00	0.3800d-05	0.6171d+04
0.0000d+00	0.4000d-05	0.6166d+04
0.0000d+00	0.4200d-05	0.6160d+04
0.0000d+00	0.4400d-05	0.6155d+04
0.0000d+00	0.4600d-05	0.6150d+04
0.0000d+00	0.4800d-05	0.6144d+04
0.0000d+00	0.5000d-05	0.6139d+04
0.0000d+00	0.1000d-04	0.6004d+04
0.0000d+00	0.2000d-04	0.5749d+04
0.0000d+00	0.3000d-04	0.5510d+04
0.0000d+00	0.4000d-04	0.5287d+04
0.0000d+00	0.5000d-04	0.5078d+04
0.0000d+00	0.6000d-04	0.4882d+04
0.0000d+00	0.7000d-04	0.4698d+04
0.0000d+00	0.8000d-04	0.4526d+04
0.0000d+00	0.9000d-04	0.4363d+04
0.0000d+00	0.1000d-03	0.4210d+04
0.0000d+00	0.1100d-03	0.4065d+04
0.0000d+00	0.1200d-03	0.3929d+04
0.0000d+00	0.1300d-03	0.3800d+04
0.0000d+00	0.1400d-03	0.3678d+04
0.0000d+00	0.1500d-03	0.3563d+04
0.0000d+00	0.1600d-03	0.3453d+04
0.0000d+00	0.1700d-03	0.3349d+04
0.0000d+00	0.1800d-03	0.3251d+04
0.0000d+00	0.1900d-03	0.3157d+04
0.0000d+00	0.2000d-03	0.3068d+04
0.0000d+00	0.2100d-03	0.2983d+04
0.0000d+00	0.2200d-03	0.2902d+04
0.0000d+00	0.2300d-03	0.2825d+04
0.0000d+00	0.2400d-03	0.2752d+04
0.0000d+00	0.2500d-03	0.2682d+04
0.0000d+00	0.2600d-03	0.2614d+04
0.0000d+00	0.2700d-03	0.2550d+04
0.0000d+00	0.2800d-03	0.2489d+04
0.0000d+00	0.2900d-03	0.2430d+04
0.0000d+00	0.3000d-03	0.2373d+04

0.0000d+00	0.3100d-03	0.2320d+04
0.0000d+00	0.3200d-03	0.2267d+04
0.0000d+00	0.3300d-03	0.2217d+04
0.0000d+00	0.3400d-03	0.2169d+04
0.0000d+00	0.3500d-03	0.2123d+04
0.0000d+00	0.3600d-03	0.2079d+04
0.0000d+00	0.3700d-03	0.2036d+04
0.0000d+00	0.3800d-03	0.1995d+04
0.0000d+00	0.3900d-03	0.1956d+04
0.0000d+00	0.4000d-03	0.1917d+04
0.0000d+00	0.4100d-03	0.1880d+04
0.0000d+00	0.4200d-03	0.1845d+04
0.0000d+00	0.4300d-03	0.1811d+04
0.0000d+00	0.4400d-03	0.1777d+04
0.1000d-04	0.0000d+00	0.6273d+04
0.1000d-04	0.2000d-06	0.6266d+04
0.1000d-04	0.4000d-06	0.6262d+04
0.1000d-04	0.6000d-06	0.6251d+04
0.1000d-04	0.8000d-06	0.6239d+04
0.1000d-04	0.1000d-05	0.6245d+04
0.1000d-04	0.1200d-05	0.6239d+04
0.1000d-04	0.1400d-05	0.6234d+04
0.1000d-04	0.1600d-05	0.6228d+04
0.1000d-04	0.1800d-05	0.6223d+04
0.1000d-04	0.2000d-05	0.6217d+04
0.1000d-04	0.2200d-05	0.6201d+04
0.1000d-04	0.2400d-05	0.6198d+04
0.1000d-04	0.2600d-05	0.6195d+04
0.1000d-04	0.2800d-05	0.6195d+04
0.1000d-04	0.3000d-05	0.6189d+04
0.1000d-04	0.3200d-05	0.6183d+04
0.1000d-04	0.3400d-05	0.6178d+04
0.1000d-04	0.3600d-05	0.6172d+04
0.1000d-04	0.3800d-05	0.6166d+04
0.1000d-04	0.4000d-05	0.6161d+04
0.1000d-04	0.4200d-05	0.6155d+04
0.1000d-04	0.4400d-05	0.6150d+04
0.1000d-04	0.4600d-05	0.6145d+04
0.1000d-04	0.4800d-05	0.6140d+04
0.1000d-04	0.5000d-05	0.6134d+04
0.1000d-04	0.1000d-04	0.6000d+04
0.1000d-04	0.2000d-04	0.5745d+04
0.1000d-04	0.3000d-04	0.5507d+04
0.1000d-04	0.4000d-04	0.5284d+04
0.1000d-04	0.5000d-04	0.5075d+04
0.1000d-04	0.6000d-04	0.4879d+04
0.1000d-04	0.7000d-04	0.4696d+04
0.1000d-04	0.8000d-04	0.4523d+04
0.1000d-04	0.9000d-04	0.4360d+04
0.1000d-04	0.1000d-03	0.4207d+04
0.1000d-04	0.1100d-03	0.4063d+04
0.1000d-04	0.1200d-03	0.3927d+04
0.1000d-04	0.1300d-03	0.3798d+04
0.1000d-04	0.1400d-03	0.3676d+04
0.1000d-04	0.1500d-03	0.3561d+04
0.1000d-04	0.1600d-03	0.3452d+04

0.1000d-04	0.1700d-03	0.3348d+04
0.1000d-04	0.1800d-03	0.3250d+04
0.1000d-04	0.1900d-03	0.3156d+04
0.1000d-04	0.2000d-03	0.3067d+04
0.1000d-04	0.2100d-03	0.2982d+04
0.1000d-04	0.2200d-03	0.2902d+04
0.1000d-04	0.2300d-03	0.2825d+04
0.1000d-04	0.2400d-03	0.2751d+04
0.1000d-04	0.2500d-03	0.2681d+04
0.1000d-04	0.2600d-03	0.2614d+04
0.1000d-04	0.2700d-03	0.2550d+04
0.1000d-04	0.2800d-03	0.2488d+04
0.1000d-04	0.2900d-03	0.2429d+04
0.1000d-04	0.3000d-03	0.2373d+04
0.1000d-04	0.3100d-03	0.2319d+04
0.1000d-04	0.3200d-03	0.2267d+04
0.1000d-04	0.3300d-03	0.2217d+04
0.1000d-04	0.3400d-03	0.2169d+04
0.1000d-04	0.3500d-03	0.2123d+04
0.1000d-04	0.3600d-03	0.2079d+04
0.1000d-04	0.3700d-03	0.2036d+04
0.1000d-04	0.3800d-03	0.1995d+04
0.1000d-04	0.3900d-03	0.1955d+04
0.1000d-04	0.4000d-03	0.1917d+04
0.1000d-04	0.4100d-03	0.1880d+04
0.1000d-04	0.4200d-03	0.1845d+04
0.1000d-04	0.4300d-03	0.1810d+04
0.1000d-04	0.4400d-03	0.1777d+04
0.2000d-04	0.0000d+00	0.6258d+04
0.2000d-04	0.2000d-06	0.6251d+04
0.2000d-04	0.4000d-06	0.6247d+04
0.2000d-04	0.6000d-06	0.6237d+04
0.2000d-04	0.8000d-06	0.6224d+04
0.2000d-04	0.1000d-05	0.6230d+04
0.2000d-04	0.1200d-05	0.6224d+04
0.2000d-04	0.1400d-05	0.6219d+04
0.2000d-04	0.1600d-05	0.6213d+04
0.2000d-04	0.1800d-05	0.6208d+04
0.2000d-04	0.2000d-05	0.6202d+04
0.2000d-04	0.2200d-05	0.6187d+04
0.2000d-04	0.2400d-05	0.6184d+04
0.2000d-04	0.2600d-05	0.6181d+04
0.2000d-04	0.2800d-05	0.6180d+04
0.2000d-04	0.3000d-05	0.6174d+04
0.2000d-04	0.3200d-05	0.6169d+04
0.2000d-04	0.3400d-05	0.6163d+04
0.2000d-04	0.3600d-05	0.6157d+04
0.2000d-04	0.3800d-05	0.6152d+04
0.2000d-04	0.4000d-05	0.6146d+04
0.2000d-04	0.4200d-05	0.6141d+04
0.2000d-04	0.4400d-05	0.6135d+04
0.2000d-04	0.4600d-05	0.6131d+04
0.2000d-04	0.4800d-05	0.6125d+04
0.2000d-04	0.5000d-05	0.6120d+04
0.2000d-04	0.1000d-04	0.5986d+04
0.2000d-04	0.2000d-04	0.5732d+04

0.2000d-04	0.3000d-04	0.5495d+04
0.2000d-04	0.4000d-04	0.5273d+04
0.2000d-04	0.5000d-04	0.5065d+04
0.2000d-04	0.6000d-04	0.4870d+04
0.2000d-04	0.7000d-04	0.4687d+04
0.2000d-04	0.8000d-04	0.4515d+04
0.2000d-04	0.9000d-04	0.4353d+04
0.2000d-04	0.1000d-03	0.4201d+04
0.2000d-04	0.1100d-03	0.4057d+04
0.2000d-04	0.1200d-03	0.3921d+04
0.2000d-04	0.1300d-03	0.3793d+04
0.2000d-04	0.1400d-03	0.3672d+04
0.2000d-04	0.1500d-03	0.3557d+04
0.2000d-04	0.1600d-03	0.3448d+04
0.2000d-04	0.1700d-03	0.3344d+04
0.2000d-04	0.1800d-03	0.3246d+04
0.2000d-04	0.1900d-03	0.3153d+04
0.2000d-04	0.2000d-03	0.3064d+04
0.2000d-04	0.2100d-03	0.2979d+04
0.2000d-04	0.2200d-03	0.2899d+04
0.2000d-04	0.2300d-03	0.2822d+04
0.2000d-04	0.2400d-03	0.2749d+04
0.2000d-04	0.2500d-03	0.2678d+04
0.2000d-04	0.2600d-03	0.2612d+04
0.2000d-04	0.2700d-03	0.2547d+04
0.2000d-04	0.2800d-03	0.2486d+04
0.2000d-04	0.2900d-03	0.2427d+04
0.2000d-04	0.3000d-03	0.2371d+04
0.2000d-04	0.3100d-03	0.2318d+04
0.2000d-04	0.3200d-03	0.2265d+04
0.2000d-04	0.3300d-03	0.2215d+04
0.2000d-04	0.3400d-03	0.2168d+04
0.2000d-04	0.3500d-03	0.2122d+04
0.2000d-04	0.3600d-03	0.2077d+04
0.2000d-04	0.3700d-03	0.2035d+04
0.2000d-04	0.3800d-03	0.1994d+04
0.2000d-04	0.3900d-03	0.1954d+04
0.2000d-04	0.4000d-03	0.1916d+04
0.2000d-04	0.4100d-03	0.1879d+04
0.2000d-04	0.4200d-03	0.1844d+04
0.2000d-04	0.4300d-03	0.1809d+04
0.2000d-04	0.4400d-03	0.1776d+04
0.3000d-04	0.0000d+00	0.6233d+04
0.3000d-04	0.2000d-06	0.6226d+04
0.3000d-04	0.4000d-06	0.6222d+04
0.3000d-04	0.6000d-06	0.5212d+04
0.3000d-04	0.8000d-06	0.6200d+04
0.3000d-04	0.1000d-05	0.6205d+04
0.3000d-04	0.1200d-05	0.6200d+04
0.3000d-04	0.1400d-05	0.6194d+04
0.3000d-04	0.1600d-05	0.6189d+04
0.3000d-04	0.1800d-05	0.6183d+04
0.3000d-04	0.2000d-05	0.6178d+04
0.3000d-04	0.2200d-05	0.6162d+04
0.3000d-04	0.2400d-05	0.6159d+04
0.3000d-04	0.2600d-05	0.6156d+04

0.3000d-04	0.2800d-05	0.6156d+04
0.3000d-04	0.3000d-05	0.6150d+04
0.3000d-04	0.3200d-05	0.6145d+04
0.3000d-04	0.3400d-05	0.6139d+04
0.3000d-04	0.3600d-05	0.6133d+04
0.3000d-04	0.3800d-05	0.6128d+04
0.3000d-04	0.4000d-05	0.6122d+04
0.3000d-04	0.4200d-05	0.6117d+04
0.3000d-04	0.4400d-05	0.6111d+04
0.3000d-04	0.4600d-05	0.6107d+04
0.3000d-04	0.4800d-05	0.6101d+04
0.3000d-04	0.5000d-05	0.6096d+04
0.3000d-04	0.1000d-04	0.5963d+04
0.3000d-04	0.2000d-04	0.5711d+04
0.3000d-04	0.3000d-04	0.5476d+04
0.3000d-04	0.4000d-04	0.5255d+04
0.3000d-04	0.5000d-04	0.5049d+04
0.3000d-04	0.6000d-04	0.4855d+04
0.3000d-04	0.7000d-04	0.4674d+04
0.3000d-04	0.8000d-04	0.4503d+04
0.3000d-04	0.9000d-04	0.4342d+04
0.3000d-04	0.1000d-03	0.4190d+04
0.3000d-04	0.1100d-03	0.4047d+04
0.3000d-04	0.1200d-03	0.3912d+04
0.3000d-04	0.1300d-03	0.3784d+04
0.3000d-04	0.1400d-03	0.3664d+04
0.3000d-04	0.1500d-03	0.3549d+04
0.3000d-04	0.1600d-03	0.3441d+04
0.3000d-04	0.1700d-03	0.3338d+04
0.3000d-04	0.1800d-03	0.3240d+04
0.3000d-04	0.1900d-03	0.3147d+04
0.3000d-04	0.2000d-03	0.3059d+04
0.3000d-04	0.2100d-03	0.2974d+04
0.3000d-04	0.2200d-03	0.2894d+04
0.3000d-04	0.2300d-03	0.2818d+04
0.3000d-04	0.2400d-03	0.2744d+04
0.3000d-04	0.2500d-03	0.2675d+04
0.3000d-04	0.2600d-03	0.2608d+04
0.3000d-04	0.2700d-03	0.2544d+04
0.3000d-04	0.2800d-03	0.2483d+04
0.3000d-04	0.2900d-03	0.2424d+04
0.3000d-04	0.3000d-03	0.2368d+04
0.3000d-04	0.3100d-03	0.2315d+04
0.3000d-04	0.3200d-03	0.2263d+04
0.3000d-04	0.3300d-03	0.2213d+04
0.3000d-04	0.3400d-03	0.2165d+04
0.3000d-04	0.3500d-03	0.2119d+04
0.3000d-04	0.3600d-03	0.2075d+04
0.3000d-04	0.3700d-03	0.2033d+04
0.3000d-04	0.3800d-03	0.1992d+04
0.3000d-04	0.3900d-03	0.1952d+04
0.3000d-04	0.4000d-03	0.1914d+04
0.3000d-04	0.4100d-03	0.1878d+04
0.3000d-04	0.4200d-03	0.1842d+04
0.3000d-04	0.4300d-03	0.1808d+04
0.3000d-04	0.4400d-03	0.1775d+04

0.4000d-04	0.0000d+00	0.6199d+04
0.4000d-04	0.2000d-06	0.6191d+04
0.4000d-04	0.4000d-06	0.6188d+04
0.4000d-04	0.6000d-06	0.6177d+04
0.4000d-04	0.8000d-06	0.6165d+04
0.4000d-04	0.1000d-05	0.6171d+04
0.4000d-04	0.1200d-05	0.6166d+04
0.4000d-04	0.1400d-05	0.6160d+04
0.4000d-04	0.1600d-05	0.6155d+04
0.4000d-04	0.1800d-05	0.6149d+04
0.4000d-04	0.2000d-05	0.6144d+04
0.4000d-04	0.2200d-05	0.6129d+04
0.4000d-04	0.2400d-05	0.6126d+04
0.4000d-04	0.2600d-05	0.6122d+04
0.4000d-04	0.2800d-05	0.6122d+04
0.4000d-04	0.3000d-05	0.6116d+04
0.4000d-04	0.3200d-05	0.6111d+04
0.4000d-04	0.3400d-05	0.6105d+04
0.4000d-04	0.3600d-05	0.6100d+04
0.4000d-04	0.3800d-05	0.6094d+04
0.4000d-04	0.4000d-05	0.6089d+04
0.4000d-04	0.4200d-05	0.6084d+04
0.4000d-04	0.4400d-05	0.6078d+04
0.4000d-04	0.4600d-05	0.6073d+04
0.4000d-04	0.4800d-05	0.6068d+04
0.4000d-04	0.5000d-05	0.6063d+04
0.4000d-04	0.1000d-04	0.5931d+04
0.4000d-04	0.2000d-04	0.5682d+04
0.4000d-04	0.3000d-04	0.5449d+04
0.4000d-04	0.4000d-04	0.5231d+04
0.4000d-04	0.5000d-04	0.5027d+04
0.4000d-04	0.6000d-04	0.4835d+04
0.4000d-04	0.7000d-04	0.4655d+04
0.4000d-04	0.8000d-04	0.4485d+04
0.4000d-04	0.9000d-04	0.4325d+04
0.4000d-04	0.1000d-03	0.4175d+04
0.4000d-04	0.1100d-03	0.4033d+04
0.4000d-04	0.1200d-03	0.3899d+04
0.4000d-04	0.1300d-03	0.3772d+04
0.4000d-04	0.1400d-03	0.3652d+04
0.4000d-04	0.1500d-03	0.3539d+04
0.4000d-04	0.1600d-03	0.3431d+04
0.4000d-04	0.1700d-03	0.3329d+04
0.4000d-04	0.1800d-03	0.3231d+04
0.4000d-04	0.1900d-03	0.3139d+04
0.4000d-04	0.2000d-03	0.3051d+04
0.4000d-04	0.2100d-03	0.2967d+04
0.4000d-04	0.2200d-03	0.2888d+04
0.4000d-04	0.2300d-03	0.2811d+04
0.4000d-04	0.2400d-03	0.2739d+04
0.4000d-04	0.2500d-03	0.2669d+04
0.4000d-04	0.2600d-03	0.2603d+04
0.4000d-04	0.2700d-03	0.2539d+04
0.4000d-04	0.2800d-03	0.2478d+04
0.4000d-04	0.2900d-03	0.2420d+04
0.4000d-04	0.3000d-03	0.2364d+04

0.4000d-04	0.3100d-03	0.2311d+04
0.4000d-04	0.3200d-03	0.2259d+04
0.4000d-04	0.3300d-03	0.2210d+04
0.4000d-04	0.3400d-03	0.2162d+04
0.4000d-04	0.3500d-03	0.2116d+04
0.4000d-04	0.3600d-03	0.2072d+04
0.4000d-04	0.3700d-03	0.2030d+04
0.4000d-04	0.3800d-03	0.1989d+04
0.4000d-04	0.3900d-03	0.1950d+04
0.4000d-04	0.4000d-03	0.1912d+04
0.4000d-04	0.4100d-03	0.1875d+04
0.4000d-04	0.4200d-03	0.1840d+04
0.4000d-04	0.4300d-03	0.1806d+04
0.4000d-04	0.4400d-03	0.1773d+04
0.5000d-04	0.0000d+00	0.6155d+04
0.5000d-04	0.2000d-06	0.6147d+04
0.5000d-04	0.4000d-06	0.6144d+04
0.5000d-04	0.6000d-06	0.6133d+04
0.5000d-04	0.8000d-06	0.6122d+04
0.5000d-04	0.1000d-05	0.6127d+04
0.5000d-04	0.1200d-05	0.6122d+04
0.5000d-04	0.1400d-05	0.6116d+04
0.5000d-04	0.1600d-05	0.6111d+04
0.5000d-04	0.1800d-05	0.6106d+04
0.5000d-04	0.2000d-05	0.6100d+04
0.5000d-04	0.2200d-05	0.6085d+04
0.5000d-04	0.2400d-05	0.6082d+04
0.5000d-04	0.2600d-05	0.6079d+04
0.5000d-04	0.2800d-05	0.6079d+04
0.5000d-04	0.3000d-05	0.6073d+04
0.5000d-04	0.3200d-05	0.6068d+04
0.5000d-04	0.3400d-05	0.6062d+04
0.5000d-04	0.3600d-05	0.6057d+04
0.5000d-04	0.3800d-05	0.6052d+04
0.5000d-04	0.4000d-05	0.6046d+04
0.5000d-04	0.4200d-05	0.6041d+04
0.5000d-04	0.4400d-05	0.6036d+04
0.5000d-04	0.4600d-05	0.6031d+04
0.5000d-04	0.4800d-05	0.6026d+04
0.5000d-04	0.5000d-05	0.6020d+04
0.5000d-04	0.1000d-04	0.5891d+04
0.5000d-04	0.2000d-04	0.5645d+04
0.5000d-04	0.3000d-04	0.5415d+04
0.5000d-04	0.4000d-04	0.5200d+04
0.5000d-04	0.5000d-04	0.4998d+04
0.5000d-04	0.6000d-04	0.4808d+04
0.5000d-04	0.7000d-04	0.4630d+04
0.5000d-04	0.8000d-04	0.4462d+04
0.5000d-04	0.9000d-04	0.4305d+04
0.5000d-04	0.1000d-03	0.4156d+04
0.5000d-04	0.1100d-03	0.4015d+04
0.5000d-04	0.1200d-03	0.3882d+04
0.5000d-04	0.1300d-03	0.3757d+04
0.5000d-04	0.1400d-03	0.3638d+04
0.5000d-04	0.1500d-03	0.3525d+04
0.5000d-04	0.1600d-03	0.3418d+04

0.5000d-04	0.1700d-03	0.3317d+04
0.5000d-04	0.1800d-03	0.3221d+04
0.5000d-04	0.1900d-03	0.3129d+04
0.5000d-04	0.2000d-03	0.3042d+04
0.5000d-04	0.2100d-03	0.2959d+04
0.5000d-04	0.2200d-03	0.2879d+04
0.5000d-04	0.2300d-03	0.2804d+04
0.5000d-04	0.2400d-03	0.2731d+04
0.5000d-04	0.2500d-03	0.2662d+04
0.5000d-04	0.2600d-03	0.2596d+04
0.5000d-04	0.2700d-03	0.2533d+04
0.5000d-04	0.2800d-03	0.2473d+04
0.5000d-04	0.2900d-03	0.2415d+04
0.5000d-04	0.3000d-03	0.2359d+04
0.5000d-04	0.3100d-03	0.2306d+04
0.5000d-04	0.3200d-03	0.2255d+04
0.5000d-04	0.3300d-03	0.2205d+04
0.5000d-04	0.3400d-03	0.2158d+04
0.5000d-04	0.3500d-03	0.2113d+04
0.5000d-04	0.3600d-03	0.2069d+04
0.5000d-04	0.3700d-03	0.2027d+04
0.5000d-04	0.3800d-03	0.1986d+04
0.5000d-04	0.3900d-03	0.1947d+04
0.5000d-04	0.4000d-03	0.1909d+04
0.5000d-04	0.4100d-03	0.1873d+04
0.5000d-04	0.4200d-03	0.1837d+04
0.5000d-04	0.4300d-03	0.1803d+04
0.5000d-04	0.4400d-03	0.1770d+04
0.6000d-04	0.0000d+00	0.6101d+04
0.6000d-04	0.2000d-06	0.6094d+04
0.6000d-04	0.4000d-06	0.6091d+04
0.6000d-04	0.6000d-06	0.6081d+04
0.6000d-04	0.8000d-06	0.6080d+04
0.6000d-04	0.1000d-05	0.6074d+04
0.6000d-04	0.1200d-05	0.6069d+04
0.6000d-04	0.1400d-05	0.6064d+04
0.6000d-04	0.1600d-05	0.6058d+04
0.6000d-04	0.1800d-05	0.6053d+04
0.6000d-04	0.2000d-05	0.6048d+04
0.6000d-04	0.2200d-05	0.6033d+04
0.6000d-04	0.2400d-05	0.6030d+04
0.6000d-04	0.2600d-05	0.6027d+04
0.6000d-04	0.2800d-05	0.6024d+04
0.6000d-04	0.3000d-05	0.6022d+04
0.6000d-04	0.3200d-05	0.6016d+04
0.6000d-04	0.3400d-05	0.6011d+04
0.6000d-04	0.3600d-05	0.6005d+04
0.6000d-04	0.3800d-05	0.6000d+04
0.6000d-04	0.4000d-05	0.5995d+04
0.6000d-04	0.4200d-05	0.5990d+04
0.6000d-04	0.4400d-05	0.5984d+04
0.6000d-04	0.4600d-05	0.5979d+04
0.6000d-04	0.4800d-05	0.5975d+04
0.6000d-04	0.5000d-05	0.5969d+04
0.6000d-04	0.1000d-04	0.5842d+04
0.6000d-04	0.2000d-04	0.5600d+04

0.6000d-04	0.3000d-04	0.5374d+04
0.6000d-04	0.4000d-04	0.5162d+04
0.6000d-04	0.5000d-04	0.4963d+04
0.6000d-04	0.6000d-04	0.4776d+04
0.6000d-04	0.7000d-04	0.4601d+04
0.6000d-04	0.8000d-04	0.4435d+04
0.6000d-04	0.9000d-04	0.4279d+04
0.6000d-04	0.1000d-03	0.4132d+04
0.6000d-04	0.1100d-03	0.3994d+04
0.6000d-04	0.1200d-03	0.3862d+04
0.6000d-04	0.1300d-03	0.3738d+04
0.6000d-04	0.1400d-03	0.3621d+04
0.6000d-04	0.1500d-03	0.3509d+04
0.6000d-04	0.1600d-03	0.3403d+04
0.6000d-04	0.1700d-03	0.3303d+04
0.6000d-04	0.1800d-03	0.3207d+04
0.6000d-04	0.1900d-03	0.3117d+04
0.6000d-04	0.2000d-03	0.3030d+04
0.6000d-04	0.2100d-03	0.2948d+04
0.6000d-04	0.2200d-03	0.2869d+04
0.6000d-04	0.2300d-03	0.2794d+04
0.6000d-04	0.2400d-03	0.2722d+04
0.6000d-04	0.2500d-03	0.2654d+04
0.6000d-04	0.2600d-03	0.2588d+04
0.6000d-04	0.2700d-03	0.2526d+04
0.6000d-04	0.2800d-03	0.2466d+04
0.6000d-04	0.2900d-03	0.2408d+04
0.6000d-04	0.3000d-03	0.2353d+04
0.6000d-04	0.3100d-03	0.2300d+04
0.6000d-04	0.3200d-03	0.2249d+04
0.6000d-04	0.3300d-03	0.2200d+04
0.6000d-04	0.3400d-03	0.2153d+04
0.6000d-04	0.3500d-03	0.2108d+04
0.6000d-04	0.3600d-03	0.2064d+04
0.6000d-04	0.3700d-03	0.2022d+04
0.6000d-04	0.3800d-03	0.1982d+04
0.6000d-04	0.3900d-03	0.1943d+04
0.6000d-04	0.4000d-03	0.1905d+04
0.6000d-04	0.4100d-03	0.1869d+04
0.6000d-04	0.4200d-03	0.1834d+04
0.6000d-04	0.4300d-03	0.1800d+04
0.6000d-04	0.4400d-03	0.1767d+04
0.7000d-04	0.0000d+00	0.6039d+04
0.7000d-04	0.2000d-06	0.6032d+04
0.7000d-04	0.4000d-06	0.6030d+04
0.7000d-04	0.6000d-06	0.6019d+04
0.7000d-04	0.8000d-06	0.6018d+04
0.7000d-04	0.1000d-05	0.6013d+04
0.7000d-04	0.1200d-05	0.6008d+04
0.7000d-04	0.1400d-05	0.6002d+04
0.7000d-04	0.1600d-05	0.5997d+04
0.7000d-04	0.1800d-05	0.5992d+04
0.7000d-04	0.2000d-05	0.5987d+04
0.7000d-04	0.2200d-05	0.5982d+04
0.7000d-04	0.2400d-05	0.5970d+04
0.7000d-04	0.2600d-05	0.5967d+04

0.7000d-04	0.2800d-05	0.5964d+04
0.7000d-04	0.3000d-05	0.5961d+04
0.7000d-04	0.3200d-05	0.5956d+04
0.7000d-04	0.3400d-05	0.5950d+04
0.7000d-04	0.3600d-05	0.5945d+04
0.7000d-04	0.3800d-05	0.5940d+04
0.7000d-04	0.4000d-05	0.5935d+04
0.7000d-04	0.4200d-05	0.5930d+04
0.7000d-04	0.4400d-05	0.5925d+04
0.7000d-04	0.4600d-05	0.5920d+04
0.7000d-04	0.4800d-05	0.5915d+04
0.7000d-04	0.5000d-05	0.5910d+04
0.7000d-04	0.1000d-04	0.5785d+04
0.7000d-04	0.2000d-04	0.5548d+04
0.7000d-04	0.3000d-04	0.5326d+04
0.7000d-04	0.4000d-04	0.5118d+04
0.7000d-04	0.5000d-04	0.4923d+04
0.7000d-04	0.6000d-04	0.4739d+04
0.7000d-04	0.7000d-04	0.4566d+04
0.7000d-04	0.8000d-04	0.4403d+04
0.7000d-04	0.9000d-04	0.4250d+04
0.7000d-04	0.1000d-03	0.4105d+04
0.7000d-04	0.1100d-03	0.3968d+04
0.7000d-04	0.1200d-03	0.3839d+04
0.7000d-04	0.1300d-03	0.3716d+04
0.7000d-04	0.1400d-03	0.3600d+04
0.7000d-04	0.1500d-03	0.3490d+04
0.7000d-04	0.1600d-03	0.3386d+04
0.7000d-04	0.1700d-03	0.3286d+04
0.7000d-04	0.1800d-03	0.3192d+04
0.7000d-04	0.1900d-03	0.3102d+04
0.7000d-04	0.2000d-03	0.3017d+04
0.7000d-04	0.2100d-03	0.2935d+04
0.7000d-04	0.2200d-03	0.2857d+04
0.7000d-04	0.2300d-03	0.2783d+04
0.7000d-04	0.2400d-03	0.2712d+04
0.7000d-04	0.2500d-03	0.2644d+04
0.7000d-04	0.2600d-03	0.2579d+04
0.7000d-04	0.2700d-03	0.2517d+04
0.7000d-04	0.2800d-03	0.2457d+04
0.7000d-04	0.2900d-03	0.2400d+04
0.7000d-04	0.3000d-03	0.2346d+04
0.7000d-04	0.3100d-03	0.2293d+04
0.7000d-04	0.3200d-03	0.2242d+04
0.7000d-04	0.3300d-03	0.2194d+04
0.7000d-04	0.3400d-03	0.2147d+04
0.7000d-04	0.3500d-03	0.2102d+04
0.7000d-04	0.3600d-03	0.2059d+04
0.7000d-04	0.3700d-03	0.2017d+04
0.7000d-04	0.3800d-03	0.1977d+04
0.7000d-04	0.3900d-03	0.1938d+04
0.7000d-04	0.4000d-03	0.1901d+04
0.7000d-04	0.4100d-03	0.1865d+04
0.7000d-04	0.4200d-03	0.1830d+04
0.7000d-04	0.4300d-03	0.1796d+04
0.7000d-04	0.4400d-03	0.1764d+04

0.8000d-04	0.0000d+00	0.5969d+04
0.8000d-04	0.2000d-06	0.5962d+04
0.8000d-04	0.4000d-06	0.5960d+04
0.8000d-04	0.6000d-06	0.5949d+04
0.8000d-04	0.8000d-06	0.5948d+04
0.8000d-04	0.1000d-05	0.5943d+04
0.8000d-04	0.1200d-05	0.5938d+04
0.8000d-04	0.1400d-05	0.5933d+04
0.8000d-04	0.1600d-05	0.5928d+04
0.8000d-04	0.1800d-05	0.5923d+04
0.8000d-04	0.2000d-05	0.5918d+04
0.8000d-04	0.2200d-05	0.5913d+04
0.8000d-04	0.2400d-05	0.5901d+04
0.8000d-04	0.2600d-05	0.5898d+04
0.8000d-04	0.2800d-05	0.5895d+04
0.8000d-04	0.3000d-05	0.5892d+04
0.8000d-04	0.3200d-05	0.5887d+04
0.8000d-04	0.3400d-05	0.5882d+04
0.8000d-04	0.3600d-05	0.5877d+04
0.8000d-04	0.3800d-05	0.5872d+04
0.8000d-04	0.4000d-05	0.5867d+04
0.8000d-04	0.4200d-05	0.5862d+04
0.8000d-04	0.4400d-05	0.5857d+04
0.8000d-04	0.4600d-05	0.5852d+04
0.8000d-04	0.4800d-05	0.5848d+04
0.8000d-04	0.5000d-05	0.5843d+04
0.8000d-04	0.1000d-04	0.5721d+04
0.8000d-04	0.2000d-04	0.5489d+04
0.8000d-04	0.3000d-04	0.5272d+04
0.8000d-04	0.4000d-04	0.5068d+04
0.8000d-04	0.5000d-04	0.4876d+04
0.8000d-04	0.6000d-04	0.4696d+04
0.8000d-04	0.7000d-04	0.4527d+04
0.8000d-04	0.8000d-04	0.4367d+04
0.8000d-04	0.9000d-04	0.4216d+04
0.8000d-04	0.1000d-03	0.4074d+04
0.8000d-04	0.1100d-03	0.3939d+04
0.8000d-04	0.1200d-03	0.3812d+04
0.8000d-04	0.1300d-03	0.3691d+04
0.8000d-04	0.1400d-03	0.3577d+04
0.8000d-04	0.1500d-03	0.3469d+04
0.8000d-04	0.1600d-03	0.3366d+04
0.8000d-04	0.1700d-03	0.3268d+04
0.8000d-04	0.1800d-03	0.3174d+04
0.8000d-04	0.1900d-03	0.3086d+04
0.8000d-04	0.2000d-03	0.3001d+04
0.8000d-04	0.2100d-03	0.2921d+04
0.8000d-04	0.2200d-03	0.2844d+04
0.8000d-04	0.2300d-03	0.2770d+04
0.8000d-04	0.2400d-03	0.2700d+04
0.8000d-04	0.2500d-03	0.2633d+04
0.8000d-04	0.2600d-03	0.2569d+04
0.8000d-04	0.2700d-03	0.2507d+04
0.8000d-04	0.2800d-03	0.2448d+04
0.8000d-04	0.2900d-03	0.2391d+04
0.8000d-04	0.3000d-03	0.2337d+04

0.8000d-04	0.3100d-03	0.2285d+04
0.8000d-04	0.3200d-03	0.2235d+04
0.8000d-04	0.3300d-03	0.2187d+04
0.8000d-04	0.3400d-03	0.2140d+04
0.8000d-04	0.3500d-03	0.2096d+04
0.8000d-04	0.3600d-03	0.2053d+04
0.8000d-04	0.3700d-03	0.2012d+04
0.8000d-04	0.3800d-03	0.1972d+04
0.8000d-04	0.3900d-03	0.1933d+04
0.8000d-04	0.4000d-03	0.1896d+04
0.8000d-04	0.4100d-03	0.1860d+04
0.8000d-04	0.4200d-03	0.1826d+04
0.8000d-04	0.4300d-03	0.1792d+04
0.8000d-04	0.4400d-03	0.1760d+04
0.9000d-04	0.0000d+00	0.5890d+04
0.9000d-04	0.2000d-06	0.5884d+04
0.9000d-04	0.4000d-06	0.5882d+04
0.9000d-04	0.6000d-06	0.5871d+04
0.9000d-04	0.8000d-06	0.5870d+04
0.9000d-04	0.1000d-05	0.5865d+04
0.9000d-04	0.1200d-05	0.5860d+04
0.9000d-04	0.1400d-05	0.5855d+04
0.9000d-04	0.1600d-05	0.5850d+04
0.9000d-04	0.1800d-05	0.5846d+04
0.9000d-04	0.2000d-05	0.5841d+04
0.9000d-04	0.2200d-05	0.5836d+04
0.9000d-04	0.2400d-05	0.5824d+04
0.9000d-04	0.2600d-05	0.5821d+04
0.9000d-04	0.2800d-05	0.5818d+04
0.9000d-04	0.3000d-05	0.5816d+04
0.9000d-04	0.3200d-05	0.5811d+04
0.9000d-04	0.3400d-05	0.5806d+04
0.9000d-04	0.3600d-05	0.5801d+04
0.9000d-04	0.3800d-05	0.5796d+04
0.9000d-04	0.4000d-05	0.5791d+04
0.9000d-04	0.4200d-05	0.5786d+04
0.9000d-04	0.4400d-05	0.5782d+04
0.9000d-04	0.4600d-05	0.5777d+04
0.9000d-04	0.4800d-05	0.5772d+04
0.9000d-04	0.5000d-05	0.5768d+04
0.9000d-04	0.1000d-04	0.5649d+04
0.9000d-04	0.2000d-04	0.5423d+04
0.9000d-04	0.3000d-04	0.5211d+04
0.9000d-04	0.4000d-04	0.5012d+04
0.9000d-04	0.5000d-04	0.4825d+04
0.9000d-04	0.6000d-04	0.4649d+04
0.9000d-04	0.7000d-04	0.4483d+04
0.9000d-04	0.8000d-04	0.4327d+04
0.9000d-04	0.9000d-04	0.4179d+04
0.9000d-04	0.1000d-03	0.4039d+04
0.9000d-04	0.1100d-03	0.3907d+04
0.9000d-04	0.1200d-03	0.3782d+04
0.9000d-04	0.1300d-03	0.3663d+04
0.9000d-04	0.1400d-03	0.3551d+04
0.9000d-04	0.1500d-03	0.3444d+04
0.9000d-04	0.1600d-03	0.3343d+04

0.9000d-04	0.1700d-03	0.3247d+04
0.9000d-04	0.1800d-03	0.3155d+04
0.9000d-04	0.1900d-03	0.3067d+04
0.9000d-04	0.2000d-03	0.2984d+04
0.9000d-04	0.2100d-03	0.2904d+04
0.9000d-04	0.2200d-03	0.2828d+04
0.9000d-04	0.2300d-03	0.2756d+04
0.9000d-04	0.2400d-03	0.2687d+04
0.9000d-04	0.2500d-03	0.2620d+04
0.9000d-04	0.2600d-03	0.2557d+04
0.9000d-04	0.2700d-03	0.2496d+04
0.9000d-04	0.2800d-03	0.2437d+04
0.9000d-04	0.2900d-03	0.2381d+04
0.9000d-04	0.3000d-03	0.2328d+04
0.9000d-04	0.3100d-03	0.2277d+04
0.9000d-04	0.3200d-03	0.2226d+04
0.9000d-04	0.3300d-03	0.2179d+04
0.9000d-04	0.3400d-03	0.2133d+04
0.9000d-04	0.3500d-03	0.2089d+04
0.9000d-04	0.3600d-03	0.2046d+04
0.9000d-04	0.3700d-03	0.2005d+04
0.9000d-04	0.3800d-03	0.1965d+04
0.9000d-04	0.3900d-03	0.1927d+04
0.9000d-04	0.4000d-03	0.1890d+04
0.9000d-04	0.4100d-03	0.1855d+04
0.9000d-04	0.4200d-03	0.1821d+04
0.9000d-04	0.4300d-03	0.1787d+04
0.9000d-04	0.4400d-03	0.1755d+04
0.1000d-03	0.0000d+00	0.5805d+04
0.1000d-03	0.2000d-06	0.5798d+04
0.1000d-03	0.4000d-06	0.5796d+04
0.1000d-03	0.6000d-06	0.5786d+04
0.1000d-03	0.8000d-06	0.5785d+04
0.1000d-03	0.1000d-05	0.5780d+04
0.1000d-03	0.1200d-05	0.5776d+04
0.1000d-03	0.1400d-05	0.5771d+04
0.1000d-03	0.1600d-05	0.5766d+04
0.1000d-03	0.1800d-05	0.5761d+04
0.1000d-03	0.2000d-05	0.5756d+04
0.1000d-03	0.2200d-05	0.5752d+04
0.1000d-03	0.2400d-05	0.5747d+04
0.1000d-03	0.2600d-05	0.5738d+04
0.1000d-03	0.2800d-05	0.5735d+04
0.1000d-03	0.3000d-05	0.5732d+04
0.1000d-03	0.3200d-05	0.5728d+04
0.1000d-03	0.3400d-05	0.5723d+04
0.1000d-03	0.3600d-05	0.5718d+04
0.1000d-03	0.3800d-05	0.5713d+04
0.1000d-03	0.4000d-05	0.5708d+04
0.1000d-03	0.4200d-05	0.5704d+04
0.1000d-03	0.4400d-05	0.5699d+04
0.1000d-03	0.4600d-05	0.5694d+04
0.1000d-03	0.4800d-05	0.5690d+04
0.1000d-03	0.5000d-05	0.5686d+04
0.1000d-03	0.1000d-04	0.5570d+04
0.1000d-03	0.2000d-04	0.5351d+04

0.1000d-03	0.3000d-04	0.5145d+04
0.1000d-03	0.4000d-04	0.4951d+04
0.1000d-03	0.5000d-04	0.4769d+04
0.1000d-03	0.6000d-04	0.4597d+04
0.1000d-03	0.7000d-04	0.4435d+04
0.1000d-03	0.8000d-04	0.4282d+04
0.1000d-03	0.9000d-04	0.4137d+04
0.1000d-03	0.1000d-03	0.4001d+04
0.1000d-03	0.1100d-03	0.3872d+04
0.1000d-03	0.1200d-03	0.3749d+04
0.1000d-03	0.1300d-03	0.3633d+04
0.1000d-03	0.1400d-03	0.3522d+04
0.1000d-03	0.1500d-03	0.3418d+04
0.1000d-03	0.1600d-03	0.3318d+04
0.1000d-03	0.1700d-03	0.3223d+04
0.1000d-03	0.1800d-03	0.3133d+04
0.1000d-03	0.1900d-03	0.3047d+04
0.1000d-03	0.2000d-03	0.2965d+04
0.1000d-03	0.2100d-03	0.2886d+04
0.1000d-03	0.2200d-03	0.2812d+04
0.1000d-03	0.2300d-03	0.2740d+04
0.1000d-03	0.2400d-03	0.2672d+04
0.1000d-03	0.2500d-03	0.2606d+04
0.1000d-03	0.2600d-03	0.2543d+04
0.1000d-03	0.2700d-03	0.2483d+04
0.1000d-03	0.2800d-03	0.2426d+04
0.1000d-03	0.2900d-03	0.2370d+04
0.1000d-03	0.3000d-03	0.2317d+04
0.1000d-03	0.3100d-03	0.2267d+04
0.1000d-03	0.3200d-03	0.2217d+04
0.1000d-03	0.3300d-03	0.2170d+04
0.1000d-03	0.3400d-03	0.2124d+04
0.1000d-03	0.3500d-03	0.2081d+04
0.1000d-03	0.3600d-03	0.2039d+04
0.1000d-03	0.3700d-03	0.1998d+04
0.1000d-03	0.3800d-03	0.1959d+04
0.1000d-03	0.3900d-03	0.1921d+04
0.1000d-03	0.4000d-03	0.1884d+04
0.1000d-03	0.4100d-03	0.1849d+04
0.1000d-03	0.4200d-03	0.1815d+04
0.1000d-03	0.4300d-03	0.1782d+04
0.1000d-03	0.4400d-03	0.1750d+04
0.1100d-03	0.0000d+00	0.5712d+04
0.1100d-03	0.2000d-06	0.5711d+04
0.1100d-03	0.4000d-06	0.5704d+04
0.1100d-03	0.6000d-06	0.5694d+04
0.1100d-03	0.8000d-06	0.5693d+04
0.1100d-03	0.1000d-05	0.5689d+04
0.1100d-03	0.1200d-05	0.5684d+04
0.1100d-03	0.1400d-05	0.5679d+04
0.1100d-03	0.1600d-05	0.5675d+04
0.1100d-03	0.1800d-05	0.5670d+04
0.1100d-03	0.2000d-05	0.5665d+04
0.1100d-03	0.2200d-05	0.5661d+04
0.1100d-03	0.2400d-05	0.5656d+04
0.1100d-03	0.2600d-05	0.5647d+04

0.1100d-03	0.2800d-05	0.5645d+04
0.1100d-03	0.3000d-05	0.5642d+04
0.1100d-03	0.3200d-05	0.5638d+04
0.1100d-03	0.3400d-05	0.5633d+04
0.1100d-03	0.3600d-05	0.5628d+04
0.1100d-03	0.3800d-05	0.5624d+04
0.1100d-03	0.4000d-05	0.5619d+04
0.1100d-03	0.4200d-05	0.5614d+04
0.1100d-03	0.4400d-05	0.5610d+04
0.1100d-03	0.4600d-05	0.5605d+04
0.1100d-03	0.4800d-05	0.5601d+04
0.1100d-03	0.5000d-05	0.5597d+04
0.1100d-03	0.1000d-04	0.5485d+04
0.1100d-03	0.2000d-04	0.5273d+04
0.1100d-03	0.3000d-04	0.5073d+04
0.1100d-03	0.4000d-04	0.4885d+04
0.1100d-03	0.5000d-04	0.4708d+04
0.1100d-03	0.6000d-04	0.4540d+04
0.1100d-03	0.7000d-04	0.4383d+04
0.1100d-03	0.8000d-04	0.4234d+04
0.1100d-03	0.9000d-04	0.4093d+04
0.1100d-03	0.1000d-03	0.3959d+04
0.1100d-03	0.1100d-03	0.3833d+04
0.1100d-03	0.1200d-03	0.3713d+04
0.1100d-03	0.1300d-03	0.3599d+04
0.1100d-03	0.1400d-03	0.3491d+04
0.1100d-03	0.1500d-03	0.3389d+04
0.1100d-03	0.1600d-03	0.3291d+04
0.1100d-03	0.1700d-03	0.3198d+04
0.1100d-03	0.1800d-03	0.3109d+04
0.1100d-03	0.1900d-03	0.3025d+04
0.1100d-03	0.2000d-03	0.2944d+04
0.1100d-03	0.2100d-03	0.2867d+04
0.1100d-03	0.2200d-03	0.2793d+04
0.1100d-03	0.2300d-03	0.2723d+04
0.1100d-03	0.2400d-03	0.2655d+04
0.1100d-03	0.2500d-03	0.2591d+04
0.1100d-03	0.2600d-03	0.2529d+04
0.1100d-03	0.2700d-03	0.2470d+04
0.1100d-03	0.2800d-03	0.2413d+04
0.1100d-03	0.2900d-03	0.2358d+04
0.1100d-03	0.3000d-03	0.2306d+04
0.1100d-03	0.3100d-03	0.2256d+04
0.1100d-03	0.3200d-03	0.2207d+04
0.1100d-03	0.3300d-03	0.2160d+04
0.1100d-03	0.3400d-03	0.2115d+04
0.1100d-03	0.3500d-03	0.2072d+04
0.1100d-03	0.3600d-03	0.2030d+04
0.1100d-03	0.3700d-03	0.1990d+04
0.1100d-03	0.3800d-03	0.1951d+04
0.1100d-03	0.3900d-03	0.1914d+04
0.1100d-03	0.4000d-03	0.1878d+04
0.1100d-03	0.4100d-03	0.1843d+04
0.1100d-03	0.4200d-03	0.1809d+04
0.1100d-03	0.4300d-03	0.1776d+04
0.1100d-03	0.4400d-03	0.1745d+04

0.1200d-03	0.0000d+00	0.5613d+04
0.1200d-03	0.2000d-06	0.5612d+04
0.1200d-03	0.4000d-06	0.5605d+04
0.1200d-03	0.6000d-06	0.5600d+04
0.1200d-03	0.8000d-06	0.5595d+04
0.1200d-03	0.1000d-05	0.5591d+04
0.1200d-03	0.1200d-05	0.5586d+04
0.1200d-03	0.1400d-05	0.5582d+04
0.1200d-03	0.1600d-05	0.5577d+04
0.1200d-03	0.1800d-05	0.5573d+04
0.1200d-03	0.2000d-05	0.5568d+04
0.1200d-03	0.2200d-05	0.5564d+04
0.1200d-03	0.2400d-05	0.5559d+04
0.1200d-03	0.2600d-05	0.5551d+04
0.1200d-03	0.2800d-05	0.5548d+04
0.1200d-03	0.3000d-05	0.5545d+04
0.1200d-03	0.3200d-05	0.5542d+04
0.1200d-03	0.3400d-05	0.5537d+04
0.1200d-03	0.3600d-05	0.5533d+04
0.1200d-03	0.3800d-05	0.5528d+04
0.1200d-03	0.4000d-05	0.5524d+04
0.1200d-03	0.4200d-05	0.5519d+04
0.1200d-03	0.4400d-05	0.5515d+04
0.1200d-03	0.4600d-05	0.5510d+04
0.1200d-03	0.4800d-05	0.5506d+04
0.1200d-03	0.5000d-05	0.5502d+04
0.1200d-03	0.1000d-04	0.5395d+04
0.1200d-03	0.2000d-04	0.5189d+04
0.1200d-03	0.3000d-04	0.4996d+04
0.1200d-03	0.4000d-04	0.4814d+04
0.1200d-03	0.5000d-04	0.4642d+04
0.1200d-03	0.6000d-04	0.4480d+04
0.1200d-03	0.7000d-04	0.4327d+04
0.1200d-03	0.8000d-04	0.4182d+04
0.1200d-03	0.9000d-04	0.4045d+04
0.1200d-03	0.1000d-03	0.3915d+04
0.1200d-03	0.1100d-03	0.3791d+04
0.1200d-03	0.1200d-03	0.3674d+04
0.1200d-03	0.1300d-03	0.3563d+04
0.1200d-03	0.1400d-03	0.3458d+04
0.1200d-03	0.1500d-03	0.3357d+04
0.1200d-03	0.1600d-03	0.3262d+04
0.1200d-03	0.1700d-03	0.3171d+04
0.1200d-03	0.1800d-03	0.3084d+04
0.1200d-03	0.1900d-03	0.3001d+04
0.1200d-03	0.2000d-03	0.2921d+04
0.1200d-03	0.2100d-03	0.2846d+04
0.1200d-03	0.2200d-03	0.2773d+04
0.1200d-03	0.2300d-03	0.2704d+04
0.1200d-03	0.2400d-03	0.2638d+04
0.1200d-03	0.2500d-03	0.2574d+04
0.1200d-03	0.2600d-03	0.2513d+04
0.1200d-03	0.2700d-03	0.2455d+04
0.1200d-03	0.2800d-03	0.2399d+04
0.1200d-03	0.2900d-03	0.2345d+04
0.1200d-03	0.3000d-03	0.2294d+04

0.1200d-03	0.3100d-03	0.2244d+04
0.1200d-03	0.3200d-03	0.2196d+04
0.1200d-03	0.3300d-03	0.2150d+04
0.1200d-03	0.3400d-03	0.2105d+04
0.1200d-03	0.3500d-03	0.2062d+04
0.1200d-03	0.3600d-03	0.2021d+04
0.1200d-03	0.3700d-03	0.1981d+04
0.1200d-03	0.3800d-03	0.1943d+04
0.1200d-03	0.3900d-03	0.1906d+04
0.1200d-03	0.4000d-03	0.1870d+04
0.1200d-03	0.4100d-03	0.1836d+04
0.1200d-03	0.4200d-03	0.1802d+04
0.1200d-03	0.4300d-03	0.1770d+04
0.1200d-03	0.4400d-03	0.1738d+04
0.1300d-03	0.0000d+00	0.5510d+04
0.1300d-03	0.2000d-06	0.5508d+04
0.1300d-03	0.4000d-06	0.5501d+04
0.1300d-03	0.6000d-06	0.5497d+04
0.1300d-03	0.8000d-06	0.5491d+04
0.1300d-03	0.1000d-05	0.5487d+04
0.1300d-03	0.1200d-05	0.5483d+04
0.1300d-03	0.1400d-05	0.5479d+04
0.1300d-03	0.1600d-05	0.5474d+04
0.1300d-03	0.1800d-05	0.5470d+04
0.1300d-03	0.2000d-05	0.5466d+04
0.1300d-03	0.2200d-05	0.5461d+04
0.1300d-03	0.2400d-05	0.5457d+04
0.1300d-03	0.2600d-05	0.5453d+04
0.1300d-03	0.2800d-05	0.5446d+04
0.1300d-03	0.3000d-05	0.5444d+04
0.1300d-03	0.3200d-05	0.5441d+04
0.1300d-03	0.3400d-05	0.5436d+04
0.1300d-03	0.3600d-05	0.5431d+04
0.1300d-03	0.3800d-05	0.5427d+04
0.1300d-03	0.4000d-05	0.5423d+04
0.1300d-03	0.4200d-05	0.5419d+04
0.1300d-03	0.4400d-05	0.5414d+04
0.1300d-03	0.4600d-05	0.5410d+04
0.1300d-03	0.4800d-05	0.5406d+04
0.1300d-03	0.5000d-05	0.5402d+04
0.1300d-03	0.1000d-04	0.5299d+04
0.1300d-03	0.2000d-04	0.5101d+04
0.1300d-03	0.3000d-04	0.4915d+04
0.1300d-03	0.4000d-04	0.4739d+04
0.1300d-03	0.5000d-04	0.4573d+04
0.1300d-03	0.6000d-04	0.4416d+04
0.1300d-03	0.7000d-04	0.4267d+04
0.1300d-03	0.8000d-04	0.4127d+04
0.1300d-03	0.9000d-04	0.3993d+04
0.1300d-03	0.1000d-03	0.3867d+04
0.1300d-03	0.1100d-03	0.3747d+04
0.1300d-03	0.1200d-03	0.3633d+04
0.1300d-03	0.1300d-03	0.3525d+04
0.1300d-03	0.1400d-03	0.3422d+04
0.1300d-03	0.1500d-03	0.3324d+04
0.1300d-03	0.1600d-03	0.3230d+04

0.1300d-03	0.1700d-03	0.3141d+04
0.1300d-03	0.1800d-03	0.3056d+04
0.1300d-03	0.1900d-03	0.2975d+04
0.1300d-03	0.2000d-03	0.2897d+04
0.1300d-03	0.2100d-03	0.2823d+04
0.1300d-03	0.2200d-03	0.2752d+04
0.1300d-03	0.2300d-03	0.2684d+04
0.1300d-03	0.2400d-03	0.2619d+04
0.1300d-03	0.2500d-03	0.2557d+04
0.1300d-03	0.2600d-03	0.2497d+04
0.1300d-03	0.2700d-03	0.2439d+04
0.1300d-03	0.2800d-03	0.2384d+04
0.1300d-03	0.2900d-03	0.2331d+04
0.1300d-03	0.3000d-03	0.2280d+04
0.1300d-03	0.3100d-03	0.2231d+04
0.1300d-03	0.3200d-03	0.2184d+04
0.1300d-03	0.3300d-03	0.2138d+04
0.1300d-03	0.3400d-03	0.2095d+04
0.1300d-03	0.3500d-03	0.2052d+04
0.1300d-03	0.3600d-03	0.2012d+04
0.1300d-03	0.3700d-03	0.1972d+04
0.1300d-03	0.3800d-03	0.1934d+04
0.1300d-03	0.3900d-03	0.1898d+04
0.1300d-03	0.4000d-03	0.1862d+04
0.1300d-03	0.4100d-03	0.1828d+04
0.1300d-03	0.4200d-03	0.1795d+04
0.1300d-03	0.4300d-03	0.1763d+04
0.1300d-03	0.4400d-03	0.1732d+04
0.1400d-03	0.0000d+00	0.5401d+04
0.1400d-03	0.2000d-06	0.5399d+04
0.1400d-03	0.4000d-06	0.5392d+04
0.1400d-03	0.6000d-06	0.5388d+04
0.1400d-03	0.8000d-06	0.5383d+04
0.1400d-03	0.1000d-05	0.5379d+04
0.1400d-03	0.1200d-05	0.5375d+04
0.1400d-03	0.1400d-05	0.5371d+04
0.1400d-03	0.1600d-05	0.5366d+04
0.1400d-03	0.1800d-05	0.5362d+04
0.1400d-03	0.2000d-05	0.5358d+04
0.1400d-03	0.2200d-05	0.5354d+04
0.1400d-03	0.2400d-05	0.5350d+04
0.1400d-03	0.2600d-05	0.5346d+04
0.1400d-03	0.2800d-05	0.5340d+04
0.1400d-03	0.3000d-05	0.5337d+04
0.1400d-03	0.3200d-05	0.5334d+04
0.1400d-03	0.3400d-05	0.5329d+04
0.1400d-03	0.3600d-05	0.5325d+04
0.1400d-03	0.3800d-05	0.5321d+04
0.1400d-03	0.4000d-05	0.5317d+04
0.1400d-03	0.4200d-05	0.5313d+04
0.1400d-03	0.4400d-05	0.5309d+04
0.1400d-03	0.4600d-05	0.5305d+04
0.1400d-03	0.4800d-05	0.5301d+04
0.1400d-03	0.5000d-05	0.5297d+04
0.1400d-03	0.1000d-04	0.5198d+04
0.1400d-03	0.2000d-04	0.5008d+04

0.1400d-03	0.3000d-04	0.4827d+04
0.1400d-03	0.4000d-04	0.4660d+04
0.1400d-03	0.5000d-04	0.4500d+04
0.1400d-03	0.6000d-04	0.4348d+04
0.1400d-03	0.7000d-04	0.4205d+04
0.1400d-03	0.8000d-04	0.4069d+04
0.1400d-03	0.9000d-04	0.3939d+04
0.1400d-03	0.1000d-03	0.3817d+04
0.1400d-03	0.1100d-03	0.3700d+04
0.1400d-03	0.1200d-03	0.3590d+04
0.1400d-03	0.1300d-03	0.3484d+04
0.1400d-03	0.1400d-03	0.3384d+04
0.1400d-03	0.1500d-03	0.3288d+04
0.1400d-03	0.1600d-03	0.3197d+04
0.1400d-03	0.1700d-03	0.3110d+04
0.1400d-03	0.1800d-03	0.3027d+04
0.1400d-03	0.1900d-03	0.2948d+04
0.1400d-03	0.2000d-03	0.2872d+04
0.1400d-03	0.2100d-03	0.2799d+04
0.1400d-03	0.2200d-03	0.2730d+04
0.1400d-03	0.2300d-03	0.2663d+04
0.1400d-03	0.2400d-03	0.2599d+04
0.1400d-03	0.2500d-03	0.2538d+04
0.1400d-03	0.2600d-03	0.2479d+04
0.1400d-03	0.2700d-03	0.2423d+04
0.1400d-03	0.2800d-03	0.2368d+04
0.1400d-03	0.2900d-03	0.2316d+04
0.1400d-03	0.3000d-03	0.2266d+04
0.1400d-03	0.3100d-03	0.2218d+04
0.1400d-03	0.3200d-03	0.2171d+04
0.1400d-03	0.3300d-03	0.2126d+04
0.1400d-03	0.3400d-03	0.2083d+04
0.1400d-03	0.3500d-03	0.2041d+04
0.1400d-03	0.3600d-03	0.2001d+04
0.1400d-03	0.3700d-03	0.1962d+04
0.1400d-03	0.3800d-03	0.1925d+04
0.1400d-03	0.3900d-03	0.1889d+04
0.1400d-03	0.4000d-03	0.1854d+04
0.1400d-03	0.4100d-03	0.1820d+04
0.1400d-03	0.4200d-03	0.1787d+04
0.1400d-03	0.4300d-03	0.1756d+04
0.1400d-03	0.4400d-03	0.1725d+04
0.1500d-03	0.0000d+00	0.5287d+04
0.1500d-03	0.2000d-06	0.5285d+04
0.1500d-03	0.4000d-06	0.5279d+04
0.1500d-03	0.6000d-06	0.5275d+04
0.1500d-03	0.8000d-06	0.5270d+04
0.1500d-03	0.1000d-05	0.5266d+04
0.1500d-03	0.1200d-05	0.5262d+04
0.1500d-03	0.1400d-05	0.5258d+04
0.1500d-03	0.1600d-05	0.5254d+04
0.1500d-03	0.1800d-05	0.5250d+04
0.1500d-03	0.2000d-05	0.5246d+04
0.1500d-03	0.2200d-05	0.5242d+04
0.1500d-03	0.2400d-05	0.5239d+04
0.1500d-03	0.2600d-05	0.5235d+04

0.1500d-03	0.2800d-05	0.5231d+04
0.1500d-03	0.3000d-05	0.5226d+04
0.1500d-03	0.3200d-05	0.5223d+04
0.1500d-03	0.3400d-05	0.5221d+04
0.1500d-03	0.3600d-05	0.5215d+04
0.1500d-03	0.3800d-05	0.5211d+04
0.1500d-03	0.4000d-05	0.5207d+04
0.1500d-03	0.4200d-05	0.5203d+04
0.1500d-03	0.4400d-05	0.5199d+04
0.1500d-03	0.4600d-05	0.5196d+04
0.1500d-03	0.4800d-05	0.5192d+04
0.1500d-03	0.5000d-05	0.5188d+04
0.1500d-03	0.1000d-04	0.5093d+04
0.1500d-03	0.2000d-04	0.4912d+04
0.1500d-03	0.3000d-04	0.4738d+04
0.1500d-03	0.4000d-04	0.4577d+04
0.1500d-03	0.5000d-04	0.4423d+04
0.1500d-03	0.6000d-04	0.4278d+04
0.1500d-03	0.7000d-04	0.4139d+04
0.1500d-03	0.8000d-04	0.4008d+04
0.1500d-03	0.9000d-04	0.3883d+04
0.1500d-03	0.1000d-03	0.3764d+04
0.1500d-03	0.1100d-03	0.3651d+04
0.1500d-03	0.1200d-03	0.3544d+04
0.1500d-03	0.1300d-03	0.3442d+04
0.1500d-03	0.1400d-03	0.3344d+04
0.1500d-03	0.1500d-03	0.3251d+04
0.1500d-03	0.1600d-03	0.3162d+04
0.1500d-03	0.1700d-03	0.3078d+04
0.1500d-03	0.1800d-03	0.2997d+04
0.1500d-03	0.1900d-03	0.2919d+04
0.1500d-03	0.2000d-03	0.2845d+04
0.1500d-03	0.2100d-03	0.2774d+04
0.1500d-03	0.2200d-03	0.2706d+04
0.1500d-03	0.2300d-03	0.2641d+04
0.1500d-03	0.2400d-03	0.2578d+04
0.1500d-03	0.2500d-03	0.2518d+04
0.1500d-03	0.2600d-03	0.2460d+04
0.1500d-03	0.2700d-03	0.2405d+04
0.1500d-03	0.2800d-03	0.2351d+04
0.1500d-03	0.2900d-03	0.2300d+04
0.1500d-03	0.3000d-03	0.2251d+04
0.1500d-03	0.3100d-03	0.2203d+04
0.1500d-03	0.3200d-03	0.2158d+04
0.1500d-03	0.3300d-03	0.2113d+04
0.1500d-03	0.3400d-03	0.2071d+04
0.1500d-03	0.3500d-03	0.2030d+04
0.1500d-03	0.3600d-03	0.1990d+04
0.1500d-03	0.3700d-03	0.1952d+04
0.1500d-03	0.3800d-03	0.1915d+04
0.1500d-03	0.3900d-03	0.1879d+04
0.1500d-03	0.4000d-03	0.1845d+04
0.1500d-03	0.4100d-03	0.1811d+04
0.1500d-03	0.4200d-03	0.1779d+04
0.1500d-03	0.4300d-03	0.1748d+04
0.1500d-03	0.4400d-03	0.1717d+04

0.1600d-03	0.0000d+00	0.5170d+04
0.1600d-03	0.2000d-06	0.5168d+04
0.1600d-03	0.4000d-06	0.5161d+04
0.1600d-03	0.6000d-06	0.5158d+04
0.1600d-03	0.8000d-06	0.5153d+04
0.1600d-03	0.1000d-05	0.5150d+04
0.1600d-03	0.1200d-05	0.5146d+04
0.1600d-03	0.1400d-05	0.5142d+04
0.1600d-03	0.1600d-05	0.5138d+04
0.1600d-03	0.1800d-05	0.5135d+04
0.1600d-03	0.2000d-05	0.5131d+04
0.1600d-03	0.2200d-05	0.5127d+04
0.1600d-03	0.2400d-05	0.5124d+04
0.1600d-03	0.2600d-05	0.5120d+04
0.1600d-03	0.2800d-05	0.5116d+04
0.1600d-03	0.3000d-05	0.5112d+04
0.1600d-03	0.3200d-05	0.5109d+04
0.1600d-03	0.3400d-05	0.5106d+04
0.1600d-03	0.3600d-05	0.5101d+04
0.1600d-03	0.3800d-05	0.5097d+04
0.1600d-03	0.4000d-05	0.5094d+04
0.1600d-03	0.4200d-05	0.5090d+04
0.1600d-03	0.4400d-05	0.5086d+04
0.1600d-03	0.4600d-05	0.5083d+04
0.1600d-03	0.4800d-05	0.5079d+04
0.1600d-03	0.5000d-05	0.5075d+04
0.1600d-03	0.1000d-04	0.4985d+04
0.1600d-03	0.2000d-04	0.4812d+04
0.1600d-03	0.3000d-04	0.4646d+04
0.1600d-03	0.4000d-04	0.4492d+04
0.1600d-03	0.5000d-04	0.4344d+04
0.1600d-03	0.6000d-04	0.4204d+04
0.1600d-03	0.7000d-04	0.4071d+04
0.1600d-03	0.8000d-04	0.3944d+04
0.1600d-03	0.9000d-04	0.3824d+04
0.1600d-03	0.1000d-03	0.3710d+04
0.1600d-03	0.1100d-03	0.3600d+04
0.1600d-03	0.1200d-03	0.3496d+04
0.1600d-03	0.1300d-03	0.3397d+04
0.1600d-03	0.1400d-03	0.3303d+04
0.1600d-03	0.1500d-03	0.3212d+04
0.1600d-03	0.1600d-03	0.3126d+04
0.1600d-03	0.1700d-03	0.3044d+04
0.1600d-03	0.1800d-03	0.2965d+04
0.1600d-03	0.1900d-03	0.2889d+04
0.1600d-03	0.2000d-03	0.2817d+04
0.1600d-03	0.2100d-03	0.2747d+04
0.1600d-03	0.2200d-03	0.2681d+04
0.1600d-03	0.2300d-03	0.2617d+04
0.1600d-03	0.2400d-03	0.2556d+04
0.1600d-03	0.2500d-03	0.2497d+04
0.1600d-03	0.2600d-03	0.2440d+04
0.1600d-03	0.2700d-03	0.2386d+04
0.1600d-03	0.2800d-03	0.2334d+04
0.1600d-03	0.2900d-03	0.2283d+04
0.1600d-03	0.3000d-03	0.2235d+04

0.1600d-03	0.3100d-03	0.2188d+04
0.1600d-03	0.3200d-03	0.2143d+04
0.1600d-03	0.3300d-03	0.2100d+04
0.1600d-03	0.3400d-03	0.2058d+04
0.1600d-03	0.3500d-03	0.2018d+04
0.1600d-03	0.3600d-03	0.1979d+04
0.1600d-03	0.3700d-03	0.1941d+04
0.1600d-03	0.3800d-03	0.1905d+04
0.1600d-03	0.3900d-03	0.1869d+04
0.1600d-03	0.4000d-03	0.1835d+04
0.1600d-03	0.4100d-03	0.1802d+04
0.1600d-03	0.4200d-03	0.1770d+04
0.1600d-03	0.4300d-03	0.1740d+04
0.1600d-03	0.4400d-03	0.1710d+04
0.1700d-03	0.0000d+00	0.5049d+04
0.1700d-03	0.2000d-06	0.5047d+04
0.1700d-03	0.4000d-06	0.5041d+04
0.1700d-03	0.6000d-06	0.5038d+04
0.1700d-03	0.8000d-06	0.5034d+04
0.1700d-03	0.1000d-05	0.5030d+04
0.1700d-03	0.1200d-05	0.5027d+04
0.1700d-03	0.1400d-05	0.5023d+04
0.1700d-03	0.1600d-05	0.5020d+04
0.1700d-03	0.1800d-05	0.5016d+04
0.1700d-03	0.2000d-05	0.5013d+04
0.1700d-03	0.2200d-05	0.5009d+04
0.1700d-03	0.2400d-05	0.5005d+04
0.1700d-03	0.2600d-05	0.5002d+04
0.1700d-03	0.2800d-05	0.4999d+04
0.1700d-03	0.3000d-05	0.4995d+04
0.1700d-03	0.3200d-05	0.4992d+04
0.1700d-03	0.3400d-05	0.4989d+04
0.1700d-03	0.3600d-05	0.4987d+04
0.1700d-03	0.3800d-05	0.4981d+04
0.1700d-03	0.4000d-05	0.4977d+04
0.1700d-03	0.4200d-05	0.4974d+04
0.1700d-03	0.4400d-05	0.4970d+04
0.1700d-03	0.4600d-05	0.4967d+04
0.1700d-03	0.4800d-05	0.4963d+04
0.1700d-03	0.5000d-05	0.4960d+04
0.1700d-03	0.1000d-04	0.4874d+04
0.1700d-03	0.2000d-04	0.4709d+04
0.1700d-03	0.3000d-04	0.4551d+04
0.1700d-03	0.4000d-04	0.4404d+04
0.1700d-03	0.5000d-04	0.4263d+04
0.1700d-03	0.6000d-04	0.4128d+04
0.1700d-03	0.7000d-04	0.4001d+04
0.1700d-03	0.8000d-04	0.3879d+04
0.1700d-03	0.9000d-04	0.3763d+04
0.1700d-03	0.1000d-03	0.3653d+04
0.1700d-03	0.1100d-03	0.3547d+04
0.1700d-03	0.1200d-03	0.3447d+04
0.1700d-03	0.1300d-03	0.3351d+04
0.1700d-03	0.1400d-03	0.3259d+04
0.1700d-03	0.1500d-03	0.3172d+04
0.1700d-03	0.1600d-03	0.3088d+04

0.1700d-03	0.1700d-03	0.3008d+04
0.1700d-03	0.1800d-03	0.2931d+04
0.1700d-03	0.1900d-03	0.2858d+04
0.1700d-03	0.2000d-03	0.2787d+04
0.1700d-03	0.2100d-03	0.2720d+04
0.1700d-03	0.2200d-03	0.2655d+04
0.1700d-03	0.2300d-03	0.2592d+04
0.1700d-03	0.2400d-03	0.2533d+04
0.1700d-03	0.2500d-03	0.2475d+04
0.1700d-03	0.2600d-03	0.2420d+04
0.1700d-03	0.2700d-03	0.2366d+04
0.1700d-03	0.2800d-03	0.2315d+04
0.1700d-03	0.2900d-03	0.2266d+04
0.1700d-03	0.3000d-03	0.2219d+04
0.1700d-03	0.3100d-03	0.2173d+04
0.1700d-03	0.3200d-03	0.2128d+04
0.1700d-03	0.3300d-03	0.2086d+04
0.1700d-03	0.3400d-03	0.2045d+04
0.1700d-03	0.3500d-03	0.2005d+04
0.1700d-03	0.3600d-03	0.1967d+04
0.1700d-03	0.3700d-03	0.1929d+04
0.1700d-03	0.3800d-03	0.1894d+04
0.1700d-03	0.3900d-03	0.1859d+04
0.1700d-03	0.4000d-03	0.1825d+04
0.1700d-03	0.4100d-03	0.1793d+04
0.1700d-03	0.4200d-03	0.1761d+04
0.1700d-03	0.4300d-03	0.1731d+04
0.1700d-03	0.4400d-03	0.1701d+04
0.1800d-03	0.0000d+00	0.4927d+04
0.1800d-03	0.2000d-06	0.4921d+04
0.1800d-03	0.4000d-06	0.4919d+04
0.1800d-03	0.6000d-06	0.4916d+04
0.1800d-03	0.8000d-06	0.4912d+04
0.1800d-03	0.1000d-05	0.4908d+04
0.1800d-03	0.1200d-05	0.4905d+04
0.1800d-03	0.1400d-05	0.4902d+04
0.1800d-03	0.1600d-05	0.4898d+04
0.1800d-03	0.1800d-05	0.4895d+04
0.1800d-03	0.2000d-05	0.4892d+04
0.1800d-03	0.2200d-05	0.4888d+04
0.1800d-03	0.2400d-05	0.4885d+04
0.1800d-03	0.2600d-05	0.4882d+04
0.1800d-03	0.2800d-05	0.4878d+04
0.1800d-03	0.3000d-05	0.4875d+04
0.1800d-03	0.3200d-05	0.4872d+04
0.1800d-03	0.3400d-05	0.4870d+04
0.1800d-03	0.3600d-05	0.4867d+04
0.1800d-03	0.3800d-05	0.4861d+04
0.1800d-03	0.4000d-05	0.4858d+04
0.1800d-03	0.4200d-05	0.4855d+04
0.1800d-03	0.4400d-05	0.4851d+04
0.1800d-03	0.4600d-05	0.4848d+04
0.1800d-03	0.4800d-05	0.4845d+04
0.1800d-03	0.5000d-05	0.4842d+04
0.1800d-03	0.1000d-04	0.4761d+04
0.1800d-03	0.2000d-04	0.4604d+04

0.1800d-03	0.3000d-04	0.4454d+04
0.1800d-03	0.4000d-04	0.4314d+04
0.1800d-03	0.5000d-04	0.4179d+04
0.1800d-03	0.6000d-04	0.4051d+04
0.1800d-03	0.7000d-04	0.3928d+04
0.1800d-03	0.8000d-04	0.3812d+04
0.1800d-03	0.9000d-04	0.3700d+04
0.1800d-03	0.1000d-03	0.3594d+04
0.1800d-03	0.1100d-03	0.3493d+04
0.1800d-03	0.1200d-03	0.3396d+04
0.1800d-03	0.1300d-03	0.3303d+04
0.1800d-03	0.1400d-03	0.3215d+04
0.1800d-03	0.1500d-03	0.3130d+04
0.1800d-03	0.1600d-03	0.3049d+04
0.1800d-03	0.1700d-03	0.2971d+04
0.1800d-03	0.1800d-03	0.2897d+04
0.1800d-03	0.1900d-03	0.2825d+04
0.1800d-03	0.2000d-03	0.2757d+04
0.1800d-03	0.2100d-03	0.2691d+04
0.1800d-03	0.2200d-03	0.2628d+04
0.1800d-03	0.2300d-03	0.2567d+04
0.1800d-03	0.2400d-03	0.2508d+04
0.1800d-03	0.2500d-03	0.2452d+04
0.1800d-03	0.2600d-03	0.2398d+04
0.1800d-03	0.2700d-03	0.2346d+04
0.1800d-03	0.2800d-03	0.2296d+04
0.1800d-03	0.2900d-03	0.2248d+04
0.1800d-03	0.3000d-03	0.2201d+04
0.1800d-03	0.3100d-03	0.2156d+04
0.1800d-03	0.3200d-03	0.2113d+04
0.1800d-03	0.3300d-03	0.2071d+04
0.1800d-03	0.3400d-03	0.2031d+04
0.1800d-03	0.3500d-03	0.1992d+04
0.1800d-03	0.3600d-03	0.1954d+04
0.1800d-03	0.3700d-03	0.1917d+04
0.1800d-03	0.3800d-03	0.1882d+04
0.1800d-03	0.3900d-03	0.1848d+04
0.1800d-03	0.4000d-03	0.1815d+04
0.1800d-03	0.4100d-03	0.1783d+04
0.1800d-03	0.4200d-03	0.1752d+04
0.1800d-03	0.4300d-03	0.1722d+04
0.1800d-03	0.4400d-03	0.1693d+04
0.1900d-03	0.0000d+00	0.4801d+04
0.1900d-03	0.2000d-06	0.4797d+04
0.1900d-03	0.4000d-06	0.4795d+04
0.1900d-03	0.6000d-06	0.4792d+04
0.1900d-03	0.8000d-06	0.4788d+04
0.1900d-03	0.1000d-05	0.4785d+04
0.1900d-03	0.1200d-05	0.4782d+04
0.1900d-03	0.1400d-05	0.4779d+04
0.1900d-03	0.1600d-05	0.4775d+04
0.1900d-03	0.1800d-05	0.4772d+04
0.1900d-03	0.2000d-05	0.4769d+04
0.1900d-03	0.2200d-05	0.4766d+04
0.1900d-03	0.2400d-05	0.4763d+04
0.1900d-03	0.2600d-05	0.4760d+04

0.1900d-03	0.2800d-05	0.4757d+04
0.1900d-03	0.3000d-05	0.4753d+04
0.1900d-03	0.3200d-05	0.4750d+04
0.1900d-03	0.3400d-05	0.4748d+04
0.1900d-03	0.3600d-05	0.4746d+04
0.1900d-03	0.3800d-05	0.4743d+04
0.1900d-03	0.4000d-05	0.4737d+04
0.1900d-03	0.4200d-05	0.4734d+04
0.1900d-03	0.4400d-05	0.4731d+04
0.1900d-03	0.4600d-05	0.4728d+04
0.1900d-03	0.4800d-05	0.4725d+04
0.1900d-03	0.5000d-05	0.4722d+04
0.1900d-03	0.1000d-04	0.4645d+04
0.1900d-03	0.2000d-04	0.4497d+04
0.1900d-03	0.3000d-04	0.4356d+04
0.1900d-03	0.4000d-04	0.4222d+04
0.1900d-03	0.5000d-04	0.4094d+04
0.1900d-03	0.6000d-04	0.3971d+04
0.1900d-03	0.7000d-04	0.3854d+04
0.1900d-03	0.8000d-04	0.3743d+04
0.1900d-03	0.9000d-04	0.3636d+04
0.1900d-03	0.1000d-03	0.3534d+04
0.1900d-03	0.1100d-03	0.3437d+04
0.1900d-03	0.1200d-03	0.3344d+04
0.1900d-03	0.1300d-03	0.3254d+04
0.1900d-03	0.1400d-03	0.3169d+04
0.1900d-03	0.1500d-03	0.3087d+04
0.1900d-03	0.1600d-03	0.3008d+04
0.1900d-03	0.1700d-03	0.2933d+04
0.1900d-03	0.1800d-03	0.2861d+04
0.1900d-03	0.1900d-03	0.2792d+04
0.1900d-03	0.2000d-03	0.2725d+04
0.1900d-03	0.2100d-03	0.2661d+04
0.1900d-03	0.2200d-03	0.2599d+04
0.1900d-03	0.2300d-03	0.2540d+04
0.1900d-03	0.2400d-03	0.2483d+04
0.1900d-03	0.2500d-03	0.2429d+04
0.1900d-03	0.2600d-03	0.2376d+04
0.1900d-03	0.2700d-03	0.2325d+04
0.1900d-03	0.2800d-03	0.2276d+04
0.1900d-03	0.2900d-03	0.2229d+04
0.1900d-03	0.3000d-03	0.2183d+04
0.1900d-03	0.3100d-03	0.2139d+04
0.1900d-03	0.3200d-03	0.2097d+04
0.1900d-03	0.3300d-03	0.2056d+04
0.1900d-03	0.3400d-03	0.2016d+04
0.1900d-03	0.3500d-03	0.1978d+04
0.1900d-03	0.3600d-03	0.1941d+04
0.1900d-03	0.3700d-03	0.1905d+04
0.1900d-03	0.3800d-03	0.1870d+04
0.1900d-03	0.3900d-03	0.1836d+04
0.1900d-03	0.4000d-03	0.1804d+04
0.1900d-03	0.4100d-03	0.1772d+04
0.1900d-03	0.4200d-03	0.1742d+04
0.1900d-03	0.4300d-03	0.1712d+04
0.1900d-03	0.4400d-03	0.1683d+04

0.2000d-03	0.0000d+00	0.4691d+04
0.2000d-03	0.2000d-06	0.4691d+04
0.2000d-03	0.4000d-06	0.4690d+04
0.2000d-03	0.6000d-06	0.4689d+04
0.2000d-03	0.8000d-06	0.4663d+04
0.2000d-03	0.1000d-05	0.4660d+04
0.2000d-03	0.1200d-05	0.4657d+04
0.2000d-03	0.1400d-05	0.4654d+04
0.2000d-03	0.1600d-05	0.4651d+04
0.2000d-03	0.1800d-05	0.4648d+04
0.2000d-03	0.2000d-05	0.4645d+04
0.2000d-03	0.2200d-05	0.4642d+04
0.2000d-03	0.2400d-05	0.4640d+04
0.2000d-03	0.2600d-05	0.4637d+04
0.2000d-03	0.2800d-05	0.4634d+04
0.2000d-03	0.3000d-05	0.4631d+04
0.2000d-03	0.3200d-05	0.4627d+04
0.2000d-03	0.3400d-05	0.4626d+04
0.2000d-03	0.3600d-05	0.4623d+04
0.2000d-03	0.3800d-05	0.4621d+04
0.2000d-03	0.4000d-05	0.4619d+04
0.2000d-03	0.4200d-05	0.4613d+04
0.2000d-03	0.4400d-05	0.4610d+04
0.2000d-03	0.4600d-05	0.4607d+04
0.2000d-03	0.4800d-05	0.4604d+04
0.2000d-03	0.5000d-05	0.4601d+04
0.2000d-03	0.1000d-04	0.4529d+04
0.2000d-03	0.2000d-04	0.4389d+04
0.2000d-03	0.3000d-04	0.4256d+04
0.2000d-03	0.4000d-04	0.4129d+04
0.2000d-03	0.5000d-04	0.4007d+04
0.2000d-03	0.6000d-04	0.3890d+04
0.2000d-03	0.7000d-04	0.3779d+04
0.2000d-03	0.8000d-04	0.3673d+04
0.2000d-03	0.9000d-04	0.3571d+04
0.2000d-03	0.1000d-03	0.3473d+04
0.2000d-03	0.1100d-03	0.3380d+04
0.2000d-03	0.1200d-03	0.3290d+04
0.2000d-03	0.1300d-03	0.3204d+04
0.2000d-03	0.1400d-03	0.3122d+04
0.2000d-03	0.1500d-03	0.3043d+04
0.2000d-03	0.1600d-03	0.2967d+04
0.2000d-03	0.1700d-03	0.2894d+04
0.2000d-03	0.1800d-03	0.2824d+04
0.2000d-03	0.1900d-03	0.2757d+04
0.2000d-03	0.2000d-03	0.2692d+04
0.2000d-03	0.2100d-03	0.2630d+04
0.2000d-03	0.2200d-03	0.2571d+04
0.2000d-03	0.2300d-03	0.2513d+04
0.2000d-03	0.2400d-03	0.2458d+04
0.2000d-03	0.2500d-03	0.2404d+04
0.2000d-03	0.2600d-03	0.2353d+04
0.2000d-03	0.2700d-03	0.2303d+04
0.2000d-03	0.2800d-03	0.2255d+04
0.2000d-03	0.2900d-03	0.2209d+04
0.2000d-03	0.3000d-03	0.2165d+04

0.2000d-03	0.3100d-03	0.2121d+04
0.2000d-03	0.3200d-03	0.2080d+04
0.2000d-03	0.3300d-03	0.2040d+04
0.2000d-03	0.3400d-03	0.2001d+04
0.2000d-03	0.3500d-03	0.1963d+04
0.2000d-03	0.3600d-03	0.1927d+04
0.2000d-03	0.3700d-03	0.1892d+04
0.2000d-03	0.3800d-03	0.1858d+04
0.2000d-03	0.3900d-03	0.1825d+04
0.2000d-03	0.4000d-03	0.1793d+04
0.2000d-03	0.4100d-03	0.1762d+04
0.2000d-03	0.4200d-03	0.1731d+04
0.2000d-03	0.4300d-03	0.1702d+04
0.2000d-03	0.4400d-03	0.1674d+04
0.2100d-03	0.0000d+00	0.4549d+04
0.2100d-03	0.2000d-06	0.4545d+04
0.2100d-03	0.4000d-06	0.4543d+04
0.2100d-03	0.6000d-06	0.4541d+04
0.2100d-03	0.8000d-06	0.4538d+04
0.2100d-03	0.1000d-05	0.4535d+04
0.2100d-03	0.1200d-05	0.4532d+04
0.2100d-03	0.1400d-05	0.4529d+04
0.2100d-03	0.1600d-05	0.4526d+04
0.2100d-03	0.1800d-05	0.4524d+04
0.2100d-03	0.2000d-05	0.4521d+04
0.2100d-03	0.2200d-05	0.4518d+04
0.2100d-03	0.2400d-05	0.4516d+04
0.2100d-03	0.2600d-05	0.4513d+04
0.2100d-03	0.2800d-05	0.4531d+04
0.2100d-03	0.3000d-05	0.4526d+04
0.2100d-03	0.3200d-05	0.4521d+04
0.2100d-03	0.3400d-05	0.4501d+04
0.2100d-03	0.3600d-05	0.4500d+04
0.2100d-03	0.3800d-05	0.4498d+04
0.2100d-03	0.4000d-05	0.4496d+04
0.2100d-03	0.4200d-05	0.4490d+04
0.2100d-03	0.4400d-05	0.4487d+04
0.2100d-03	0.4600d-05	0.4485d+04
0.2100d-03	0.4800d-05	0.4482d+04
0.2100d-03	0.5000d-05	0.4479d+04
0.2100d-03	0.1000d-04	0.4412d+04
0.2100d-03	0.2000d-04	0.4280d+04
0.2100d-03	0.3000d-04	0.4155d+04
0.2100d-03	0.4000d-04	0.4035d+04
0.2100d-03	0.5000d-04	0.3919d+04
0.2100d-03	0.6000d-04	0.3809d+04
0.2100d-03	0.7000d-04	0.3703d+04
0.2100d-03	0.8000d-04	0.3601d+04
0.2100d-03	0.9000d-04	0.3504d+04
0.2100d-03	0.1000d-03	0.3411d+04
0.2100d-03	0.1100d-03	0.3321d+04
0.2100d-03	0.1200d-03	0.3235d+04
0.2100d-03	0.1300d-03	0.3153d+04
0.2100d-03	0.1400d-03	0.3074d+04
0.2100d-03	0.1500d-03	0.2998d+04
0.2100d-03	0.1600d-03	0.2925d+04

0.2100d-03	0.1700d-03	0.2854d+04
0.2100d-03	0.1800d-03	0.2787d+04
0.2100d-03	0.1900d-03	0.2722d+04
0.2100d-03	0.2000d-03	0.2659d+04
0.2100d-03	0.2100d-03	0.2599d+04
0.2100d-03	0.2200d-03	0.2541d+04
0.2100d-03	0.2300d-03	0.2485d+04
0.2100d-03	0.2400d-03	0.2431d+04
0.2100d-03	0.2500d-03	0.2379d+04
0.2100d-03	0.2600d-03	0.2329d+04
0.2100d-03	0.2700d-03	0.2281d+04
0.2100d-03	0.2800d-03	0.2234d+04
0.2100d-03	0.2900d-03	0.2189d+04
0.2100d-03	0.3000d-03	0.2145d+04
0.2100d-03	0.3100d-03	0.2103d+04
0.2100d-03	0.3200d-03	0.2063d+04
0.2100d-03	0.3300d-03	0.2023d+04
0.2100d-03	0.3400d-03	0.1985d+04
0.2100d-03	0.3500d-03	0.1948d+04
0.2100d-03	0.3600d-03	0.1913d+04
0.2100d-03	0.3700d-03	0.1878d+04
0.2100d-03	0.3800d-03	0.1845d+04
0.2100d-03	0.3900d-03	0.1812d+04
0.2100d-03	0.4000d-03	0.1781d+04
0.2100d-03	0.4100d-03	0.1750d+04
0.2100d-03	0.4200d-03	0.1721d+04
0.2100d-03	0.4300d-03	0.1692d+04
0.2100d-03	0.4400d-03	0.1664d+04
0.2200d-03	0.0000d+00	0.4423d+04
0.2200d-03	0.2000d-06	0.4419d+04
0.2200d-03	0.4000d-06	0.4417d+04
0.2200d-03	0.6000d-06	0.4415d+04
0.2200d-03	0.8000d-06	0.4412d+04
0.2200d-03	0.1000d-05	0.4409d+04
0.2200d-03	0.1200d-05	0.4407d+04
0.2200d-03	0.1400d-05	0.4404d+04
0.2200d-03	0.1600d-05	0.4402d+04
0.2200d-03	0.1800d-05	0.4399d+04
0.2200d-03	0.2000d-05	0.4396d+04
0.2200d-03	0.2200d-05	0.4394d+04
0.2200d-03	0.2400d-05	0.4391d+04
0.2200d-03	0.2600d-05	0.4389d+04
0.2200d-03	0.2800d-05	0.4386d+04
0.2200d-03	0.3000d-05	0.4383d+04
0.2200d-03	0.3200d-05	0.4381d+04
0.2200d-03	0.3400d-05	0.4378d+04
0.2200d-03	0.3600d-05	0.4375d+04
0.2200d-03	0.3800d-05	0.4375d+04
0.2200d-03	0.4000d-05	0.4373d+04
0.2200d-03	0.4200d-05	0.4371d+04
0.2200d-03	0.4400d-05	0.4367d+04
0.2200d-03	0.4600d-05	0.4362d+04
0.2200d-03	0.4800d-05	0.4356d+04
0.2200d-03	0.5000d-05	0.4357d+04
0.2200d-03	0.1000d-04	0.4294d+04
0.2200d-03	0.2000d-04	0.4171d+04

0.2200d-03	0.3000d-04	0.4053d+04
0.2200d-03	0.4000d-04	0.3940d+04
0.2200d-03	0.5000d-04	0.3831d+04
0.2200d-03	0.6000d-04	0.3726d+04
0.2200d-03	0.7000d-04	0.3626d+04
0.2200d-03	0.8000d-04	0.3529d+04
0.2200d-03	0.9000d-04	0.3437d+04
0.2200d-03	0.1000d-03	0.3348d+04
0.2200d-03	0.1100d-03	0.3262d+04
0.2200d-03	0.1200d-03	0.3180d+04
0.2200d-03	0.1300d-03	0.3101d+04
0.2200d-03	0.1400d-03	0.3025d+04
0.2200d-03	0.1500d-03	0.2952d+04
0.2200d-03	0.1600d-03	0.2881d+04
0.2200d-03	0.1700d-03	0.2814d+04
0.2200d-03	0.1800d-03	0.2748d+04
0.2200d-03	0.1900d-03	0.2686d+04
0.2200d-03	0.2000d-03	0.2625d+04
0.2200d-03	0.2100d-03	0.2567d+04
0.2200d-03	0.2200d-03	0.2510d+04
0.2200d-03	0.2300d-03	0.2456d+04
0.2200d-03	0.2400d-03	0.2404d+04
0.2200d-03	0.2500d-03	0.2353d+04
0.2200d-03	0.2600d-03	0.2305d+04
0.2200d-03	0.2700d-03	0.2258d+04
0.2200d-03	0.2800d-03	0.2212d+04
0.2200d-03	0.2900d-03	0.2168d+04
0.2200d-03	0.3000d-03	0.2126d+04
0.2200d-03	0.3100d-03	0.2084d+04
0.2200d-03	0.3200d-03	0.2045d+04
0.2200d-03	0.3300d-03	0.2006d+04
0.2200d-03	0.3400d-03	0.1969d+04
0.2200d-03	0.3500d-03	0.1933d+04
0.2200d-03	0.3600d-03	0.1898d+04
0.2200d-03	0.3700d-03	0.1864d+04
0.2200d-03	0.3800d-03	0.1831d+04
0.2200d-03	0.3900d-03	0.1800d+04
0.2200d-03	0.4000d-03	0.1769d+04
0.2200d-03	0.4100d-03	0.1739d+04
0.2200d-03	0.4200d-03	0.1710d+04
0.2200d-03	0.4300d-03	0.1681d+04
0.2200d-03	0.4400d-03	0.1654d+04
0.2300d-03	0.0000d+00	0.4297d+04
0.2300d-03	0.2000d-06	0.4293d+04
0.2300d-03	0.4000d-06	0.4292d+04
0.2300d-03	0.6000d-06	0.4290d+04
0.2300d-03	0.8000d-06	0.4287d+04
0.2300d-03	0.1000d-05	0.4284d+04
0.2300d-03	0.1200d-05	0.4282d+04
0.2300d-03	0.1400d-05	0.4280d+04
0.2300d-03	0.1600d-05	0.4277d+04
0.2300d-03	0.1800d-05	0.4275d+04
0.2300d-03	0.2000d-05	0.4272d+04
0.2300d-03	0.2200d-05	0.4270d+04
0.2300d-03	0.2400d-05	0.4268d+04
0.2300d-03	0.2600d-05	0.4265d+04

0.2300d-03	0.2800d-05	0.4263d+04
0.2300d-03	0.3000d-05	0.4260d+04
0.2300d-03	0.3200d-05	0.4258d+04
0.2300d-03	0.3400d-05	0.4255d+04
0.2300d-03	0.3600d-05	0.4253d+04
0.2300d-03	0.3800d-05	0.4253d+04
0.2300d-03	0.4000d-05	0.4251d+04
0.2300d-03	0.4200d-05	0.4249d+04
0.2300d-03	0.4400d-05	0.4246d+04
0.2300d-03	0.4600d-05	0.4241d+04
0.2300d-03	0.4800d-05	0.4238d+04
0.2300d-03	0.5000d-05	0.4236d+04
0.2300d-03	0.1000d-04	0.4177d+04
0.2300d-03	0.2000d-04	0.4062d+04
0.2300d-03	0.3000d-04	0.3951d+04
0.2300d-03	0.4000d-04	0.3845d+04
0.2300d-03	0.5000d-04	0.3742d+04
0.2300d-03	0.6000d-04	0.3643d+04
0.2300d-03	0.7000d-04	0.3548d+04
0.2300d-03	0.8000d-04	0.3457d+04
0.2300d-03	0.9000d-04	0.3369d+04
0.2300d-03	0.1000d-03	0.3284d+04
0.2300d-03	0.1100d-03	0.3202d+04
0.2300d-03	0.1200d-03	0.3124d+04
0.2300d-03	0.1300d-03	0.3048d+04
0.2300d-03	0.1400d-03	0.2975d+04
0.2300d-03	0.1500d-03	0.2905d+04
0.2300d-03	0.1600d-03	0.2837d+04
0.2300d-03	0.1700d-03	0.2772d+04
0.2300d-03	0.1800d-03	0.2709d+04
0.2300d-03	0.1900d-03	0.2649d+04
0.2300d-03	0.2000d-03	0.2590d+04
0.2300d-03	0.2100d-03	0.2534d+04
0.2300d-03	0.2200d-03	0.2479d+04
0.2300d-03	0.2300d-03	0.2427d+04
0.2300d-03	0.2400d-03	0.2376d+04
0.2300d-03	0.2500d-03	0.2327d+04
0.2300d-03	0.2600d-03	0.2280d+04
0.2300d-03	0.2700d-03	0.2234d+04
0.2300d-03	0.2800d-03	0.2190d+04
0.2300d-03	0.2900d-03	0.2147d+04
0.2300d-03	0.3000d-03	0.2105d+04
0.2300d-03	0.3100d-03	0.2065d+04
0.2300d-03	0.3200d-03	0.2026d+04
0.2300d-03	0.3300d-03	0.1989d+04
0.2300d-03	0.3400d-03	0.1952d+04
0.2300d-03	0.3500d-03	0.1917d+04
0.2300d-03	0.3600d-03	0.1883d+04
0.2300d-03	0.3700d-03	0.1850d+04
0.2300d-03	0.3800d-03	0.1818d+04
0.2300d-03	0.3900d-03	0.1786d+04
0.2300d-03	0.4000d-03	0.1756d+04
0.2300d-03	0.4100d-03	0.1727d+04
0.2300d-03	0.4200d-03	0.1698d+04
0.2300d-03	0.4300d-03	0.1671d+04
0.2300d-03	0.4400d-03	0.1644d+04

0.2400d-03	0.0000d+00	0.4172d+04
0.2400d-03	0.2000d-06	0.4169d+04
0.2400d-03	0.4000d-06	0.4167d+04
0.2400d-03	0.6000d-06	0.4165d+04
0.2400d-03	0.8000d-06	0.4162d+04
0.2400d-03	0.1000d-05	0.4160d+04
0.2400d-03	0.1200d-05	0.4158d+04
0.2400d-03	0.1400d-05	0.4156d+04
0.2400d-03	0.1600d-05	0.4153d+04
0.2400d-03	0.1800d-05	0.4151d+04
0.2400d-03	0.2000d-05	0.4149d+04
0.2400d-03	0.2200d-05	0.4147d+04
0.2400d-03	0.2400d-05	0.4145d+04
0.2400d-03	0.2600d-05	0.4142d+04
0.2400d-03	0.2800d-05	0.4140d+04
0.2400d-03	0.3000d-05	0.4138d+04
0.2400d-03	0.3200d-05	0.4135d+04
0.2400d-03	0.3400d-05	0.4133d+04
0.2400d-03	0.3600d-05	0.4131d+04
0.2400d-03	0.3800d-05	0.4129d+04
0.2400d-03	0.4000d-05	0.4129d+04
0.2400d-03	0.4200d-05	0.4127d+04
0.2400d-03	0.4400d-05	0.4125d+04
0.2400d-03	0.4600d-05	0.4123d+04
0.2400d-03	0.4800d-05	0.4118d+04
0.2400d-03	0.5000d-05	0.4115d+04
0.2400d-03	0.1000d-04	0.4061d+04
0.2400d-03	0.2000d-04	0.3953d+04
0.2400d-03	0.3000d-04	0.3850d+04
0.2400d-03	0.4000d-04	0.3750d+04
0.2400d-03	0.5000d-04	0.3653d+04
0.2400d-03	0.6000d-04	0.3560d+04
0.2400d-03	0.7000d-04	0.3471d+04
0.2400d-03	0.8000d-04	0.3384d+04
0.2400d-03	0.9000d-04	0.3300d+04
0.2400d-03	0.1000d-03	0.3220d+04
0.2400d-03	0.1100d-03	0.3142d+04
0.2400d-03	0.1200d-03	0.3067d+04
0.2400d-03	0.1300d-03	0.2995d+04
0.2400d-03	0.1400d-03	0.2925d+04
0.2400d-03	0.1500d-03	0.2858d+04
0.2400d-03	0.1600d-03	0.2793d+04
0.2400d-03	0.1700d-03	0.2730d+04
0.2400d-03	0.1800d-03	0.2670d+04
0.2400d-03	0.1900d-03	0.2611d+04
0.2400d-03	0.2000d-03	0.2555d+04
0.2400d-03	0.2100d-03	0.2501d+04
0.2400d-03	0.2200d-03	0.2448d+04
0.2400d-03	0.2300d-03	0.2397d+04
0.2400d-03	0.2400d-03	0.2348d+04
0.2400d-03	0.2500d-03	0.2300d+04
0.2400d-03	0.2600d-03	0.2254d+04
0.2400d-03	0.2700d-03	0.2210d+04
0.2400d-03	0.2800d-03	0.2167d+04
0.2400d-03	0.2900d-03	0.2125d+04
0.2400d-03	0.3000d-03	0.2085d+04

0.2400d-03	0.3100d-03	0.2046d+04
0.2400d-03	0.3200d-03	0.2008d+04
0.2400d-03	0.3300d-03	0.1971d+04
0.2400d-03	0.3400d-03	0.1935d+04
0.2400d-03	0.3500d-03	0.1901d+04
0.2400d-03	0.3600d-03	0.1868d+04
0.2400d-03	0.3700d-03	0.1835d+04
0.2400d-03	0.3800d-03	0.1804d+04
0.2400d-03	0.3900d-03	0.1773d+04
0.2400d-03	0.4000d-03	0.1743d+04
0.2400d-03	0.4100d-03	0.1715d+04
0.2400d-03	0.4200d-03	0.1687d+04
0.2400d-03	0.4300d-03	0.1659d+04
0.2400d-03	0.4400d-03	0.1633d+04
0.2500d-03	0.0000d+00	0.4048d+04
0.2500d-03	0.2000d-06	0.4045d+04
0.2500d-03	0.4000d-06	0.4044d+04
0.2500d-03	0.6000d-06	0.4042d+04
0.2500d-03	0.8000d-06	0.4040d+04
0.2500d-03	0.1000d-05	0.4037d+04
0.2500d-03	0.1200d-05	0.4035d+04
0.2500d-03	0.1400d-05	0.4033d+04
0.2500d-03	0.1600d-05	0.4031d+04
0.2500d-03	0.1800d-05	0.4029d+04
0.2500d-03	0.2000d-05	0.4027d+04
0.2500d-03	0.2200d-05	0.4025d+04
0.2500d-03	0.2400d-05	0.4023d+04
0.2500d-03	0.2600d-05	0.4021d+04
0.2500d-03	0.2800d-05	0.4019d+04
0.2500d-03	0.3000d-05	0.4017d+04
0.2500d-03	0.3200d-05	0.4015d+04
0.2500d-03	0.3400d-05	0.4012d+04
0.2500d-03	0.3600d-05	0.4010d+04
0.2500d-03	0.3800d-05	0.4008d+04
0.2500d-03	0.4000d-05	0.4006d+04
0.2500d-03	0.4200d-05	0.4007d+04
0.2500d-03	0.4400d-05	0.4005d+04
0.2500d-03	0.4600d-05	0.4003d+04
0.2500d-03	0.4800d-05	0.4001d+04
0.2500d-03	0.5000d-05	0.3996d+04
0.2500d-03	0.1000d-04	0.3945d+04
0.2500d-03	0.2000d-04	0.3845d+04
0.2500d-03	0.3000d-04	0.3749d+04
0.2500d-03	0.4000d-04	0.3656d+04
0.2500d-03	0.5000d-04	0.3565d+04
0.2500d-03	0.6000d-04	0.3478d+04
0.2500d-03	0.7000d-04	0.3393d+04
0.2500d-03	0.8000d-04	0.3311d+04
0.2500d-03	0.9000d-04	0.3232d+04
0.2500d-03	0.1000d-03	0.3156d+04
0.2500d-03	0.1100d-03	0.3082d+04
0.2500d-03	0.1200d-03	0.3010d+04
0.2500d-03	0.1300d-03	0.2942d+04
0.2500d-03	0.1400d-03	0.2875d+04
0.2500d-03	0.1500d-03	0.2811d+04
0.2500d-03	0.1600d-03	0.2748d+04

0.2500d-03	0.1700d-03	0.2688d+04
0.2500d-03	0.1800d-03	0.2630d+04
0.2500d-03	0.1900d-03	0.2574d+04
0.2500d-03	0.2000d-03	0.2519d+04
0.2500d-03	0.2100d-03	0.2467d+04
0.2500d-03	0.2200d-03	0.2416d+04
0.2500d-03	0.2300d-03	0.2367d+04
0.2500d-03	0.2400d-03	0.2319d+04
0.2500d-03	0.2500d-03	0.2273d+04
0.2500d-03	0.2600d-03	0.2228d+04
0.2500d-03	0.2700d-03	0.2185d+04
0.2500d-03	0.2800d-03	0.2144d+04
0.2500d-03	0.2900d-03	0.2103d+04
0.2500d-03	0.3000d-03	0.2064d+04
0.2500d-03	0.3100d-03	0.2026d+04
0.2500d-03	0.3200d-03	0.1989d+04
0.2500d-03	0.3300d-03	0.1953d+04
0.2500d-03	0.3400d-03	0.1918d+04
0.2500d-03	0.3500d-03	0.1884d+04
0.2500d-03	0.3600d-03	0.1852d+04
0.2500d-03	0.3700d-03	0.1820d+04
0.2500d-03	0.3800d-03	0.1789d+04
0.2500d-03	0.3900d-03	0.1759d+04
0.2500d-03	0.4000d-03	0.1730d+04
0.2500d-03	0.4100d-03	0.1702d+04
0.2500d-03	0.4200d-03	0.1675d+04
0.2500d-03	0.4300d-03	0.1648d+04
0.2500d-03	0.4400d-03	0.1622d+04
0.2600d-03	0.0000d+00	0.3926d+04
0.2600d-03	0.2000d-06	0.3924d+04
0.2600d-03	0.4000d-06	0.3922d+04
0.2600d-03	0.6000d-06	0.3921d+04
0.2600d-03	0.8000d-06	0.3918d+04
0.2600d-03	0.1000d-05	0.3916d+04
0.2600d-03	0.1200d-05	0.3915d+04
0.2600d-03	0.1400d-05	0.3913d+04
0.2600d-03	0.1600d-05	0.3911d+04
0.2600d-03	0.1800d-05	0.3909d+04
0.2600d-03	0.2000d-05	0.3907d+04
0.2600d-03	0.2200d-05	0.3905d+04
0.2600d-03	0.2400d-05	0.3903d+04
0.2600d-03	0.2600d-05	0.3901d+04
0.2600d-03	0.2800d-05	0.3899d+04
0.2600d-03	0.3000d-05	0.3897d+04
0.2600d-03	0.3200d-05	0.3895d+04
0.2600d-03	0.3400d-05	0.3893d+04
0.2600d-03	0.3600d-05	0.3891d+04
0.2600d-03	0.3800d-05	0.3889d+04
0.2600d-03	0.4000d-05	0.3888d+04
0.2600d-03	0.4200d-05	0.3888d+04
0.2600d-03	0.4400d-05	0.3886d+04
0.2600d-03	0.4600d-05	0.3885d+04
0.2600d-03	0.4800d-05	0.3883d+04
0.2600d-03	0.5000d-05	0.3881d+04
0.2600d-03	0.1000d-04	0.3831d+04
0.2600d-03	0.2000d-04	0.3739d+04

0.2600d-03	0.3000d-04	0.3649d+04
0.2600d-03	0.4000d-04	0.3562d+04
0.2600d-03	0.5000d-04	0.3477d+04
0.2600d-03	0.6000d-04	0.3395d+04
0.2600d-03	0.7000d-04	0.3316d+04
0.2600d-03	0.8000d-04	0.3239d+04
0.2600d-03	0.9000d-04	0.3164d+04
0.2600d-03	0.1000d-03	0.3091d+04
0.2600d-03	0.1100d-03	0.3021d+04
0.2600d-03	0.1200d-03	0.2954d+04
0.2600d-03	0.1300d-03	0.2888d+04
0.2600d-03	0.1400d-03	0.2824d+04
0.2600d-03	0.1500d-03	0.2763d+04
0.2600d-03	0.1600d-03	0.2703d+04
0.2600d-03	0.1700d-03	0.2646d+04
0.2600d-03	0.1800d-03	0.2590d+04
0.2600d-03	0.1900d-03	0.2536d+04
0.2600d-03	0.2000d-03	0.2483d+04
0.2600d-03	0.2100d-03	0.2433d+04
0.2600d-03	0.2200d-03	0.2384d+04
0.2600d-03	0.2300d-03	0.2336d+04
0.2600d-03	0.2400d-03	0.2290d+04
0.2600d-03	0.2500d-03	0.2245d+04
0.2600d-03	0.2600d-03	0.2202d+04
0.2600d-03	0.2700d-03	0.2160d+04
0.2600d-03	0.2800d-03	0.2120d+04
0.2600d-03	0.2900d-03	0.2080d+04
0.2600d-03	0.3000d-03	0.2042d+04
0.2600d-03	0.3100d-03	0.2005d+04
0.2600d-03	0.3200d-03	0.1969d+04
0.2600d-03	0.3300d-03	0.1934d+04
0.2600d-03	0.3400d-03	0.1900d+04
0.2600d-03	0.3500d-03	0.1868d+04
0.2600d-03	0.3600d-03	0.1836d+04
0.2600d-03	0.3700d-03	0.1805d+04
0.2600d-03	0.3800d-03	0.1775d+04
0.2600d-03	0.3900d-03	0.1745d+04
0.2600d-03	0.4000d-03	0.1717d+04
0.2600d-03	0.4100d-03	0.1689d+04
0.2600d-03	0.4200d-03	0.1662d+04
0.2600d-03	0.4300d-03	0.1636d+04
0.2600d-03	0.4400d-03	0.1611d+04
0.2700d-03	0.0000d+00	0.3806d+04
0.2700d-03	0.2000d-06	0.3804d+04
0.2700d-03	0.4000d-06	0.3803d+04
0.2700d-03	0.6000d-06	0.3801d+04
0.2700d-03	0.8000d-06	0.3799d+04
0.2700d-03	0.1000d-05	0.3797d+04
0.2700d-03	0.1200d-05	0.3796d+04
0.2700d-03	0.1400d-05	0.3794d+04
0.2700d-03	0.1600d-05	0.3792d+04
0.2700d-03	0.1800d-05	0.3790d+04
0.2700d-03	0.2000d-05	0.3789d+04
0.2700d-03	0.2200d-05	0.3787d+04
0.2700d-03	0.2400d-05	0.3785d+04
0.2700d-03	0.2600d-05	0.3784d+04

0.2700d-03	0.2800d-05	0.3782d+04
0.2700d-03	0.3000d-05	0.3780d+04
0.2700d-03	0.3200d-05	0.3778d+04
0.2700d-03	0.3400d-05	0.3776d+04
0.2700d-03	0.3600d-05	0.3774d+04
0.2700d-03	0.3800d-05	0.3773d+04
0.2700d-03	0.4000d-05	0.3771d+04
0.2700d-03	0.4200d-05	0.3769d+04
0.2700d-03	0.4400d-05	0.3770d+04
0.2700d-03	0.4600d-05	0.3768d+04
0.2700d-03	0.4800d-05	0.3767d+04
0.2700d-03	0.5000d-05	0.3765d+04
0.2700d-03	0.1000d-04	0.3719d+04
0.2700d-03	0.2000d-04	0.3634d+04
0.2700d-03	0.3000d-04	0.3550d+04
0.2700d-03	0.4000d-04	0.3469d+04
0.2700d-03	0.5000d-04	0.3390d+04
0.2700d-03	0.6000d-04	0.3314d+04
0.2700d-03	0.7000d-04	0.3239d+04
0.2700d-03	0.8000d-04	0.3166d+04
0.2700d-03	0.9000d-04	0.3096d+04
0.2700d-03	0.1000d-03	0.3027d+04
0.2700d-03	0.1100d-03	0.2961d+04
0.2700d-03	0.1200d-03	0.2897d+04
0.2700d-03	0.1300d-03	0.2834d+04
0.2700d-03	0.1400d-03	0.2774d+04
0.2700d-03	0.1500d-03	0.2715d+04
0.2700d-03	0.1600d-03	0.2658d+04
0.2700d-03	0.1700d-03	0.2603d+04
0.2700d-03	0.1800d-03	0.2549d+04
0.2700d-03	0.1900d-03	0.2497d+04
0.2700d-03	0.2000d-03	0.2447d+04
0.2700d-03	0.2100d-03	0.2398d+04
0.2700d-03	0.2200d-03	0.2351d+04
0.2700d-03	0.2300d-03	0.2305d+04
0.2700d-03	0.2400d-03	0.2261d+04
0.2700d-03	0.2500d-03	0.2218d+04
0.2700d-03	0.2600d-03	0.2176d+04
0.2700d-03	0.2700d-03	0.2135d+04
0.2700d-03	0.2800d-03	0.2096d+04
0.2700d-03	0.2900d-03	0.2058d+04
0.2700d-03	0.3000d-03	0.2020d+04
0.2700d-03	0.3100d-03	0.1984d+04
0.2700d-03	0.3200d-03	0.1949d+04
0.2700d-03	0.3300d-03	0.1915d+04
0.2700d-03	0.3400d-03	0.1882d+04
0.2700d-03	0.3500d-03	0.1850d+04
0.2700d-03	0.3600d-03	0.1819d+04
0.2700d-03	0.3700d-03	0.1789d+04
0.2700d-03	0.3800d-03	0.1760d+04
0.2700d-03	0.3900d-03	0.1731d+04
0.2700d-03	0.4000d-03	0.1703d+04
0.2700d-03	0.4100d-03	0.1676d+04
0.2700d-03	0.4200d-03	0.1650d+04
0.2700d-03	0.4300d-03	0.1624d+04
0.2700d-03	0.4400d-03	0.1599d+04

0.2800d-03	0.0000d+00	0.3689d+04
0.2800d-03	0.2000d-06	0.3687d+04
0.2800d-03	0.4000d-06	0.3686d+04
0.2800d-03	0.6000d-06	0.3684d+04
0.2800d-03	0.8000d-06	0.3683d+04
0.2800d-03	0.1000d-05	0.3681d+04
0.2800d-03	0.1200d-05	0.3679d+04
0.2800d-03	0.1400d-05	0.3678d+04
0.2800d-03	0.1600d-05	0.3676d+04
0.2800d-03	0.1800d-05	0.3674d+04
0.2800d-03	0.2000d-05	0.3673d+04
0.2800d-03	0.2200d-05	0.3671d+04
0.2800d-03	0.2400d-05	0.3670d+04
0.2800d-03	0.2600d-05	0.3668d+04
0.2800d-03	0.2800d-05	0.3666d+04
0.2800d-03	0.3000d-05	0.3665d+04
0.2800d-03	0.3200d-05	0.3663d+04
0.2800d-03	0.3400d-05	0.3661d+04
0.2800d-03	0.3600d-05	0.3660d+04
0.2800d-03	0.3800d-05	0.3658d+04
0.2800d-03	0.4000d-05	0.3657d+04
0.2800d-03	0.4200d-05	0.3655d+04
0.2800d-03	0.4400d-05	0.3653d+04
0.2800d-03	0.4600d-05	0.3654d+04
0.2800d-03	0.4800d-05	0.3653d+04
0.2800d-03	0.5000d-05	0.3651d+04
0.2800d-03	0.1000d-04	0.3609d+04
0.2800d-03	0.2000d-04	0.3530d+04
0.2800d-03	0.3000d-04	0.3453d+04
0.2800d-03	0.4000d-04	0.3378d+04
0.2800d-03	0.5000d-04	0.3304d+04
0.2800d-03	0.6000d-04	0.3233d+04
0.2800d-03	0.7000d-04	0.3163d+04
0.2800d-03	0.8000d-04	0.3095d+04
0.2800d-03	0.9000d-04	0.3028d+04
0.2800d-03	0.1000d-03	0.2964d+04
0.2800d-03	0.1100d-03	0.2901d+04
0.2800d-03	0.1200d-03	0.2840d+04
0.2800d-03	0.1300d-03	0.2781d+04
0.2800d-03	0.1400d-03	0.2723d+04
0.2800d-03	0.1500d-03	0.2667d+04
0.2800d-03	0.1600d-03	0.2613d+04
0.2800d-03	0.1700d-03	0.2560d+04
0.2800d-03	0.1800d-03	0.2509d+04
0.2800d-03	0.1900d-03	0.2459d+04
0.2800d-03	0.2000d-03	0.2411d+04
0.2800d-03	0.2100d-03	0.2364d+04
0.2800d-03	0.2200d-03	0.2318d+04
0.2800d-03	0.2300d-03	0.2274d+04
0.2800d-03	0.2400d-03	0.2231d+04
0.2800d-03	0.2500d-03	0.2189d+04
0.2800d-03	0.2600d-03	0.2149d+04
0.2800d-03	0.2700d-03	0.2110d+04
0.2800d-03	0.2800d-03	0.2072d+04
0.2800d-03	0.2900d-03	0.2034d+04
0.2800d-03	0.3000d-03	0.1998d+04

0.2800d-03	0.3100d-03	0.1963d+04
0.2800d-03	0.3200d-03	0.1929d+04
0.2800d-03	0.3300d-03	0.1896d+04
0.2800d-03	0.3400d-03	0.1864d+04
0.2800d-03	0.3500d-03	0.1833d+04
0.2800d-03	0.3600d-03	0.1803d+04
0.2800d-03	0.3700d-03	0.1773d+04
0.2800d-03	0.3800d-03	0.1744d+04
0.2800d-03	0.3900d-03	0.1716d+04
0.2800d-03	0.4000d-03	0.1689d+04
0.2800d-03	0.4100d-03	0.1663d+04
0.2800d-03	0.4200d-03	0.1637d+04
0.2800d-03	0.4300d-03	0.1612d+04
0.2800d-03	0.4400d-03	0.1587d+04
0.2900d-03	0.0000d+00	0.3574d+04
0.2900d-03	0.2000d-06	0.3572d+04
0.2900d-03	0.4000d-06	0.3572d+04
0.2900d-03	0.6000d-06	0.3570d+04
0.2900d-03	0.8000d-06	0.3569d+04
0.2900d-03	0.1000d-05	0.3567d+04
0.2900d-03	0.1200d-05	0.3566d+04
0.2900d-03	0.1400d-05	0.3564d+04
0.2900d-03	0.1600d-05	0.3563d+04
0.2900d-03	0.1800d-05	0.3561d+04
0.2900d-03	0.2000d-05	0.3560d+04
0.2900d-03	0.2200d-05	0.3558d+04
0.2900d-03	0.2400d-05	0.3557d+04
0.2900d-03	0.2600d-05	0.3555d+04
0.2900d-03	0.2800d-05	0.3554d+04
0.2900d-03	0.3000d-05	0.3552d+04
0.2900d-03	0.3200d-05	0.3551d+04
0.2900d-03	0.3400d-05	0.3549d+04
0.2900d-03	0.3600d-05	0.3548d+04
0.2900d-03	0.3800d-05	0.3546d+04
0.2900d-03	0.4000d-05	0.3545d+04
0.2900d-03	0.4200d-05	0.3543d+04
0.2900d-03	0.4400d-05	0.3542d+04
0.2900d-03	0.4600d-05	0.3540d+04
0.2900d-03	0.4800d-05	0.3541d+04
0.2900d-03	0.5000d-05	0.3540d+04
0.2900d-03	0.1000d-04	0.3501d+04
0.2900d-03	0.2000d-04	0.3429d+04
0.2900d-03	0.3000d-04	0.3358d+04
0.2900d-03	0.4000d-04	0.3288d+04
0.2900d-03	0.5000d-04	0.3220d+04
0.2900d-03	0.6000d-04	0.3153d+04
0.2900d-03	0.7000d-04	0.3087d+04
0.2900d-03	0.8000d-04	0.3024d+04
0.2900d-03	0.9000d-04	0.2961d+04
0.2900d-03	0.1000d-03	0.2900d+04
0.2900d-03	0.1100d-03	0.2841d+04
0.2900d-03	0.1200d-03	0.2783d+04
0.2900d-03	0.1300d-03	0.2727d+04
0.2900d-03	0.1400d-03	0.2672d+04
0.2900d-03	0.1500d-03	0.2619d+04
0.2900d-03	0.1600d-03	0.2567d+04

0.2900d-03	0.1700d-03	0.2517d+04
0.2900d-03	0.1800d-03	0.2468d+04
0.2900d-03	0.1900d-03	0.2420d+04
0.2900d-03	0.2000d-03	0.2374d+04
0.2900d-03	0.2100d-03	0.2329d+04
0.2900d-03	0.2200d-03	0.2285d+04
0.2900d-03	0.2300d-03	0.2243d+04
0.2900d-03	0.2400d-03	0.2201d+04
0.2900d-03	0.2500d-03	0.2161d+04
0.2900d-03	0.2600d-03	0.2122d+04
0.2900d-03	0.2700d-03	0.2084d+04
0.2900d-03	0.2800d-03	0.2047d+04
0.2900d-03	0.2900d-03	0.2011d+04
0.2900d-03	0.3000d-03	0.1976d+04
0.2900d-03	0.3100d-03	0.1942d+04
0.2900d-03	0.3200d-03	0.1909d+04
0.2900d-03	0.3300d-03	0.1877d+04
0.2900d-03	0.3400d-03	0.1846d+04
0.2900d-03	0.3500d-03	0.1815d+04
0.2900d-03	0.3600d-03	0.1786d+04
0.2900d-03	0.3700d-03	0.1757d+04
0.2900d-03	0.3800d-03	0.1729d+04
0.2900d-03	0.3900d-03	0.1702d+04
0.2900d-03	0.4000d-03	0.1675d+04
0.2900d-03	0.4100d-03	0.1649d+04
0.2900d-03	0.4200d-03	0.1624d+04
0.2900d-03	0.4300d-03	0.1599d+04
0.2900d-03	0.4400d-03	0.1575d+04
0.3000d-03	0.0000d+00	0.3463d+04
0.3000d-03	0.2000d-06	0.3461d+04
0.3000d-03	0.4000d-06	0.3460d+04
0.3000d-03	0.6000d-06	0.3459d+04
0.3000d-03	0.8000d-06	0.3458d+04
0.3000d-03	0.1000d-05	0.3456d+04
0.3000d-03	0.1200d-05	0.3455d+04
0.3000d-03	0.1400d-05	0.3453d+04
0.3000d-03	0.1600d-05	0.3452d+04
0.3000d-03	0.1800d-05	0.3451d+04
0.3000d-03	0.2000d-05	0.3450d+04
0.3000d-03	0.2200d-05	0.3448d+04
0.3000d-03	0.2400d-05	0.3447d+04
0.3000d-03	0.2600d-05	0.3445d+04
0.3000d-03	0.2800d-05	0.3444d+04
0.3000d-03	0.3000d-05	0.3443d+04
0.3000d-03	0.3200d-05	0.3441d+04
0.3000d-03	0.3400d-05	0.3440d+04
0.3000d-03	0.3600d-05	0.3438d+04
0.3000d-03	0.3800d-05	0.3437d+04
0.3000d-03	0.4000d-05	0.3436d+04
0.3000d-03	0.4200d-05	0.3434d+04
0.3000d-03	0.4400d-05	0.3433d+04
0.3000d-03	0.4600d-05	0.3432d+04
0.3000d-03	0.4800d-05	0.3430d+04
0.3000d-03	0.5000d-05	0.3431d+04
0.3000d-03	0.1000d-04	0.3396d+04
0.3000d-03	0.2000d-04	0.3330d+04

0.3000d-03	0.3000d-04	0.3264d+04
0.3000d-03	0.4000d-04	0.3200d+04
0.3000d-03	0.5000d-04	0.3137d+04
0.3000d-03	0.6000d-04	0.3074d+04
0.3000d-03	0.7000d-04	0.3013d+04
0.3000d-03	0.8000d-04	0.2954d+04
0.3000d-03	0.9000d-04	0.2895d+04
0.3000d-03	0.1000d-03	0.2838d+04
0.3000d-03	0.1100d-03	0.2782d+04
0.3000d-03	0.1200d-03	0.2727d+04
0.3000d-03	0.1300d-03	0.2674d+04
0.3000d-03	0.1400d-03	0.2622d+04
0.3000d-03	0.1500d-03	0.2572d+04
0.3000d-03	0.1600d-03	0.2522d+04
0.3000d-03	0.1700d-03	0.2474d+04
0.3000d-03	0.1800d-03	0.2427d+04
0.3000d-03	0.1900d-03	0.2382d+04
0.3000d-03	0.2000d-03	0.2337d+04
0.3000d-03	0.2100d-03	0.2294d+04
0.3000d-03	0.2200d-03	0.2252d+04
0.3000d-03	0.2300d-03	0.2211d+04
0.3000d-03	0.2400d-03	0.2171d+04
0.3000d-03	0.2500d-03	0.2133d+04
0.3000d-03	0.2600d-03	0.2095d+04
0.3000d-03	0.2700d-03	0.2058d+04
0.3000d-03	0.2800d-03	0.2022d+04
0.3000d-03	0.2900d-03	0.1988d+04
0.3000d-03	0.3000d-03	0.1954d+04
0.3000d-03	0.3100d-03	0.1921d+04
0.3000d-03	0.3200d-03	0.1889d+04
0.3000d-03	0.3300d-03	0.1858d+04
0.3000d-03	0.3400d-03	0.1827d+04
0.3000d-03	0.3500d-03	0.1798d+04
0.3000d-03	0.3600d-03	0.1769d+04
0.3000d-03	0.3700d-03	0.1741d+04
0.3000d-03	0.3800d-03	0.1713d+04
0.3000d-03	0.3900d-03	0.1687d+04
0.3000d-03	0.4000d-03	0.1661d+04
0.3000d-03	0.4100d-03	0.1635d+04
0.3000d-03	0.4200d-03	0.1611d+04
0.3000d-03	0.4300d-03	0.1587d+04
0.3000d-03	0.4400d-03	0.1563d+04
0.3100d-03	0.0000d+00	0.3354d+04
0.3100d-03	0.2000d-06	0.3353d+04
0.3100d-03	0.4000d-06	0.3352d+04
0.3100d-03	0.6000d-06	0.3351d+04
0.3100d-03	0.8000d-06	0.3350d+04
0.3100d-03	0.1000d-05	0.3348d+04
0.3100d-03	0.1200d-05	0.3347d+04
0.3100d-03	0.1400d-05	0.3346d+04
0.3100d-03	0.1600d-05	0.3344d+04
0.3100d-03	0.1800d-05	0.3343d+04
0.3100d-03	0.2000d-05	0.3342d+04
0.3100d-03	0.2200d-05	0.3341d+04
0.3100d-03	0.2400d-05	0.3340d+04
0.3100d-03	0.2600d-05	0.3338d+04

0.3100d-03	0.2800d-05	0.3337d+04
0.3100d-03	0.3000d-05	0.3336d+04
0.3100d-03	0.3200d-05	0.3335d+04
0.3100d-03	0.3400d-05	0.3333d+04
0.3100d-03	0.3600d-05	0.3332d+04
0.3100d-03	0.3800d-05	0.3331d+04
0.3100d-03	0.4000d-05	0.3330d+04
0.3100d-03	0.4200d-05	0.3329d+04
0.3100d-03	0.4400d-05	0.3327d+04
0.3100d-03	0.4600d-05	0.3326d+04
0.3100d-03	0.4800d-05	0.3325d+04
0.3100d-03	0.5000d-05	0.3326d+04
0.3100d-03	0.1000d-04	0.3293d+04
0.3100d-03	0.2000d-04	0.3233d+04
0.3100d-03	0.3000d-04	0.3173d+04
0.3100d-03	0.4000d-04	0.3114d+04
0.3100d-03	0.5000d-04	0.3055d+04
0.3100d-03	0.6000d-04	0.2997d+04
0.3100d-03	0.7000d-04	0.2940d+04
0.3100d-03	0.8000d-04	0.2885d+04
0.3100d-03	0.9000d-04	0.2830d+04
0.3100d-03	0.1000d-03	0.2776d+04
0.3100d-03	0.1100d-03	0.2723d+04
0.3100d-03	0.1200d-03	0.2672d+04
0.3100d-03	0.1300d-03	0.2622d+04
0.3100d-03	0.1400d-03	0.2572d+04
0.3100d-03	0.1500d-03	0.2524d+04
0.3100d-03	0.1600d-03	0.2477d+04
0.3100d-03	0.1700d-03	0.2432d+04
0.3100d-03	0.1800d-03	0.2387d+04
0.3100d-03	0.1900d-03	0.2343d+04
0.3100d-03	0.2000d-03	0.2301d+04
0.3100d-03	0.2100d-03	0.2259d+04
0.3100d-03	0.2200d-03	0.2219d+04
0.3100d-03	0.2300d-03	0.2180d+04
0.3100d-03	0.2400d-03	0.2141d+04
0.3100d-03	0.2500d-03	0.2104d+04
0.3100d-03	0.2600d-03	0.2068d+04
0.3100d-03	0.2700d-03	0.2032d+04
0.3100d-03	0.2800d-03	0.1998d+04
0.3100d-03	0.2900d-03	0.1964d+04
0.3100d-03	0.3000d-03	0.1931d+04
0.3100d-03	0.3100d-03	0.1899d+04
0.3100d-03	0.3200d-03	0.1868d+04
0.3100d-03	0.3300d-03	0.1838d+04
0.3100d-03	0.3400d-03	0.1808d+04
0.3100d-03	0.3500d-03	0.1779d+04
0.3100d-03	0.3600d-03	0.1751d+04
0.3100d-03	0.3700d-03	0.1724d+04
0.3100d-03	0.3800d-03	0.1697d+04
0.3100d-03	0.3900d-03	0.1671d+04
0.3100d-03	0.4000d-03	0.1646d+04
0.3100d-03	0.4100d-03	0.1621d+04
0.3100d-03	0.4200d-03	0.1597d+04
0.3100d-03	0.4300d-03	0.1574d+04
0.3100d-03	0.4400d-03	0.1551d+04

0.3200d-03	0.0000d+00	0.3249d+04
0.3200d-03	0.2000d-06	0.3248d+04
0.3200d-03	0.4000d-06	0.3247d+04
0.3200d-03	0.6000d-06	0.3246d+04
0.3200d-03	0.8000d-06	0.3245d+04
0.3200d-03	0.1000d-05	0.3244d+04
0.3200d-03	0.1200d-05	0.3242d+04
0.3200d-03	0.1400d-05	0.3241d+04
0.3200d-03	0.1600d-05	0.3240d+04
0.3200d-03	0.1800d-05	0.3239d+04
0.3200d-03	0.2000d-05	0.3238d+04
0.3200d-03	0.2200d-05	0.3237d+04
0.3200d-03	0.2400d-05	0.3236d+04
0.3200d-03	0.2600d-05	0.3235d+04
0.3200d-03	0.2800d-05	0.3234d+04
0.3200d-03	0.3000d-05	0.3232d+04
0.3200d-03	0.3200d-05	0.3231d+04
0.3200d-03	0.3400d-05	0.3230d+04
0.3200d-03	0.3600d-05	0.3229d+04
0.3200d-03	0.3800d-05	0.3228d+04
0.3200d-03	0.4000d-05	0.3227d+04
0.3200d-03	0.4200d-05	0.3226d+04
0.3200d-03	0.4400d-05	0.3225d+04
0.3200d-03	0.4600d-05	0.3224d+04
0.3200d-03	0.4800d-05	0.3222d+04
0.3200d-03	0.5000d-05	0.3221d+04
0.3200d-03	0.1000d-04	0.3194d+04
0.3200d-03	0.2000d-04	0.3139d+04
0.3200d-03	0.3000d-04	0.3084d+04
0.3200d-03	0.4000d-04	0.3029d+04
0.3200d-03	0.5000d-04	0.2975d+04
0.3200d-03	0.6000d-04	0.2922d+04
0.3200d-03	0.7000d-04	0.2869d+04
0.3200d-03	0.8000d-04	0.2817d+04
0.3200d-03	0.9000d-04	0.2765d+04
0.3200d-03	0.1000d-03	0.2715d+04
0.3200d-03	0.1100d-03	0.2666d+04
0.3200d-03	0.1200d-03	0.2617d+04
0.3200d-03	0.1300d-03	0.2570d+04
0.3200d-03	0.1400d-03	0.2523d+04
0.3200d-03	0.1500d-03	0.2477d+04
0.3200d-03	0.1600d-03	0.2433d+04
0.3200d-03	0.1700d-03	0.2389d+04
0.3200d-03	0.1800d-03	0.2347d+04
0.3200d-03	0.1900d-03	0.2305d+04
0.3200d-03	0.2000d-03	0.2264d+04
0.3200d-03	0.2100d-03	0.2225d+04
0.3200d-03	0.2200d-03	0.2186d+04
0.3200d-03	0.2300d-03	0.2148d+04
0.3200d-03	0.2400d-03	0.2111d+04
0.3200d-03	0.2500d-03	0.2075d+04
0.3200d-03	0.2600d-03	0.2040d+04
0.3200d-03	0.2700d-03	0.2006d+04
0.3200d-03	0.2800d-03	0.1973d+04
0.3200d-03	0.2900d-03	0.1940d+04
0.3200d-03	0.3000d-03	0.1908d+04

0.3200d-03	0.3100d-03	0.1878d+04
0.3200d-03	0.3200d-03	0.1847d+04
0.3200d-03	0.3300d-03	0.1818d+04
0.3200d-03	0.3400d-03	0.1789d+04
0.3200d-03	0.3500d-03	0.1761d+04
0.3200d-03	0.3600d-03	0.1734d+04
0.3200d-03	0.3700d-03	0.1707d+04
0.3200d-03	0.3800d-03	0.1681d+04
0.3200d-03	0.3900d-03	0.1656d+04
0.3200d-03	0.4000d-03	0.1631d+04
0.3200d-03	0.4100d-03	0.1607d+04
0.3200d-03	0.4200d-03	0.1584d+04
0.3200d-03	0.4300d-03	0.1561d+04
0.3200d-03	0.4400d-03	0.1538d+04
0.3300d-03	0.0000d+00	0.3147d+04
0.3300d-03	0.2000d-06	0.3146d+04
0.3300d-03	0.4000d-06	0.3145d+04
0.3300d-03	0.6000d-06	0.3144d+04
0.3300d-03	0.8000d-06	0.3143d+04
0.3300d-03	0.1000d-05	0.3142d+04
0.3300d-03	0.1200d-05	0.3141d+04
0.3300d-03	0.1400d-05	0.3140d+04
0.3300d-03	0.1600d-05	0.3139d+04
0.3300d-03	0.1800d-05	0.3138d+04
0.3300d-03	0.2000d-05	0.3137d+04
0.3300d-03	0.2200d-05	0.3136d+04
0.3300d-03	0.2400d-05	0.3135d+04
0.3300d-03	0.2600d-05	0.3134d+04
0.3300d-03	0.2800d-05	0.3133d+04
0.3300d-03	0.3000d-05	0.3132d+04
0.3300d-03	0.3200d-05	0.3131d+04
0.3300d-03	0.3400d-05	0.3130d+04
0.3300d-03	0.3600d-05	0.3129d+04
0.3300d-03	0.3800d-05	0.3128d+04
0.3300d-03	0.4000d-05	0.3127d+04
0.3300d-03	0.4200d-05	0.3126d+04
0.3300d-03	0.4400d-05	0.3125d+04
0.3300d-03	0.4600d-05	0.3124d+04
0.3300d-03	0.4800d-05	0.3123d+04
0.3300d-03	0.5000d-05	0.3122d+04
0.3300d-03	0.1000d-04	0.3097d+04
0.3300d-03	0.2000d-04	0.3047d+04
0.3300d-03	0.3000d-04	0.2997d+04
0.3300d-03	0.4000d-04	0.2947d+04
0.3300d-03	0.5000d-04	0.2897d+04
0.3300d-03	0.6000d-04	0.2848d+04
0.3300d-03	0.7000d-04	0.2799d+04
0.3300d-03	0.8000d-04	0.2750d+04
0.3300d-03	0.9000d-04	0.2702d+04
0.3300d-03	0.1000d-03	0.2655d+04
0.3300d-03	0.1100d-03	0.2609d+04
0.3300d-03	0.1200d-03	0.2563d+04
0.3300d-03	0.1300d-03	0.2518d+04
0.3300d-03	0.1400d-03	0.2474d+04
0.3300d-03	0.1500d-03	0.2431d+04
0.3300d-03	0.1600d-03	0.2389d+04

0.3300d-03	0.1700d-03	0.2347d+04
0.3300d-03	0.1800d-03	0.2307d+04
0.3300d-03	0.1900d-03	0.2267d+04
0.3300d-03	0.2000d-03	0.2228d+04
0.3300d-03	0.2100d-03	0.2190d+04
0.3300d-03	0.2200d-03	0.2153d+04
0.3300d-03	0.2300d-03	0.2117d+04
0.3300d-03	0.2400d-03	0.2081d+04
0.3300d-03	0.2500d-03	0.2047d+04
0.3300d-03	0.2600d-03	0.2013d+04
0.3300d-03	0.2700d-03	0.1980d+04
0.3300d-03	0.2800d-03	0.1948d+04
0.3300d-03	0.2900d-03	0.1916d+04
0.3300d-03	0.3000d-03	0.1886d+04
0.3300d-03	0.3100d-03	0.1856d+04
0.3300d-03	0.3200d-03	0.1827d+04
0.3300d-03	0.3300d-03	0.1798d+04
0.3300d-03	0.3400d-03	0.1770d+04
0.3300d-03	0.3500d-03	0.1743d+04
0.3300d-03	0.3600d-03	0.1716d+04
0.3300d-03	0.3700d-03	0.1691d+04
0.3300d-03	0.3800d-03	0.1665d+04
0.3300d-03	0.3900d-03	0.1641d+04
0.3300d-03	0.4000d-03	0.1617d+04
0.3300d-03	0.4100d-03	0.1593d+04
0.3300d-03	0.4200d-03	0.1570d+04
0.3300d-03	0.4300d-03	0.1548d+04
0.3300d-03	0.4400d-03	0.1526d+04
0.3400d-03	0.0000d+00	0.3049d+04
0.3400d-03	0.2000d-06	0.3048d+04
0.3400d-03	0.4000d-06	0.3047d+04
0.3400d-03	0.6000d-06	0.3046d+04
0.3400d-03	0.8000d-06	0.3046d+04
0.3400d-03	0.1000d-05	0.3045d+04
0.3400d-03	0.1200d-05	0.3044d+04
0.3400d-03	0.1400d-05	0.3043d+04
0.3400d-03	0.1600d-05	0.3042d+04
0.3400d-03	0.1800d-05	0.3041d+04
0.3400d-03	0.2000d-05	0.3040d+04
0.3400d-03	0.2200d-05	0.3039d+04
0.3400d-03	0.2400d-05	0.3038d+04
0.3400d-03	0.2600d-05	0.3037d+04
0.3400d-03	0.2800d-05	0.3036d+04
0.3400d-03	0.3000d-05	0.3036d+04
0.3400d-03	0.3200d-05	0.3035d+04
0.3400d-03	0.3400d-05	0.3034d+04
0.3400d-03	0.3600d-05	0.3033d+04
0.3400d-03	0.3800d-05	0.3032d+04
0.3400d-03	0.4000d-05	0.3031d+04
0.3400d-03	0.4200d-05	0.3030d+04
0.3400d-03	0.4400d-05	0.3029d+04
0.3400d-03	0.4600d-05	0.3028d+04
0.3400d-03	0.4800d-05	0.3027d+04
0.3400d-03	0.5000d-05	0.3026d+04
0.3400d-03	0.1000d-04	0.3004d+04
0.3400d-03	0.2000d-04	0.2960d+04

0.3400d-03	0.3000d-04	0.2913d+04
0.3400d-03	0.4000d-04	0.2867d+04
0.3400d-03	0.5000d-04	0.2821d+04
0.3400d-03	0.6000d-04	0.2775d+04
0.3400d-03	0.7000d-04	0.2730d+04
0.3400d-03	0.8000d-04	0.2685d+04
0.3400d-03	0.9000d-04	0.2640d+04
0.3400d-03	0.1000d-03	0.2596d+04
0.3400d-03	0.1100d-03	0.2553d+04
0.3400d-03	0.1200d-03	0.2510d+04
0.3400d-03	0.1300d-03	0.2467d+04
0.3400d-03	0.1400d-03	0.2426d+04
0.3400d-03	0.1500d-03	0.2385d+04
0.3400d-03	0.1600d-03	0.2345d+04
0.3400d-03	0.1700d-03	0.2305d+04
0.3400d-03	0.1800d-03	0.2267d+04
0.3400d-03	0.1900d-03	0.2229d+04
0.3400d-03	0.2000d-03	0.2192d+04
0.3400d-03	0.2100d-03	0.2156d+04
0.3400d-03	0.2200d-03	0.2120d+04
0.3400d-03	0.2300d-03	0.2085d+04
0.3400d-03	0.2400d-03	0.2051d+04
0.3400d-03	0.2500d-03	0.2018d+04
0.3400d-03	0.2600d-03	0.1986d+04
0.3400d-03	0.2700d-03	0.1954d+04
0.3400d-03	0.2800d-03	0.1923d+04
0.3400d-03	0.2900d-03	0.1893d+04
0.3400d-03	0.3000d-03	0.1863d+04
0.3400d-03	0.3100d-03	0.1834d+04
0.3400d-03	0.3200d-03	0.1806d+04
0.3400d-03	0.3300d-03	0.1778d+04
0.3400d-03	0.3400d-03	0.1751d+04
0.3400d-03	0.3500d-03	0.1725d+04
0.3400d-03	0.3600d-03	0.1699d+04
0.3400d-03	0.3700d-03	0.1674d+04
0.3400d-03	0.3800d-03	0.1649d+04
0.3400d-03	0.3900d-03	0.1625d+04
0.3400d-03	0.4000d-03	0.1602d+04
0.3400d-03	0.4100d-03	0.1579d+04
0.3400d-03	0.4200d-03	0.1556d+04
0.3400d-03	0.4300d-03	0.1534d+04
0.3400d-03	0.4400d-03	0.1513d+04
0.3500d-03	0.0000d+00	0.2954d+04
0.3500d-03	0.2000d-06	0.2953d+04
0.3500d-03	0.4000d-06	0.2953d+04
0.3500d-03	0.6000d-06	0.2952d+04
0.3500d-03	0.8000d-06	0.2951d+04
0.3500d-03	0.1000d-05	0.2950d+04
0.3500d-03	0.1200d-05	0.2950d+04
0.3500d-03	0.1400d-05	0.2949d+04
0.3500d-03	0.1600d-05	0.2948d+04
0.3500d-03	0.1800d-05	0.2947d+04
0.3500d-03	0.2000d-05	0.2946d+04
0.3500d-03	0.2200d-05	0.2946d+04
0.3500d-03	0.2400d-05	0.2945d+04
0.3500d-03	0.2600d-05	0.2944d+04

0.3500d-03	0.2800d-05	0.2943d+04
0.3500d-03	0.3000d-05	0.2942d+04
0.3500d-03	0.3200d-05	0.2941d+04
0.3500d-03	0.3400d-05	0.2941d+04
0.3500d-03	0.3600d-05	0.2940d+04
0.3500d-03	0.3800d-05	0.2939d+04
0.3500d-03	0.4000d-05	0.2938d+04
0.3500d-03	0.4200d-05	0.2937d+04
0.3500d-03	0.4400d-05	0.2936d+04
0.3500d-03	0.4600d-05	0.2936d+04
0.3500d-03	0.4800d-05	0.2935d+04
0.3500d-03	0.5000d-05	0.2934d+04
0.3500d-03	0.1000d-04	0.2914d+04
0.3500d-03	0.2000d-04	0.2874d+04
0.3500d-03	0.3000d-04	0.2831d+04
0.3500d-03	0.4000d-04	0.2789d+04
0.3500d-03	0.5000d-04	0.2747d+04
0.3500d-03	0.6000d-04	0.2705d+04
0.3500d-03	0.7000d-04	0.2663d+04
0.3500d-03	0.8000d-04	0.2621d+04
0.3500d-03	0.9000d-04	0.2580d+04
0.3500d-03	0.1000d-03	0.2538d+04
0.3500d-03	0.1100d-03	0.2498d+04
0.3500d-03	0.1200d-03	0.2457d+04
0.3500d-03	0.1300d-03	0.2418d+04
0.3500d-03	0.1400d-03	0.2378d+04
0.3500d-03	0.1500d-03	0.2340d+04
0.3500d-03	0.1600d-03	0.2302d+04
0.3500d-03	0.1700d-03	0.2264d+04
0.3500d-03	0.1800d-03	0.2228d+04
0.3500d-03	0.1900d-03	0.2192d+04
0.3500d-03	0.2000d-03	0.2156d+04
0.3500d-03	0.2100d-03	0.2122d+04
0.3500d-03	0.2200d-03	0.2088d+04
0.3500d-03	0.2300d-03	0.2054d+04
0.3500d-03	0.2400d-03	0.2022d+04
0.3500d-03	0.2500d-03	0.1990d+04
0.3500d-03	0.2600d-03	0.1958d+04
0.3500d-03	0.2700d-03	0.1928d+04
0.3500d-03	0.2800d-03	0.1898d+04
0.3500d-03	0.2900d-03	0.1869d+04
0.3500d-03	0.3000d-03	0.1840d+04
0.3500d-03	0.3100d-03	0.1812d+04
0.3500d-03	0.3200d-03	0.1785d+04
0.3500d-03	0.3300d-03	0.1758d+04
0.3500d-03	0.3400d-03	0.1732d+04
0.3500d-03	0.3500d-03	0.1706d+04
0.3500d-03	0.3600d-03	0.1681d+04
0.3500d-03	0.3700d-03	0.1657d+04
0.3500d-03	0.3800d-03	0.1633d+04
0.3500d-03	0.3900d-03	0.1609d+04
0.3500d-03	0.4000d-03	0.1587d+04
0.3500d-03	0.4100d-03	0.1564d+04
0.3500d-03	0.4200d-03	0.1542d+04
0.3500d-03	0.4300d-03	0.1521d+04
0.3500d-03	0.4400d-03	0.1500d+04

0.3600d-03	0.0000d+00	0.2863d+04
0.3600d-03	0.2000d-06	0.2862d+04
0.3600d-03	0.4000d-06	0.2862d+04
0.3600d-03	0.6000d-06	0.2861d+04
0.3600d-03	0.8000d-06	0.2860d+04
0.3600d-03	0.1000d-05	0.2860d+04
0.3600d-03	0.1200d-05	0.2859d+04
0.3600d-03	0.1400d-05	0.2858d+04
0.3600d-03	0.1600d-05	0.2857d+04
0.3600d-03	0.1800d-05	0.2857d+04
0.3600d-03	0.2000d-05	0.2856d+04
0.3600d-03	0.2200d-05	0.2855d+04
0.3600d-03	0.2400d-05	0.2855d+04
0.3600d-03	0.2600d-05	0.2854d+04
0.3600d-03	0.2800d-05	0.2853d+04
0.3600d-03	0.3000d-05	0.2852d+04
0.3600d-03	0.3200d-05	0.2852d+04
0.3600d-03	0.3400d-05	0.2851d+04
0.3600d-03	0.3600d-05	0.2850d+04
0.3600d-03	0.3800d-05	0.2849d+04
0.3600d-03	0.4000d-05	0.2849d+04
0.3600d-03	0.4200d-05	0.2848d+04
0.3600d-03	0.4400d-05	0.2847d+04
0.3600d-03	0.4600d-05	0.2847d+04
0.3600d-03	0.4800d-05	0.2846d+04
0.3600d-03	0.5000d-05	0.2845d+04
0.3600d-03	0.1000d-04	0.2827d+04
0.3600d-03	0.2000d-04	0.2791d+04
0.3600d-03	0.3000d-04	0.2752d+04
0.3600d-03	0.4000d-04	0.2714d+04
0.3600d-03	0.5000d-04	0.2675d+04
0.3600d-03	0.6000d-04	0.2637d+04
0.3600d-03	0.7000d-04	0.2598d+04
0.3600d-03	0.8000d-04	0.2559d+04
0.3600d-03	0.9000d-04	0.2520d+04
0.3600d-03	0.1000d-03	0.2482d+04
0.3600d-03	0.1100d-03	0.2444d+04
0.3600d-03	0.1200d-03	0.2406d+04
0.3600d-03	0.1300d-03	0.2368d+04
0.3600d-03	0.1400d-03	0.2331d+04
0.3600d-03	0.1500d-03	0.2295d+04
0.3600d-03	0.1600d-03	0.2259d+04
0.3600d-03	0.1700d-03	0.2224d+04
0.3600d-03	0.1800d-03	0.2189d+04
0.3600d-03	0.1900d-03	0.2154d+04
0.3600d-03	0.2000d-03	0.2121d+04
0.3600d-03	0.2100d-03	0.2088d+04
0.3600d-03	0.2200d-03	0.2055d+04
0.3600d-03	0.2300d-03	0.2023d+04
0.3600d-03	0.2400d-03	0.1992d+04
0.3600d-03	0.2500d-03	0.1961d+04
0.3600d-03	0.2600d-03	0.1931d+04
0.3600d-03	0.2700d-03	0.1902d+04
0.3600d-03	0.2800d-03	0.1873d+04
0.3600d-03	0.2900d-03	0.1845d+04
0.3600d-03	0.3000d-03	0.1817d+04

0.3600d-03	0.3100d-03	0.1790d+04
0.3600d-03	0.3200d-03	0.1764d+04
0.3600d-03	0.3300d-03	0.1738d+04
0.3600d-03	0.3400d-03	0.1712d+04
0.3600d-03	0.3500d-03	0.1688d+04
0.3600d-03	0.3600d-03	0.1663d+04
0.3600d-03	0.3700d-03	0.1640d+04
0.3600d-03	0.3800d-03	0.1616d+04
0.3600d-03	0.3900d-03	0.1594d+04
0.3600d-03	0.4000d-03	0.1571d+04
0.3600d-03	0.4100d-03	0.1550d+04
0.3600d-03	0.4200d-03	0.1528d+04
0.3600d-03	0.4300d-03	0.1508d+04
0.3600d-03	0.4400d-03	0.1487d+04
0.3700d-03	0.0000d+00	0.2776d+04
0.3700d-03	0.2000d-06	0.2775d+04
0.3700d-03	0.4000d-06	0.2774d+04
0.3700d-03	0.6000d-06	0.2774d+04
0.3700d-03	0.8000d-06	0.2773d+04
0.3700d-03	0.1000d-05	0.2772d+04
0.3700d-03	0.1200d-05	0.2772d+04
0.3700d-03	0.1400d-05	0.2771d+04
0.3700d-03	0.1600d-05	0.2771d+04
0.3700d-03	0.1800d-05	0.2770d+04
0.3700d-03	0.2000d-05	0.2769d+04
0.3700d-03	0.2200d-05	0.2769d+04
0.3700d-03	0.2400d-05	0.2768d+04
0.3700d-03	0.2600d-05	0.2767d+04
0.3700d-03	0.2800d-05	0.2767d+04
0.3700d-03	0.3000d-05	0.2766d+04
0.3700d-03	0.3200d-05	0.2765d+04
0.3700d-03	0.3400d-05	0.2765d+04
0.3700d-03	0.3600d-05	0.2764d+04
0.3700d-03	0.3800d-05	0.2763d+04
0.3700d-03	0.4000d-05	0.2763d+04
0.3700d-03	0.4200d-05	0.2762d+04
0.3700d-03	0.4400d-05	0.2761d+04
0.3700d-03	0.4600d-05	0.2761d+04
0.3700d-03	0.4800d-05	0.2760d+04
0.3700d-03	0.5000d-05	0.2760d+04
0.3700d-03	0.1000d-04	0.2743d+04
0.3700d-03	0.2000d-04	0.2711d+04
0.3700d-03	0.3000d-04	0.2676d+04
0.3700d-03	0.4000d-04	0.2641d+04
0.3700d-03	0.5000d-04	0.2606d+04
0.3700d-03	0.6000d-04	0.2570d+04
0.3700d-03	0.7000d-04	0.2534d+04
0.3700d-03	0.8000d-04	0.2498d+04
0.3700d-03	0.9000d-04	0.2462d+04
0.3700d-03	0.1000d-03	0.2427d+04
0.3700d-03	0.1100d-03	0.2391d+04
0.3700d-03	0.1200d-03	0.2355d+04
0.3700d-03	0.1300d-03	0.2320d+04
0.3700d-03	0.1400d-03	0.2285d+04
0.3700d-03	0.1500d-03	0.2251d+04
0.3700d-03	0.1600d-03	0.2217d+04

0.3700d-03	0.1700d-03	0.2183d+04
0.3700d-03	0.1800d-03	0.2150d+04
0.3700d-03	0.1900d-03	0.2118d+04
0.3700d-03	0.2000d-03	0.2086d+04
0.3700d-03	0.2100d-03	0.2054d+04
0.3700d-03	0.2200d-03	0.2023d+04
0.3700d-03	0.2300d-03	0.1993d+04
0.3700d-03	0.2400d-03	0.1963d+04
0.3700d-03	0.2500d-03	0.1933d+04
0.3700d-03	0.2600d-03	0.1904d+04
0.3700d-03	0.2700d-03	0.1876d+04
0.3700d-03	0.2800d-03	0.1848d+04
0.3700d-03	0.2900d-03	0.1821d+04
0.3700d-03	0.3000d-03	0.1795d+04
0.3700d-03	0.3100d-03	0.1768d+04
0.3700d-03	0.3200d-03	0.1743d+04
0.3700d-03	0.3300d-03	0.1718d+04
0.3700d-03	0.3400d-03	0.1693d+04
0.3700d-03	0.3500d-03	0.1669d+04
0.3700d-03	0.3600d-03	0.1646d+04
0.3700d-03	0.3700d-03	0.1623d+04
0.3700d-03	0.3800d-03	0.1600d+04
0.3700d-03	0.3900d-03	0.1578d+04
0.3700d-03	0.4000d-03	0.1556d+04
0.3700d-03	0.4100d-03	0.1535d+04
0.3700d-03	0.4200d-03	0.1514d+04
0.3700d-03	0.4300d-03	0.1494d+04
0.3700d-03	0.4400d-03	0.1474d+04
0.3800d-03	0.0000d+00	0.2692d+04
0.3800d-03	0.2000d-06	0.2691d+04
0.3800d-03	0.4000d-06	0.2691d+04
0.3800d-03	0.6000d-06	0.2690d+04
0.3800d-03	0.8000d-06	0.2689d+04
0.3800d-03	0.1000d-05	0.2689d+04
0.3800d-03	0.1200d-05	0.2688d+04
0.3800d-03	0.1400d-05	0.2688d+04
0.3800d-03	0.1600d-05	0.2687d+04
0.3800d-03	0.1800d-05	0.2687d+04
0.3800d-03	0.2000d-05	0.2686d+04
0.3800d-03	0.2200d-05	0.2685d+04
0.3800d-03	0.2400d-05	0.2685d+04
0.3800d-03	0.2600d-05	0.2684d+04
0.3800d-03	0.2800d-05	0.2684d+04
0.3800d-03	0.3000d-05	0.2683d+04
0.3800d-03	0.3200d-05	0.2683d+04
0.3800d-03	0.3400d-05	0.2682d+04
0.3800d-03	0.3600d-05	0.2681d+04
0.3800d-03	0.3800d-05	0.2681d+04
0.3800d-03	0.4000d-05	0.2680d+04
0.3800d-03	0.4200d-05	0.2680d+04
0.3800d-03	0.4400d-05	0.2679d+04
0.3800d-03	0.4600d-05	0.2678d+04
0.3800d-03	0.4800d-05	0.2678d+04
0.3800d-03	0.5000d-05	0.2677d+04
0.3800d-03	0.1000d-04	0.2663d+04
0.3800d-03	0.2000d-04	0.2633d+04

0.3800d-03	0.3000d-04	0.2602d+04
0.3800d-03	0.4000d-04	0.2570d+04
0.3800d-03	0.5000d-04	0.2538d+04
0.3800d-03	0.6000d-04	0.2505d+04
0.3800d-03	0.7000d-04	0.2472d+04
0.3800d-03	0.8000d-04	0.2439d+04
0.3800d-03	0.9000d-04	0.2406d+04
0.3800d-03	0.1000d-03	0.2373d+04
0.3800d-03	0.1100d-03	0.2339d+04
0.3800d-03	0.1200d-03	0.2306d+04
0.3800d-03	0.1300d-03	0.2273d+04
0.3800d-03	0.1400d-03	0.2240d+04
0.3800d-03	0.1500d-03	0.2208d+04
0.3800d-03	0.1600d-03	0.2176d+04
0.3800d-03	0.1700d-03	0.2144d+04
0.3800d-03	0.1800d-03	0.2113d+04
0.3800d-03	0.1900d-03	0.2082d+04
0.3800d-03	0.2000d-03	0.2051d+04
0.3800d-03	0.2100d-03	0.2021d+04
0.3800d-03	0.2200d-03	0.1991d+04
0.3800d-03	0.2300d-03	0.1962d+04
0.3800d-03	0.2400d-03	0.1934d+04
0.3800d-03	0.2500d-03	0.1905d+04
0.3800d-03	0.2600d-03	0.1878d+04
0.3800d-03	0.2700d-03	0.1850d+04
0.3800d-03	0.2800d-03	0.1824d+04
0.3800d-03	0.2900d-03	0.1798d+04
0.3800d-03	0.3000d-03	0.1772d+04
0.3800d-03	0.3100d-03	0.1747d+04
0.3800d-03	0.3200d-03	0.1722d+04
0.3800d-03	0.3300d-03	0.1698d+04
0.3800d-03	0.3400d-03	0.1674d+04
0.3800d-03	0.3500d-03	0.1651d+04
0.3800d-03	0.3600d-03	0.1628d+04
0.3800d-03	0.3700d-03	0.1605d+04
0.3800d-03	0.3800d-03	0.1584d+04
0.3800d-03	0.3900d-03	0.1562d+04
0.3800d-03	0.4000d-03	0.1541d+04
0.3800d-03	0.4100d-03	0.1520d+04
0.3800d-03	0.4200d-03	0.1500d+04
0.3800d-03	0.4300d-03	0.1480d+04
0.3800d-03	0.4400d-03	0.1461d+04
0.3900d-03	0.0000d+00	0.2611d+04
0.3900d-03	0.2000d-06	0.2611d+04
0.3900d-03	0.4000d-06	0.2610d+04
0.3900d-03	0.6000d-06	0.2610d+04
0.3900d-03	0.8000d-06	0.2609d+04
0.3900d-03	0.1000d-05	0.2609d+04
0.3900d-03	0.1200d-05	0.2608d+04
0.3900d-03	0.1400d-05	0.2608d+04
0.3900d-03	0.1600d-05	0.2607d+04
0.3900d-03	0.1800d-05	0.2607d+04
0.3900d-03	0.2000d-05	0.2606d+04
0.3900d-03	0.2200d-05	0.2606d+04
0.3900d-03	0.2400d-05	0.2605d+04
0.3900d-03	0.2600d-05	0.2605d+04

0.3900d-03	0.2800d-05	0.2604d+04
0.3900d-03	0.3000d-05	0.2604d+04
0.3900d-03	0.3200d-05	0.2603d+04
0.3900d-03	0.3400d-05	0.2603d+04
0.3900d-03	0.3600d-05	0.2602d+04
0.3900d-03	0.3800d-05	0.2602d+04
0.3900d-03	0.4000d-05	0.2601d+04
0.3900d-03	0.4200d-05	0.2601d+04
0.3900d-03	0.4400d-05	0.2600d+04
0.3900d-03	0.4600d-05	0.2600d+04
0.3900d-03	0.4800d-05	0.2599d+04
0.3900d-03	0.5000d-05	0.2599d+04
0.3900d-03	0.1000d-04	0.2586d+04
0.3900d-03	0.2000d-04	0.2559d+04
0.3900d-03	0.3000d-04	0.2531d+04
0.3900d-03	0.4000d-04	0.2502d+04
0.3900d-03	0.5000d-04	0.2473d+04
0.3900d-03	0.6000d-04	0.2443d+04
0.3900d-03	0.7000d-04	0.2413d+04
0.3900d-03	0.8000d-04	0.2382d+04
0.3900d-03	0.9000d-04	0.2351d+04
0.3900d-03	0.1000d-03	0.2320d+04
0.3900d-03	0.1100d-03	0.2289d+04
0.3900d-03	0.1200d-03	0.2258d+04
0.3900d-03	0.1300d-03	0.2227d+04
0.3900d-03	0.1400d-03	0.2196d+04
0.3900d-03	0.1500d-03	0.2165d+04
0.3900d-03	0.1600d-03	0.2135d+04
0.3900d-03	0.1700d-03	0.2105d+04
0.3900d-03	0.1800d-03	0.2075d+04
0.3900d-03	0.1900d-03	0.2046d+04
0.3900d-03	0.2000d-03	0.2017d+04
0.3900d-03	0.2100d-03	0.1988d+04
0.3900d-03	0.2200d-03	0.1960d+04
0.3900d-03	0.2300d-03	0.1932d+04
0.3900d-03	0.2400d-03	0.1905d+04
0.3900d-03	0.2500d-03	0.1878d+04
0.3900d-03	0.2600d-03	0.1851d+04
0.3900d-03	0.2700d-03	0.1825d+04
0.3900d-03	0.2800d-03	0.1799d+04
0.3900d-03	0.2900d-03	0.1774d+04
0.3900d-03	0.3000d-03	0.1749d+04
0.3900d-03	0.3100d-03	0.1725d+04
0.3900d-03	0.3200d-03	0.1701d+04
0.3900d-03	0.3300d-03	0.1678d+04
0.3900d-03	0.3400d-03	0.1655d+04
0.3900d-03	0.3500d-03	0.1632d+04
0.3900d-03	0.3600d-03	0.1610d+04
0.3900d-03	0.3700d-03	0.1588d+04
0.3900d-03	0.3800d-03	0.1567d+04
0.3900d-03	0.3900d-03	0.1546d+04
0.3900d-03	0.4000d-03	0.1526d+04
0.3900d-03	0.4100d-03	0.1506d+04
0.3900d-03	0.4200d-03	0.1486d+04
0.3900d-03	0.4300d-03	0.1467d+04
0.3900d-03	0.4400d-03	0.1448d+04

0.4000d-03	0.0000d+00	0.2534d+04
0.4000d-03	0.2000d-06	0.2534d+04
0.4000d-03	0.4000d-06	0.2533d+04
0.4000d-03	0.6000d-06	0.2533d+04
0.4000d-03	0.8000d-06	0.2533d+04
0.4000d-03	0.1000d-05	0.2532d+04
0.4000d-03	0.1200d-05	0.2532d+04
0.4000d-03	0.1400d-05	0.2531d+04
0.4000d-03	0.1600d-05	0.2531d+04
0.4000d-03	0.1800d-05	0.2530d+04
0.4000d-03	0.2000d-05	0.2530d+04
0.4000d-03	0.2200d-05	0.2529d+04
0.4000d-03	0.2400d-05	0.2529d+04
0.4000d-03	0.2600d-05	0.2528d+04
0.4000d-03	0.2800d-05	0.2528d+04
0.4000d-03	0.3000d-05	0.2528d+04
0.4000d-03	0.3200d-05	0.2527d+04
0.4000d-03	0.3400d-05	0.2527d+04
0.4000d-03	0.3600d-05	0.2526d+04
0.4000d-03	0.3800d-05	0.2526d+04
0.4000d-03	0.4000d-05	0.2525d+04
0.4000d-03	0.4200d-05	0.2525d+04
0.4000d-03	0.4400d-05	0.2524d+04
0.4000d-03	0.4600d-05	0.2524d+04
0.4000d-03	0.4800d-05	0.2523d+04
0.4000d-03	0.5000d-05	0.2523d+04
0.4000d-03	0.1000d-04	0.2512d+04
0.4000d-03	0.2000d-04	0.2488d+04
0.4000d-03	0.3000d-04	0.2463d+04
0.4000d-03	0.4000d-04	0.2437d+04
0.4000d-03	0.5000d-04	0.2410d+04
0.4000d-03	0.6000d-04	0.2382d+04
0.4000d-03	0.7000d-04	0.2354d+04
0.4000d-03	0.8000d-04	0.2326d+04
0.4000d-03	0.9000d-04	0.2297d+04
0.4000d-03	0.1000d-03	0.2269d+04
0.4000d-03	0.1100d-03	0.2240d+04
0.4000d-03	0.1200d-03	0.2211d+04
0.4000d-03	0.1300d-03	0.2182d+04
0.4000d-03	0.1400d-03	0.2153d+04
0.4000d-03	0.1500d-03	0.2124d+04
0.4000d-03	0.1600d-03	0.2095d+04
0.4000d-03	0.1700d-03	0.2067d+04
0.4000d-03	0.1800d-03	0.2039d+04
0.4000d-03	0.1900d-03	0.2011d+04
0.4000d-03	0.2000d-03	0.1983d+04
0.4000d-03	0.2100d-03	0.1956d+04
0.4000d-03	0.2200d-03	0.1929d+04
0.4000d-03	0.2300d-03	0.1902d+04
0.4000d-03	0.2400d-03	0.1876d+04
0.4000d-03	0.2500d-03	0.1850d+04
0.4000d-03	0.2600d-03	0.1825d+04
0.4000d-03	0.2700d-03	0.1800d+04
0.4000d-03	0.2800d-03	0.1775d+04
0.4000d-03	0.2900d-03	0.1751d+04
0.4000d-03	0.3000d-03	0.1727d+04

0.4000d-03	0.3100d-03	0.1703d+04
0.4000d-03	0.3200d-03	0.1680d+04
0.4000d-03	0.3300d-03	0.1658d+04
0.4000d-03	0.3400d-03	0.1635d+04
0.4000d-03	0.3500d-03	0.1614d+04
0.4000d-03	0.3600d-03	0.1592d+04
0.4000d-03	0.3700d-03	0.1571d+04
0.4000d-03	0.3800d-03	0.1551d+04
0.4000d-03	0.3900d-03	0.1530d+04
0.4000d-03	0.4000d-03	0.1510d+04
0.4000d-03	0.4100d-03	0.1491d+04
0.4000d-03	0.4200d-03	0.1472d+04
0.4000d-03	0.4300d-03	0.1453d+04
0.4000d-03	0.4400d-03	0.1435d+04
0.4100d-03	0.0000d+00	0.2461d+04
0.4100d-03	0.2000d-06	0.2460d+04
0.4100d-03	0.4000d-06	0.2460d+04
0.4100d-03	0.6000d-06	0.2460d+04
0.4100d-03	0.8000d-06	0.2459d+04
0.4100d-03	0.1000d-05	0.2459d+04
0.4100d-03	0.1200d-05	0.2458d+04
0.4100d-03	0.1400d-05	0.2458d+04
0.4100d-03	0.1600d-05	0.2458d+04
0.4100d-03	0.1800d-05	0.2457d+04
0.4100d-03	0.2000d-05	0.2457d+04
0.4100d-03	0.2200d-05	0.2456d+04
0.4100d-03	0.2400d-05	0.2456d+04
0.4100d-03	0.2600d-05	0.2456d+04
0.4100d-03	0.2800d-05	0.2455d+04
0.4100d-03	0.3000d-05	0.2455d+04
0.4100d-03	0.3200d-05	0.2454d+04
0.4100d-03	0.3400d-05	0.2454d+04
0.4100d-03	0.3600d-05	0.2454d+04
0.4100d-03	0.3800d-05	0.2453d+04
0.4100d-03	0.4000d-05	0.2453d+04
0.4100d-03	0.4200d-05	0.2452d+04
0.4100d-03	0.4400d-05	0.2452d+04
0.4100d-03	0.4600d-05	0.2452d+04
0.4100d-03	0.4800d-05	0.2451d+04
0.4100d-03	0.5000d-05	0.2451d+04
0.4100d-03	0.1000d-04	0.2441d+04
0.4100d-03	0.2000d-04	0.2420d+04
0.4100d-03	0.3000d-04	0.2397d+04
0.4100d-03	0.4000d-04	0.2373d+04
0.4100d-03	0.5000d-04	0.2349d+04
0.4100d-03	0.6000d-04	0.2324d+04
0.4100d-03	0.7000d-04	0.2298d+04
0.4100d-03	0.8000d-04	0.2272d+04
0.4100d-03	0.9000d-04	0.2246d+04
0.4100d-03	0.1000d-03	0.2219d+04
0.4100d-03	0.1100d-03	0.2192d+04
0.4100d-03	0.1200d-03	0.2165d+04
0.4100d-03	0.1300d-03	0.2137d+04
0.4100d-03	0.1400d-03	0.2110d+04
0.4100d-03	0.1500d-03	0.2083d+04
0.4100d-03	0.1600d-03	0.2056d+04

0.4100d-03	0.1700d-03	0.2029d+04
0.4100d-03	0.1800d-03	0.2003d+04
0.4100d-03	0.1900d-03	0.1976d+04
0.4100d-03	0.2000d-03	0.1950d+04
0.4100d-03	0.2100d-03	0.1924d+04
0.4100d-03	0.2200d-03	0.1898d+04
0.4100d-03	0.2300d-03	0.1873d+04
0.4100d-03	0.2400d-03	0.1848d+04
0.4100d-03	0.2500d-03	0.1823d+04
0.4100d-03	0.2600d-03	0.1799d+04
0.4100d-03	0.2700d-03	0.1775d+04
0.4100d-03	0.2800d-03	0.1751d+04
0.4100d-03	0.2900d-03	0.1728d+04
0.4100d-03	0.3000d-03	0.1705d+04
0.4100d-03	0.3100d-03	0.1682d+04
0.4100d-03	0.3200d-03	0.1660d+04
0.4100d-03	0.3300d-03	0.1638d+04
0.4100d-03	0.3400d-03	0.1616d+04
0.4100d-03	0.3500d-03	0.1595d+04
0.4100d-03	0.3600d-03	0.1575d+04
0.4100d-03	0.3700d-03	0.1554d+04
0.4100d-03	0.3800d-03	0.1534d+04
0.4100d-03	0.3900d-03	0.1514d+04
0.4100d-03	0.4000d-03	0.1495d+04
0.4100d-03	0.4100d-03	0.1476d+04
0.4100d-03	0.4200d-03	0.1458d+04
0.4100d-03	0.4300d-03	0.1439d+04
0.4100d-03	0.4400d-03	0.1421d+04
0.4200d-03	0.0000d+00	0.2390d+04
0.4200d-03	0.2000d-06	0.2390d+04
0.4200d-03	0.4000d-06	0.2390d+04
0.4200d-03	0.6000d-06	0.2389d+04
0.4200d-03	0.8000d-06	0.2389d+04
0.4200d-03	0.1000d-05	0.2389d+04
0.4200d-03	0.1200d-05	0.2388d+04
0.4200d-03	0.1400d-05	0.2388d+04
0.4200d-03	0.1600d-05	0.2388d+04
0.4200d-03	0.1800d-05	0.2387d+04
0.4200d-03	0.2000d-05	0.2387d+04
0.4200d-03	0.2200d-05	0.2387d+04
0.4200d-03	0.2400d-05	0.2386d+04
0.4200d-03	0.2600d-05	0.2386d+04
0.4200d-03	0.2800d-05	0.2386d+04
0.4200d-03	0.3000d-05	0.2385d+04
0.4200d-03	0.3200d-05	0.2385d+04
0.4200d-03	0.3400d-05	0.2384d+04
0.4200d-03	0.3600d-05	0.2384d+04
0.4200d-03	0.3800d-05	0.2384d+04
0.4200d-03	0.4000d-05	0.2383d+04
0.4200d-03	0.4200d-05	0.2383d+04
0.4200d-03	0.4400d-05	0.2383d+04
0.4200d-03	0.4600d-05	0.2382d+04
0.4200d-03	0.4800d-05	0.2382d+04
0.4200d-03	0.5000d-05	0.2382d+04
0.4200d-03	0.1000d-04	0.2373d+04
0.4200d-03	0.2000d-04	0.2354d+04

0.4200d-03	0.3000d-04	0.2334d+04
0.4200d-03	0.4000d-04	0.2312d+04
0.4200d-03	0.5000d-04	0.2290d+04
0.4200d-03	0.6000d-04	0.2267d+04
0.4200d-03	0.7000d-04	0.2244d+04
0.4200d-03	0.8000d-04	0.2220d+04
0.4200d-03	0.9000d-04	0.2195d+04
0.4200d-03	0.1000d-03	0.2170d+04
0.4200d-03	0.1100d-03	0.2145d+04
0.4200d-03	0.1200d-03	0.2120d+04
0.4200d-03	0.1300d-03	0.2094d+04
0.4200d-03	0.1400d-03	0.2069d+04
0.4200d-03	0.1500d-03	0.2043d+04
0.4200d-03	0.1600d-03	0.2018d+04
0.4200d-03	0.1700d-03	0.1993d+04
0.4200d-03	0.1800d-03	0.1967d+04
0.4200d-03	0.1900d-03	0.1942d+04
0.4200d-03	0.2000d-03	0.1917d+04
0.4200d-03	0.2100d-03	0.1892d+04
0.4200d-03	0.2200d-03	0.1868d+04
0.4200d-03	0.2300d-03	0.1844d+04
0.4200d-03	0.2400d-03	0.1820d+04
0.4200d-03	0.2500d-03	0.1796d+04
0.4200d-03	0.2600d-03	0.1773d+04
0.4200d-03	0.2700d-03	0.1750d+04
0.4200d-03	0.2800d-03	0.1727d+04
0.4200d-03	0.2900d-03	0.1705d+04
0.4200d-03	0.3000d-03	0.1682d+04
0.4200d-03	0.3100d-03	0.1661d+04
0.4200d-03	0.3200d-03	0.1639d+04
0.4200d-03	0.3300d-03	0.1618d+04
0.4200d-03	0.3400d-03	0.1597d+04
0.4200d-03	0.3500d-03	0.1577d+04
0.4200d-03	0.3600d-03	0.1557d+04
0.4200d-03	0.3700d-03	0.1537d+04
0.4200d-03	0.3800d-03	0.1518d+04
0.4200d-03	0.3900d-03	0.1499d+04
0.4200d-03	0.4000d-03	0.1480d+04
0.4200d-03	0.4100d-03	0.1462d+04
0.4200d-03	0.4200d-03	0.1443d+04
0.4200d-03	0.4300d-03	0.1426d+04
0.4200d-03	0.4400d-03	0.1408d+04
0.4300d-03	0.0000d+00	0.2323d+04
0.4300d-03	0.2000d-06	0.2323d+04
0.4300d-03	0.4000d-06	0.2323d+04
0.4300d-03	0.6000d-06	0.2322d+04
0.4300d-03	0.8000d-06	0.2322d+04
0.4300d-03	0.1000d-05	0.2322d+04
0.4300d-03	0.1200d-05	0.2322d+04
0.4300d-03	0.1400d-05	0.2321d+04
0.4300d-03	0.1600d-05	0.2321d+04
0.4300d-03	0.1800d-05	0.2321d+04
0.4300d-03	0.2000d-05	0.2320d+04
0.4300d-03	0.2200d-05	0.2320d+04
0.4300d-03	0.2400d-05	0.2320d+04
0.4300d-03	0.2600d-05	0.2319d+04

0.4300d-03	0.2800d-05	0.2319d+04
0.4300d-03	0.3000d-05	0.2319d+04
0.4300d-03	0.3200d-05	0.2318d+04
0.4300d-03	0.3400d-05	0.2318d+04
0.4300d-03	0.3600d-05	0.2318d+04
0.4300d-03	0.3800d-05	0.2318d+04
0.4300d-03	0.4000d-05	0.2317d+04
0.4300d-03	0.4200d-05	0.2317d+04
0.4300d-03	0.4400d-05	0.2317d+04
0.4300d-03	0.4600d-05	0.2316d+04
0.4300d-03	0.4800d-05	0.2316d+04
0.4300d-03	0.5000d-05	0.2316d+04
0.4300d-03	0.1000d-04	0.2308d+04
0.4300d-03	0.2000d-04	0.2291d+04
0.4300d-03	0.3000d-04	0.2273d+04
0.4300d-03	0.4000d-04	0.2254d+04
0.4300d-03	0.5000d-04	0.2234d+04
0.4300d-03	0.6000d-04	0.2213d+04
0.4300d-03	0.7000d-04	0.2191d+04
0.4300d-03	0.8000d-04	0.2169d+04
0.4300d-03	0.9000d-04	0.2146d+04
0.4300d-03	0.1000d-03	0.2123d+04
0.4300d-03	0.1100d-03	0.2100d+04
0.4300d-03	0.1200d-03	0.2076d+04
0.4300d-03	0.1300d-03	0.2052d+04
0.4300d-03	0.1400d-03	0.2028d+04
0.4300d-03	0.1500d-03	0.2004d+04
0.4300d-03	0.1600d-03	0.1980d+04
0.4300d-03	0.1700d-03	0.1957d+04
0.4300d-03	0.1800d-03	0.1933d+04
0.4300d-03	0.1900d-03	0.1909d+04
0.4300d-03	0.2000d-03	0.1885d+04
0.4300d-03	0.2100d-03	0.1862d+04
0.4300d-03	0.2200d-03	0.1838d+04
0.4300d-03	0.2300d-03	0.1815d+04
0.4300d-03	0.2400d-03	0.1792d+04
0.4300d-03	0.2500d-03	0.1770d+04
0.4300d-03	0.2600d-03	0.1747d+04
0.4300d-03	0.2700d-03	0.1725d+04
0.4300d-03	0.2800d-03	0.1703d+04
0.4300d-03	0.2900d-03	0.1682d+04
0.4300d-03	0.3000d-03	0.1661d+04
0.4300d-03	0.3100d-03	0.1640d+04
0.4300d-03	0.3200d-03	0.1619d+04
0.4300d-03	0.3300d-03	0.1599d+04
0.4300d-03	0.3400d-03	0.1578d+04
0.4300d-03	0.3500d-03	0.1559d+04
0.4300d-03	0.3600d-03	0.1539d+04
0.4300d-03	0.3700d-03	0.1520d+04
0.4300d-03	0.3800d-03	0.1501d+04
0.4300d-03	0.3900d-03	0.1483d+04
0.4300d-03	0.4000d-03	0.1465d+04
0.4300d-03	0.4100d-03	0.1447d+04
0.4300d-03	0.4200d-03	0.1429d+04
0.4300d-03	0.4300d-03	0.1412d+04
0.4300d-03	0.4400d-03	0.1395d+04

0.4400d-03	0.0000d+00	0.2259d+04
0.4400d-03	0.2000d-06	0.2259d+04
0.4400d-03	0.4000d-06	0.2259d+04
0.4400d-03	0.6000d-06	0.2259d+04
0.4400d-03	0.8000d-06	0.2258d+04
0.4400d-03	0.1000d-05	0.2258d+04
0.4400d-03	0.1200d-05	0.2258d+04
0.4400d-03	0.1400d-05	0.2257d+04
0.4400d-03	0.1600d-05	0.2257d+04
0.4400d-03	0.1800d-05	0.2257d+04
0.4400d-03	0.2000d-05	0.2257d+04
0.4400d-03	0.2200d-05	0.2256d+04
0.4400d-03	0.2400d-05	0.2256d+04
0.4400d-03	0.2600d-05	0.2256d+04
0.4400d-03	0.2800d-05	0.2256d+04
0.4400d-03	0.3000d-05	0.2255d+04
0.4400d-03	0.3200d-05	0.2255d+04
0.4400d-03	0.3400d-05	0.2255d+04
0.4400d-03	0.3600d-05	0.2255d+04
0.4400d-03	0.3800d-05	0.2254d+04
0.4400d-03	0.4000d-05	0.2254d+04
0.4400d-03	0.4200d-05	0.2254d+04
0.4400d-03	0.4400d-05	0.2253d+04
0.4400d-03	0.4600d-05	0.2253d+04
0.4400d-03	0.4800d-05	0.2253d+04
0.4400d-03	0.5000d-05	0.2253d+04
0.4400d-03	0.1000d-04	0.2246d+04
0.4400d-03	0.2000d-04	0.2231d+04
0.4400d-03	0.3000d-04	0.2215d+04
0.4400d-03	0.4000d-04	0.2197d+04
0.4400d-03	0.5000d-04	0.2179d+04
0.4400d-03	0.6000d-04	0.2160d+04
0.4400d-03	0.7000d-04	0.2140d+04
0.4400d-03	0.8000d-04	0.2120d+04
0.4400d-03	0.9000d-04	0.2099d+04
0.4400d-03	0.1000d-03	0.2077d+04
0.4400d-03	0.1100d-03	0.2056d+04
0.4400d-03	0.1200d-03	0.2034d+04
0.4400d-03	0.1300d-03	0.2011d+04
0.4400d-03	0.1400d-03	0.1989d+04
0.4400d-03	0.1500d-03	0.1966d+04
0.4400d-03	0.1600d-03	0.1944d+04
0.4400d-03	0.1700d-03	0.1921d+04
0.4400d-03	0.1800d-03	0.1899d+04
0.4400d-03	0.1900d-03	0.1876d+04
0.4400d-03	0.2000d-03	0.1854d+04
0.4400d-03	0.2100d-03	0.1831d+04
0.4400d-03	0.2200d-03	0.1809d+04
0.4400d-03	0.2300d-03	0.1787d+04
0.4400d-03	0.2400d-03	0.1765d+04
0.4400d-03	0.2500d-03	0.1744d+04
0.4400d-03	0.2600d-03	0.1722d+04
0.4400d-03	0.2700d-03	0.1701d+04
0.4400d-03	0.2800d-03	0.1680d+04
0.4400d-03	0.2900d-03	0.1659d+04
0.4400d-03	0.3000d-03	0.1639d+04

0.4400d-03	0.3100d-03	0.1619d+04
0.4400d-03	0.3200d-03	0.1599d+04
0.4400d-03	0.3300d-03	0.1579d+04
0.4400d-03	0.3400d-03	0.1560d+04
0.4400d-03	0.3500d-03	0.1541d+04
0.4400d-03	0.3600d-03	0.1522d+04
0.4400d-03	0.3700d-03	0.1503d+04
0.4400d-03	0.3800d-03	0.1485d+04
0.4400d-03	0.3900d-03	0.1467d+04
0.4400d-03	0.4000d-03	0.1450d+04
0.4400d-03	0.4100d-03	0.1432d+04
0.4400d-03	0.4200d-03	0.1415d+04
0.4400d-03	0.4300d-03	0.1398d+04
0.4400d-03	0.4400d-03	0.1382d+04
0.4500d-03	0.0000d+00	0.2198d+04
0.4500d-03	0.2000d-06	0.2198d+04
0.4500d-03	0.4000d-06	0.2198d+04
0.4500d-03	0.6000d-06	0.2198d+04
0.4500d-03	0.8000d-06	0.2197d+04
0.4500d-03	0.1000d-05	0.2197d+04
0.4500d-03	0.1200d-05	0.2197d+04
0.4500d-03	0.1400d-05	0.2197d+04
0.4500d-03	0.1600d-05	0.2196d+04
0.4500d-03	0.1800d-05	0.2196d+04
0.4500d-03	0.2000d-05	0.2196d+04
0.4500d-03	0.2200d-05	0.2196d+04
0.4500d-03	0.2400d-05	0.2196d+04
0.4500d-03	0.2600d-05	0.2195d+04
0.4500d-03	0.2800d-05	0.2195d+04
0.4500d-03	0.3000d-05	0.2195d+04
0.4500d-03	0.3200d-05	0.2195d+04
0.4500d-03	0.3400d-05	0.2194d+04
0.4500d-03	0.3600d-05	0.2194d+04
0.4500d-03	0.3800d-05	0.2194d+04
0.4500d-03	0.4000d-05	0.2194d+04
0.4500d-03	0.4200d-05	0.2193d+04
0.4500d-03	0.4400d-05	0.2193d+04
0.4500d-03	0.4600d-05	0.2193d+04
0.4500d-03	0.4800d-05	0.2193d+04
0.4500d-03	0.5000d-05	0.2193d+04
0.4500d-03	0.1000d-04	0.2187d+04
0.4500d-03	0.2000d-04	0.2173d+04
0.4500d-03	0.3000d-04	0.2159d+04
0.4500d-03	0.4000d-04	0.2143d+04
0.4500d-03	0.5000d-04	0.2127d+04
0.4500d-03	0.6000d-04	0.2109d+04
0.4500d-03	0.7000d-04	0.2091d+04
0.4500d-03	0.8000d-04	0.2072d+04
0.4500d-03	0.9000d-04	0.2053d+04
0.4500d-03	0.1000d-03	0.2033d+04
0.4500d-03	0.1100d-03	0.2013d+04
0.4500d-03	0.1200d-03	0.1992d+04
0.4500d-03	0.1300d-03	0.1972d+04
0.4500d-03	0.1400d-03	0.1951d+04
0.4500d-03	0.1500d-03	0.1929d+04
0.4500d-03	0.1600d-03	0.1908d+04

0.4500d-03	0.1700d-03	0.1887d+04
0.4500d-03	0.1800d-03	0.1865d+04
0.4500d-03	0.1900d-03	0.1844d+04
0.4500d-03	0.2000d-03	0.1823d+04
0.4500d-03	0.2100d-03	0.1801d+04
0.4500d-03	0.2200d-03	0.1780d+04
0.4500d-03	0.2300d-03	0.1759d+04
0.4500d-03	0.2400d-03	0.1738d+04
0.4500d-03	0.2500d-03	0.1718d+04
0.4500d-03	0.2600d-03	0.1697d+04
0.4500d-03	0.2700d-03	0.1677d+04
0.4500d-03	0.2800d-03	0.1657d+04
0.4500d-03	0.2900d-03	0.1637d+04
0.4500d-03	0.3000d-03	0.1617d+04
0.4500d-03	0.3100d-03	0.1598d+04
0.4500d-03	0.3200d-03	0.1579d+04
0.4500d-03	0.3300d-03	0.1560d+04
0.4500d-03	0.3400d-03	0.1541d+04
0.4500d-03	0.3500d-03	0.1523d+04
0.4500d-03	0.3600d-03	0.1504d+04
0.4500d-03	0.3700d-03	0.1487d+04
0.4500d-03	0.3800d-03	0.1469d+04
0.4500d-03	0.3900d-03	0.1452d+04
0.4500d-03	0.4000d-03	0.1434d+04
0.4500d-03	0.4100d-03	0.1418d+04
0.4500d-03	0.4200d-03	0.1401d+04
0.4500d-03	0.4300d-03	0.1385d+04
0.4500d-03	0.4400d-03	0.1369d+04
0.4600d-03	0.0000d+00	0.2140d+04
0.4600d-03	0.2000d-06	0.2140d+04
0.4600d-03	0.4000d-06	0.2140d+04
0.4600d-03	0.6000d-06	0.2140d+04
0.4600d-03	0.8000d-06	0.2139d+04
0.4600d-03	0.1000d-05	0.2139d+04
0.4600d-03	0.1200d-05	0.2139d+04
0.4600d-03	0.1400d-05	0.2139d+04
0.4600d-03	0.1600d-05	0.2139d+04
0.4600d-03	0.1800d-05	0.2138d+04
0.4600d-03	0.2000d-05	0.2138d+04
0.4600d-03	0.2200d-05	0.2138d+04
0.4600d-03	0.2400d-05	0.2138d+04
0.4600d-03	0.2600d-05	0.2138d+04
0.4600d-03	0.2800d-05	0.2137d+04
0.4600d-03	0.3000d-05	0.2137d+04
0.4600d-03	0.3200d-05	0.2137d+04
0.4600d-03	0.3400d-05	0.2137d+04
0.4600d-03	0.3600d-05	0.2136d+04
0.4600d-03	0.3800d-05	0.2136d+04
0.4600d-03	0.4000d-05	0.2136d+04
0.4600d-03	0.4200d-05	0.2136d+04
0.4600d-03	0.4400d-05	0.2136d+04
0.4600d-03	0.4600d-05	0.2136d+04
0.4600d-03	0.4800d-05	0.2136d+04
0.4600d-03	0.5000d-05	0.2135d+04
0.4600d-03	0.1000d-04	0.2130d+04
0.4600d-03	0.2000d-04	0.2118d+04

0.4600d-03	0.3000d-04	0.2105d+04
0.4600d-03	0.4000d-04	0.2091d+04
0.4600d-03	0.5000d-04	0.2076d+04
0.4600d-03	0.6000d-04	0.2060d+04
0.4600d-03	0.7000d-04	0.2044d+04
0.4600d-03	0.8000d-04	0.2026d+04
0.4600d-03	0.9000d-04	0.2009d+04
0.4600d-03	0.1000d-03	0.1990d+04
0.4600d-03	0.1100d-03	0.1971d+04
0.4600d-03	0.1200d-03	0.1952d+04
0.4600d-03	0.1300d-03	0.1933d+04
0.4600d-03	0.1400d-03	0.1913d+04
0.4600d-03	0.1500d-03	0.1893d+04
0.4600d-03	0.1600d-03	0.1873d+04
0.4600d-03	0.1700d-03	0.1853d+04
0.4600d-03	0.1800d-03	0.1833d+04
0.4600d-03	0.1900d-03	0.1813d+04
0.4600d-03	0.2000d-03	0.1792d+04
0.4600d-03	0.2100d-03	0.1772d+04
0.4600d-03	0.2200d-03	0.1752d+04
0.4600d-03	0.2300d-03	0.1732d+04
0.4600d-03	0.2400d-03	0.1712d+04
0.4600d-03	0.2500d-03	0.1692d+04
0.4600d-03	0.2600d-03	0.1673d+04
0.4600d-03	0.2700d-03	0.1653d+04
0.4600d-03	0.2800d-03	0.1634d+04
0.4600d-03	0.2900d-03	0.1615d+04
0.4600d-03	0.3000d-03	0.1596d+04
0.4600d-03	0.3100d-03	0.1577d+04
0.4600d-03	0.3200d-03	0.1559d+04
0.4600d-03	0.3300d-03	0.1541d+04
0.4600d-03	0.3400d-03	0.1523d+04
0.4600d-03	0.3500d-03	0.1505d+04
0.4600d-03	0.3600d-03	0.1487d+04
0.4600d-03	0.3700d-03	0.1470d+04
0.4600d-03	0.3800d-03	0.1453d+04
0.4600d-03	0.3900d-03	0.1436d+04
0.4600d-03	0.4000d-03	0.1419d+04
0.4600d-03	0.4100d-03	0.1403d+04
0.4600d-03	0.4200d-03	0.1387d+04
0.4600d-03	0.4300d-03	0.1371d+04
0.4600d-03	0.4400d-03	0.1349d+04
0.4700d-03	0.0000d+00	0.2085d+04
0.4700d-03	0.2000d-06	0.2084d+04
0.4700d-03	0.4000d-06	0.2084d+04
0.4700d-03	0.6000d-06	0.2084d+04
0.4700d-03	0.8000d-06	0.2084d+04
0.4700d-03	0.1000d-05	0.2084d+04
0.4700d-03	0.1200d-05	0.2084d+04
0.4700d-03	0.1400d-05	0.2083d+04
0.4700d-03	0.1600d-05	0.2083d+04
0.4700d-03	0.1800d-05	0.2083d+04
0.4700d-03	0.2000d-05	0.2083d+04
0.4700d-03	0.2200d-05	0.2083d+04
0.4700d-03	0.2400d-05	0.2083d+04
0.4700d-03	0.2600d-05	0.2082d+04

0.4700d-03	0.2800d-05	0.2082d+04
0.4700d-03	0.3000d-05	0.2082d+04
0.4700d-03	0.3200d-05	0.2082d+04
0.4700d-03	0.3400d-05	0.2082d+04
0.4700d-03	0.3600d-05	0.2082d+04
0.4700d-03	0.3800d-05	0.2082d+04
0.4700d-03	0.4000d-05	0.2081d+04
0.4700d-03	0.4200d-05	0.2081d+04
0.4700d-03	0.4400d-05	0.2081d+04
0.4700d-03	0.4600d-05	0.2081d+04
0.4700d-03	0.4800d-05	0.2081d+04
0.4700d-03	0.5000d-05	0.2081d+04
0.4700d-03	0.1000d-04	0.2076d+04
0.4700d-03	0.2000d-04	0.2066d+04
0.4700d-03	0.3000d-04	0.2054d+04
0.4700d-03	0.4000d-04	0.2041d+04
0.4700d-03	0.5000d-04	0.2028d+04
0.4700d-03	0.6000d-04	0.2013d+04
0.4700d-03	0.7000d-04	0.1998d+04
0.4700d-03	0.8000d-04	0.1982d+04
0.4700d-03	0.9000d-04	0.1966d+04
0.4700d-03	0.1000d-03	0.1949d+04
0.4700d-03	0.1100d-03	0.1931d+04
0.4700d-03	0.1200d-03	0.1913d+04
0.4700d-03	0.1300d-03	0.1895d+04
0.4700d-03	0.1400d-03	0.1877d+04
0.4700d-03	0.1500d-03	0.1858d+04
0.4700d-03	0.1600d-03	0.1839d+04
0.4700d-03	0.1700d-03	0.1820d+04
0.4700d-03	0.1800d-03	0.1801d+04
0.4700d-03	0.1900d-03	0.1782d+04
0.4700d-03	0.2000d-03	0.1763d+04
0.4700d-03	0.2100d-03	0.1743d+04
0.4700d-03	0.2200d-03	0.1724d+04
0.4700d-03	0.2300d-03	0.1705d+04
0.4700d-03	0.2400d-03	0.1686d+04
0.4700d-03	0.2500d-03	0.1667d+04
0.4700d-03	0.2600d-03	0.1649d+04
0.4700d-03	0.2700d-03	0.1630d+04
0.4700d-03	0.2800d-03	0.1612d+04
0.4700d-03	0.2900d-03	0.1593d+04
0.4700d-03	0.3000d-03	0.1575d+04
0.4700d-03	0.3100d-03	0.1557d+04
0.4700d-03	0.3200d-03	0.1539d+04
0.4700d-03	0.3300d-03	0.1522d+04
0.4700d-03	0.3400d-03	0.1504d+04
0.4700d-03	0.3500d-03	0.1487d+04
0.4700d-03	0.3600d-03	0.1470d+04
0.4700d-03	0.3700d-03	0.1453d+04
0.4700d-03	0.3800d-03	0.1437d+04
0.4700d-03	0.3900d-03	0.1421d+04
0.4700d-03	0.4000d-03	0.1405d+04
0.4700d-03	0.4100d-03	0.1389d+04
0.4700d-03	0.4200d-03	0.1373d+04
0.4700d-03	0.4300d-03	0.1358d+04
0.4700d-03	0.4400d-03	0.1336d+04

0.4800d-03	0.0000d+00	0.2032d+04
0.4800d-03	0.2000d-06	0.2032d+04
0.4800d-03	0.4000d-06	0.2032d+04
0.4800d-03	0.6000d-06	0.2031d+04
0.4800d-03	0.8000d-06	0.2031d+04
0.4800d-03	0.1000d-05	0.2031d+04
0.4800d-03	0.1200d-05	0.2031d+04
0.4800d-03	0.1400d-05	0.2031d+04
0.4800d-03	0.1600d-05	0.2031d+04
0.4800d-03	0.1800d-05	0.2030d+04
0.4800d-03	0.2000d-05	0.2030d+04
0.4800d-03	0.2200d-05	0.2030d+04
0.4800d-03	0.2400d-05	0.2030d+04
0.4800d-03	0.2600d-05	0.2030d+04
0.4800d-03	0.2800d-05	0.2030d+04
0.4800d-03	0.3000d-05	0.2030d+04
0.4800d-03	0.3200d-05	0.2029d+04
0.4800d-03	0.3400d-05	0.2029d+04
0.4800d-03	0.3600d-05	0.2029d+04
0.4800d-03	0.3800d-05	0.2029d+04
0.4800d-03	0.4000d-05	0.2029d+04
0.4800d-03	0.4200d-05	0.2029d+04
0.4800d-03	0.4400d-05	0.2029d+04
0.4800d-03	0.4600d-05	0.2029d+04
0.4800d-03	0.4800d-05	0.2028d+04
0.4800d-03	0.5000d-05	0.2028d+04
0.4800d-03	0.1000d-04	0.2024d+04
0.4800d-03	0.2000d-04	0.2015d+04
0.4800d-03	0.3000d-04	0.2005d+04
0.4800d-03	0.4000d-04	0.1993d+04
0.4800d-03	0.5000d-04	0.1981d+04
0.4800d-03	0.6000d-04	0.1968d+04
0.4800d-03	0.7000d-04	0.1954d+04
0.4800d-03	0.8000d-04	0.1939d+04
0.4800d-03	0.9000d-04	0.1924d+04
0.4800d-03	0.1000d-03	0.1908d+04
0.4800d-03	0.1100d-03	0.1892d+04
0.4800d-03	0.1200d-03	0.1876d+04
0.4800d-03	0.1300d-03	0.1858d+04
0.4800d-03	0.1400d-03	0.1841d+04
0.4800d-03	0.1500d-03	0.1824d+04
0.4800d-03	0.1600d-03	0.1806d+04
0.4800d-03	0.1700d-03	0.1788d+04
0.4800d-03	0.1800d-03	0.1770d+04
0.4800d-03	0.1900d-03	0.1752d+04
0.4800d-03	0.2000d-03	0.1734d+04
0.4800d-03	0.2100d-03	0.1715d+04
0.4800d-03	0.2200d-03	0.1697d+04
0.4800d-03	0.2300d-03	0.1679d+04
0.4800d-03	0.2400d-03	0.1661d+04
0.4800d-03	0.2500d-03	0.1643d+04
0.4800d-03	0.2600d-03	0.1625d+04
0.4800d-03	0.2700d-03	0.1607d+04
0.4800d-03	0.2800d-03	0.1589d+04
0.4800d-03	0.2900d-03	0.1572d+04
0.4800d-03	0.3000d-03	0.1554d+04

0.4800d-03	0.3100d-03	0.1537d+04
0.4800d-03	0.3200d-03	0.1520d+04
0.4800d-03	0.3300d-03	0.1503d+04
0.4800d-03	0.3400d-03	0.1486d+04
0.4800d-03	0.3500d-03	0.1470d+04
0.4800d-03	0.3600d-03	0.1453d+04
0.4800d-03	0.3700d-03	0.1437d+04
0.4800d-03	0.3800d-03	0.1421d+04
0.4800d-03	0.3900d-03	0.1405d+04
0.4800d-03	0.4000d-03	0.1390d+04
0.4800d-03	0.4100d-03	0.1374d+04
0.4800d-03	0.4200d-03	0.1359d+04
0.4800d-03	0.4300d-03	0.1338d+04
0.4800d-03	0.4400d-03	0.1323d+04
0.4900d-03	0.0000d+00	0.1981d+04
0.4900d-03	0.2000d-06	0.1981d+04
0.4900d-03	0.4000d-06	0.1981d+04
0.4900d-03	0.6000d-06	0.1981d+04
0.4900d-03	0.8000d-06	0.1981d+04
0.4900d-03	0.1000d-05	0.1980d+04
0.4900d-03	0.1200d-05	0.1980d+04
0.4900d-03	0.1400d-05	0.1980d+04
0.4900d-03	0.1600d-05	0.1980d+04
0.4900d-03	0.1800d-05	0.1980d+04
0.4900d-03	0.2000d-05	0.1980d+04
0.4900d-03	0.2200d-05	0.1980d+04
0.4900d-03	0.2400d-05	0.1980d+04
0.4900d-03	0.2600d-05	0.1980d+04
0.4900d-03	0.2800d-05	0.1980d+04
0.4900d-03	0.3000d-05	0.1980d+04
0.4900d-03	0.3200d-05	0.1979d+04
0.4900d-03	0.3400d-05	0.1979d+04
0.4900d-03	0.3600d-05	0.1979d+04
0.4900d-03	0.3800d-05	0.1979d+04
0.4900d-03	0.4000d-05	0.1979d+04
0.4900d-03	0.4200d-05	0.1979d+04
0.4900d-03	0.4400d-05	0.1979d+04
0.4900d-03	0.4600d-05	0.1979d+04
0.4900d-03	0.4800d-05	0.1979d+04
0.4900d-03	0.5000d-05	0.1978d+04
0.4900d-03	0.1000d-04	0.1975d+04
0.4900d-03	0.2000d-04	0.1967d+04
0.4900d-03	0.3000d-04	0.1958d+04
0.4900d-03	0.4000d-04	0.1947d+04
0.4900d-03	0.5000d-04	0.1936d+04
0.4900d-03	0.6000d-04	0.1924d+04
0.4900d-03	0.7000d-04	0.1912d+04
0.4900d-03	0.8000d-04	0.1898d+04
0.4900d-03	0.9000d-04	0.1884d+04
0.4900d-03	0.1000d-03	0.1869d+04
0.4900d-03	0.1100d-03	0.1854d+04
0.4900d-03	0.1200d-03	0.1839d+04
0.4900d-03	0.1300d-03	0.1823d+04
0.4900d-03	0.1400d-03	0.1807d+04
0.4900d-03	0.1500d-03	0.1790d+04
0.4900d-03	0.1600d-03	0.1773d+04

0.4900d-03	0.1700d-03	0.1757d+04
0.4900d-03	0.1800d-03	0.1739d+04
0.4900d-03	0.1900d-03	0.1722d+04
0.4900d-03	0.2000d-03	0.1705d+04
0.4900d-03	0.2100d-03	0.1688d+04
0.4900d-03	0.2200d-03	0.1670d+04
0.4900d-03	0.2300d-03	0.1653d+04
0.4900d-03	0.2400d-03	0.1636d+04
0.4900d-03	0.2500d-03	0.1619d+04
0.4900d-03	0.2600d-03	0.1602d+04
0.4900d-03	0.2700d-03	0.1584d+04
0.4900d-03	0.2800d-03	0.1567d+04
0.4900d-03	0.2900d-03	0.1551d+04
0.4900d-03	0.3000d-03	0.1534d+04
0.4900d-03	0.3100d-03	0.1517d+04
0.4900d-03	0.3200d-03	0.1501d+04
0.4900d-03	0.3300d-03	0.1484d+04
0.4900d-03	0.3400d-03	0.1468d+04
0.4900d-03	0.3500d-03	0.1452d+04
0.4900d-03	0.3600d-03	0.1436d+04
0.4900d-03	0.3700d-03	0.1421d+04
0.4900d-03	0.3800d-03	0.1405d+04
0.4900d-03	0.3900d-03	0.1390d+04
0.4900d-03	0.4000d-03	0.1375d+04
0.4900d-03	0.4100d-03	0.1360d+04
0.4900d-03	0.4200d-03	0.1345d+04
0.4900d-03	0.4300d-03	0.1324d+04
0.4900d-03	0.4400d-03	0.1310d+04
0.5000d-03	0.0000d+00	0.1933d+04
0.5000d-03	0.2000d-06	0.1933d+04
0.5000d-03	0.4000d-06	0.1933d+04
0.5000d-03	0.6000d-06	0.1933d+04
0.5000d-03	0.8000d-06	0.1933d+04
0.5000d-03	0.1000d-05	0.1933d+04
0.5000d-03	0.1200d-05	0.1932d+04
0.5000d-03	0.1400d-05	0.1932d+04
0.5000d-03	0.1600d-05	0.1932d+04
0.5000d-03	0.1800d-05	0.1932d+04
0.5000d-03	0.2000d-05	0.1932d+04
0.5000d-03	0.2200d-05	0.1932d+04
0.5000d-03	0.2400d-05	0.1932d+04
0.5000d-03	0.2600d-05	0.1932d+04
0.5000d-03	0.2800d-05	0.1932d+04
0.5000d-03	0.3000d-05	0.1932d+04
0.5000d-03	0.3200d-05	0.1932d+04
0.5000d-03	0.3400d-05	0.1932d+04
0.5000d-03	0.3600d-05	0.1932d+04
0.5000d-03	0.3800d-05	0.1931d+04
0.5000d-03	0.4000d-05	0.1931d+04
0.5000d-03	0.4200d-05	0.1931d+04
0.5000d-03	0.4400d-05	0.1931d+04
0.5000d-03	0.4600d-05	0.1931d+04
0.5000d-03	0.4800d-05	0.1931d+04
0.5000d-03	0.5000d-05	0.1931d+04
0.5000d-03	0.1000d-04	0.1928d+04
0.5000d-03	0.2000d-04	0.1921d+04

0.5000d-03	0.3000d-04	0.1912d+04
0.5000d-03	0.4000d-04	0.1903d+04
0.5000d-03	0.5000d-04	0.1893d+04
0.5000d-03	0.6000d-04	0.1882d+04
0.5000d-03	0.7000d-04	0.1871d+04
0.5000d-03	0.8000d-04	0.1858d+04
0.5000d-03	0.9000d-04	0.1845d+04
0.5000d-03	0.1000d-03	0.1832d+04
0.5000d-03	0.1100d-03	0.1818d+04
0.5000d-03	0.1200d-03	0.1803d+04
0.5000d-03	0.1300d-03	0.1788d+04
0.5000d-03	0.1400d-03	0.1773d+04
0.5000d-03	0.1500d-03	0.1758d+04
0.5000d-03	0.1600d-03	0.1742d+04
0.5000d-03	0.1700d-03	0.1726d+04
0.5000d-03	0.1800d-03	0.1710d+04
0.5000d-03	0.1900d-03	0.1694d+04
0.5000d-03	0.2000d-03	0.1677d+04
0.5000d-03	0.2100d-03	0.1661d+04
0.5000d-03	0.2200d-03	0.1644d+04
0.5000d-03	0.2300d-03	0.1628d+04
0.5000d-03	0.2400d-03	0.1611d+04
0.5000d-03	0.2500d-03	0.1595d+04
0.5000d-03	0.2600d-03	0.1579d+04
0.5000d-03	0.2700d-03	0.1562d+04
0.5000d-03	0.2800d-03	0.1546d+04
0.5000d-03	0.2900d-03	0.1530d+04
0.5000d-03	0.3000d-03	0.1514d+04
0.5000d-03	0.3100d-03	0.1498d+04
0.5000d-03	0.3200d-03	0.1482d+04
0.5000d-03	0.3300d-03	0.1466d+04
0.5000d-03	0.3400d-03	0.1450d+04
0.5000d-03	0.3500d-03	0.1435d+04
0.5000d-03	0.3600d-03	0.1420d+04
0.5000d-03	0.3700d-03	0.1405d+04
0.5000d-03	0.3800d-03	0.1390d+04
0.5000d-03	0.3900d-03	0.1375d+04
0.5000d-03	0.4000d-03	0.1360d+04
0.5000d-03	0.4100d-03	0.1346d+04
0.5000d-03	0.4200d-03	0.1332d+04
0.5000d-03	0.4300d-03	0.1311d+04
0.5000d-03	0.4400d-03	0.1297d+04
0.5100d-03	0.0000d+00	0.1888d+04
0.5100d-03	0.2000d-06	0.1888d+04
0.5100d-03	0.4000d-06	0.1888d+04
0.5100d-03	0.6000d-06	0.1887d+04
0.5100d-03	0.8000d-06	0.1887d+04
0.5100d-03	0.1000d-05	0.1887d+04
0.5100d-03	0.1200d-05	0.1887d+04
0.5100d-03	0.1400d-05	0.1887d+04
0.5100d-03	0.1600d-05	0.1887d+04
0.5100d-03	0.1800d-05	0.1887d+04
0.5100d-03	0.2000d-05	0.1887d+04
0.5100d-03	0.2200d-05	0.1887d+04
0.5100d-03	0.2400d-05	0.1886d+04
0.5100d-03	0.2600d-05	0.1886d+04

0.5100d-03	0.2800d-05	0.1886d+04
0.5100d-03	0.3000d-05	0.1886d+04
0.5100d-03	0.3200d-05	0.1886d+04
0.5100d-03	0.3400d-05	0.1886d+04
0.5100d-03	0.3600d-05	0.1886d+04
0.5100d-03	0.3800d-05	0.1886d+04
0.5100d-03	0.4000d-05	0.1886d+04
0.5100d-03	0.4200d-05	0.1886d+04
0.5100d-03	0.4400d-05	0.1886d+04
0.5100d-03	0.4600d-05	0.1886d+04
0.5100d-03	0.4800d-05	0.1886d+04
0.5100d-03	0.5000d-05	0.1885d+04
0.5100d-03	0.1000d-04	0.1883d+04
0.5100d-03	0.2000d-04	0.1876d+04
0.5100d-03	0.3000d-04	0.1869d+04
0.5100d-03	0.4000d-04	0.1861d+04
0.5100d-03	0.5000d-04	0.1852d+04
0.5100d-03	0.6000d-04	0.1842d+04
0.5100d-03	0.7000d-04	0.1831d+04
0.5100d-03	0.8000d-04	0.1820d+04
0.5100d-03	0.9000d-04	0.1808d+04
0.5100d-03	0.1000d-03	0.1795d+04
0.5100d-03	0.1100d-03	0.1782d+04
0.5100d-03	0.1200d-03	0.1769d+04
0.5100d-03	0.1300d-03	0.1755d+04
0.5100d-03	0.1400d-03	0.1741d+04
0.5100d-03	0.1500d-03	0.1726d+04
0.5100d-03	0.1600d-03	0.1711d+04
0.5100d-03	0.1700d-03	0.1696d+04
0.5100d-03	0.1800d-03	0.1681d+04
0.5100d-03	0.1900d-03	0.1666d+04
0.5100d-03	0.2000d-03	0.1650d+04
0.5100d-03	0.2100d-03	0.1634d+04
0.5100d-03	0.2200d-03	0.1619d+04
0.5100d-03	0.2300d-03	0.1603d+04
0.5100d-03	0.2400d-03	0.1587d+04
0.5100d-03	0.2500d-03	0.1572d+04
0.5100d-03	0.2600d-03	0.1556d+04
0.5100d-03	0.2700d-03	0.1540d+04
0.5100d-03	0.2800d-03	0.1525d+04
0.5100d-03	0.2900d-03	0.1509d+04
0.5100d-03	0.3000d-03	0.1494d+04
0.5100d-03	0.3100d-03	0.1478d+04
0.5100d-03	0.3200d-03	0.1463d+04
0.5100d-03	0.3300d-03	0.1448d+04
0.5100d-03	0.3400d-03	0.1433d+04
0.5100d-03	0.3500d-03	0.1418d+04
0.5100d-03	0.3600d-03	0.1403d+04
0.5100d-03	0.3700d-03	0.1389d+04
0.5100d-03	0.3800d-03	0.1374d+04
0.5100d-03	0.3900d-03	0.1360d+04
0.5100d-03	0.4000d-03	0.1346d+04
0.5100d-03	0.4100d-03	0.1332d+04
0.5100d-03	0.4200d-03	0.1312d+04
0.5100d-03	0.4300d-03	0.1298d+04
0.5100d-03	0.4400d-03	0.1291d+04

0.5200d-03	0.0000d+00	0.1844d+04
0.5200d-03	0.2000d-06	0.1844d+04
0.5200d-03	0.4000d-06	0.1844d+04
0.5200d-03	0.6000d-06	0.1844d+04
0.5200d-03	0.8000d-06	0.1844d+04
0.5200d-03	0.1000d-05	0.1843d+04
0.5200d-03	0.1200d-05	0.1843d+04
0.5200d-03	0.1400d-05	0.1843d+04
0.5200d-03	0.1600d-05	0.1843d+04
0.5200d-03	0.1800d-05	0.1843d+04
0.5200d-03	0.2000d-05	0.1843d+04
0.5200d-03	0.2200d-05	0.1843d+04
0.5200d-03	0.2400d-05	0.1843d+04
0.5200d-03	0.2600d-05	0.1843d+04
0.5200d-03	0.2800d-05	0.1843d+04
0.5200d-03	0.3000d-05	0.1843d+04
0.5200d-03	0.3200d-05	0.1843d+04
0.5200d-03	0.3400d-05	0.1843d+04
0.5200d-03	0.3600d-05	0.1843d+04
0.5200d-03	0.3800d-05	0.1842d+04
0.5200d-03	0.4000d-05	0.1842d+04
0.5200d-03	0.4200d-05	0.1842d+04
0.5200d-03	0.4400d-05	0.1842d+04
0.5200d-03	0.4600d-05	0.1842d+04
0.5200d-03	0.4800d-05	0.1842d+04
0.5200d-03	0.5000d-05	0.1842d+04
0.5200d-03	0.1000d-04	0.1840d+04
0.5200d-03	0.2000d-04	0.1834d+04
0.5200d-03	0.3000d-04	0.1828d+04
0.5200d-03	0.4000d-04	0.1820d+04
0.5200d-03	0.5000d-04	0.1812d+04
0.5200d-03	0.6000d-04	0.1803d+04
0.5200d-03	0.7000d-04	0.1793d+04
0.5200d-03	0.8000d-04	0.1783d+04
0.5200d-03	0.9000d-04	0.1772d+04
0.5200d-03	0.1000d-03	0.1760d+04
0.5200d-03	0.1100d-03	0.1748d+04
0.5200d-03	0.1200d-03	0.1735d+04
0.5200d-03	0.1300d-03	0.1722d+04
0.5200d-03	0.1400d-03	0.1709d+04
0.5200d-03	0.1500d-03	0.1695d+04
0.5200d-03	0.1600d-03	0.1681d+04
0.5200d-03	0.1700d-03	0.1667d+04
0.5200d-03	0.1800d-03	0.1653d+04
0.5200d-03	0.1900d-03	0.1638d+04
0.5200d-03	0.2000d-03	0.1623d+04
0.5200d-03	0.2100d-03	0.1609d+04
0.5200d-03	0.2200d-03	0.1594d+04
0.5200d-03	0.2300d-03	0.1579d+04
0.5200d-03	0.2400d-03	0.1564d+04
0.5200d-03	0.2500d-03	0.1549d+04
0.5200d-03	0.2600d-03	0.1534d+04
0.5200d-03	0.2700d-03	0.1519d+04
0.5200d-03	0.2800d-03	0.1504d+04
0.5200d-03	0.2900d-03	0.1489d+04
0.5200d-03	0.3000d-03	0.1474d+04

0.5200d-03	0.3100d-03	0.1459d+04
0.5200d-03	0.3200d-03	0.1445d+04
0.5200d-03	0.3300d-03	0.1430d+04
0.5200d-03	0.3400d-03	0.1416d+04
0.5200d-03	0.3500d-03	0.1401d+04
0.5200d-03	0.3600d-03	0.1387d+04
0.5200d-03	0.3700d-03	0.1373d+04
0.5200d-03	0.3800d-03	0.1359d+04
0.5200d-03	0.3900d-03	0.1345d+04
0.5200d-03	0.4000d-03	0.1331d+04
0.5200d-03	0.4100d-03	0.1318d+04
0.5200d-03	0.4200d-03	0.1298d+04
0.5200d-03	0.4300d-03	0.1285d+04
0.5200d-03	0.4400d-03	0.1278d+04
0.5300d-03	0.0000d+00	0.1802d+04
0.5300d-03	0.2000d-06	0.1802d+04
0.5300d-03	0.4000d-06	0.1802d+04
0.5300d-03	0.6000d-06	0.1802d+04
0.5300d-03	0.8000d-06	0.1802d+04
0.5300d-03	0.1000d-05	0.1802d+04
0.5300d-03	0.1200d-05	0.1802d+04
0.5300d-03	0.1400d-05	0.1802d+04
0.5300d-03	0.1600d-05	0.1802d+04
0.5300d-03	0.1800d-05	0.1802d+04
0.5300d-03	0.2000d-05	0.1802d+04
0.5300d-03	0.2200d-05	0.1802d+04
0.5300d-03	0.2400d-05	0.1802d+04
0.5300d-03	0.2600d-05	0.1801d+04
0.5300d-03	0.2800d-05	0.1801d+04
0.5300d-03	0.3000d-05	0.1801d+04
0.5300d-03	0.3200d-05	0.1801d+04
0.5300d-03	0.3400d-05	0.1801d+04
0.5300d-03	0.3600d-05	0.1801d+04
0.5300d-03	0.3800d-05	0.1801d+04
0.5300d-03	0.4000d-05	0.1801d+04
0.5300d-03	0.4200d-05	0.1801d+04
0.5300d-03	0.4400d-05	0.1801d+04
0.5300d-03	0.4600d-05	0.1801d+04
0.5300d-03	0.4800d-05	0.1801d+04
0.5300d-03	0.5000d-05	0.1801d+04
0.5300d-03	0.1000d-04	0.1799d+04
0.5300d-03	0.2000d-04	0.1794d+04
0.5300d-03	0.3000d-04	0.1788d+04
0.5300d-03	0.4000d-04	0.1781d+04
0.5300d-03	0.5000d-04	0.1774d+04
0.5300d-03	0.6000d-04	0.1766d+04
0.5300d-03	0.7000d-04	0.1757d+04
0.5300d-03	0.8000d-04	0.1747d+04
0.5300d-03	0.9000d-04	0.1737d+04
0.5300d-03	0.1000d-03	0.1726d+04
0.5300d-03	0.1100d-03	0.1715d+04
0.5300d-03	0.1200d-03	0.1703d+04
0.5300d-03	0.1300d-03	0.1691d+04
0.5300d-03	0.1400d-03	0.1678d+04
0.5300d-03	0.1500d-03	0.1665d+04
0.5300d-03	0.1600d-03	0.1652d+04

0.5300d-03	0.1700d-03	0.1639d+04
0.5300d-03	0.1800d-03	0.1625d+04
0.5300d-03	0.1900d-03	0.1611d+04
0.5300d-03	0.2000d-03	0.1597d+04
0.5300d-03	0.2100d-03	0.1583d+04
0.5300d-03	0.2200d-03	0.1569d+04
0.5300d-03	0.2300d-03	0.1555d+04
0.5300d-03	0.2400d-03	0.1541d+04
0.5300d-03	0.2500d-03	0.1526d+04
0.5300d-03	0.2600d-03	0.1512d+04
0.5300d-03	0.2700d-03	0.1498d+04
0.5300d-03	0.2800d-03	0.1483d+04
0.5300d-03	0.2900d-03	0.1469d+04
0.5300d-03	0.3000d-03	0.1455d+04
0.5300d-03	0.3100d-03	0.1441d+04
0.5300d-03	0.3200d-03	0.1426d+04
0.5300d-03	0.3300d-03	0.1412d+04
0.5300d-03	0.3400d-03	0.1399d+04
0.5300d-03	0.3500d-03	0.1385d+04
0.5300d-03	0.3600d-03	0.1371d+04
0.5300d-03	0.3700d-03	0.1357d+04
0.5300d-03	0.3800d-03	0.1344d+04
0.5300d-03	0.3900d-03	0.1330d+04
0.5300d-03	0.4000d-03	0.1317d+04
0.5300d-03	0.4100d-03	0.1298d+04
0.5300d-03	0.4200d-03	0.1285d+04
0.5300d-03	0.4300d-03	0.1272d+04
0.5300d-03	0.4400d-03	0.1265d+04
0.5400d-03	0.0000d+00	0.1763d+04
0.5400d-03	0.2000d-06	0.1762d+04
0.5400d-03	0.4000d-06	0.1762d+04
0.5400d-03	0.6000d-06	0.1762d+04
0.5400d-03	0.8000d-06	0.1762d+04
0.5400d-03	0.1000d-05	0.1762d+04
0.5400d-03	0.1200d-05	0.1762d+04
0.5400d-03	0.1400d-05	0.1762d+04
0.5400d-03	0.1600d-05	0.1762d+04
0.5400d-03	0.1800d-05	0.1762d+04
0.5400d-03	0.2000d-05	0.1762d+04
0.5400d-03	0.2200d-05	0.1762d+04
0.5400d-03	0.2400d-05	0.1762d+04
0.5400d-03	0.2600d-05	0.1762d+04
0.5400d-03	0.2800d-05	0.1762d+04
0.5400d-03	0.3000d-05	0.1762d+04
0.5400d-03	0.3200d-05	0.1762d+04
0.5400d-03	0.3400d-05	0.1762d+04
0.5400d-03	0.3600d-05	0.1762d+04
0.5400d-03	0.3800d-05	0.1761d+04
0.5400d-03	0.4000d-05	0.1761d+04
0.5400d-03	0.4200d-05	0.1761d+04
0.5400d-03	0.4400d-05	0.1761d+04
0.5400d-03	0.4600d-05	0.1761d+04
0.5400d-03	0.4800d-05	0.1761d+04
0.5400d-03	0.5000d-05	0.1761d+04
0.5400d-03	0.1000d-04	0.1759d+04
0.5400d-03	0.2000d-04	0.1755d+04

0.5400d-03	0.3000d-04	0.1750d+04
0.5400d-03	0.4000d-04	0.1744d+04
0.5400d-03	0.5000d-04	0.1737d+04
0.5400d-03	0.6000d-04	0.1730d+04
0.5400d-03	0.7000d-04	0.1721d+04
0.5400d-03	0.8000d-04	0.1713d+04
0.5400d-03	0.9000d-04	0.1703d+04
0.5400d-03	0.1000d-03	0.1693d+04
0.5400d-03	0.1100d-03	0.1682d+04
0.5400d-03	0.1200d-03	0.1671d+04
0.5400d-03	0.1300d-03	0.1660d+04
0.5400d-03	0.1400d-03	0.1648d+04
0.5400d-03	0.1500d-03	0.1636d+04
0.5400d-03	0.1600d-03	0.1624d+04
0.5400d-03	0.1700d-03	0.1611d+04
0.5400d-03	0.1800d-03	0.1598d+04
0.5400d-03	0.1900d-03	0.1585d+04
0.5400d-03	0.2000d-03	0.1572d+04
0.5400d-03	0.2100d-03	0.1559d+04
0.5400d-03	0.2200d-03	0.1545d+04
0.5400d-03	0.2300d-03	0.1532d+04
0.5400d-03	0.2400d-03	0.1518d+04
0.5400d-03	0.2500d-03	0.1504d+04
0.5400d-03	0.2600d-03	0.1491d+04
0.5400d-03	0.2700d-03	0.1477d+04
0.5400d-03	0.2800d-03	0.1463d+04
0.5400d-03	0.2900d-03	0.1449d+04
0.5400d-03	0.3000d-03	0.1436d+04
0.5400d-03	0.3100d-03	0.1422d+04
0.5400d-03	0.3200d-03	0.1409d+04
0.5400d-03	0.3300d-03	0.1395d+04
0.5400d-03	0.3400d-03	0.1382d+04
0.5400d-03	0.3500d-03	0.1368d+04
0.5400d-03	0.3600d-03	0.1355d+04
0.5400d-03	0.3700d-03	0.1342d+04
0.5400d-03	0.3800d-03	0.1329d+04
0.5400d-03	0.3900d-03	0.1316d+04
0.5400d-03	0.4000d-03	0.1303d+04
0.5400d-03	0.4100d-03	0.1284d+04
0.5400d-03	0.4200d-03	0.1272d+04
0.5400d-03	0.4300d-03	0.1265d+04
0.5400d-03	0.4400d-03	0.1253d+04
0.5500d-03	0.0000d+00	0.1725d+04
0.5500d-03	0.2000d-06	0.1725d+04
0.5500d-03	0.4000d-06	0.1724d+04
0.5500d-03	0.6000d-06	0.1724d+04
0.5500d-03	0.8000d-06	0.1724d+04
0.5500d-03	0.1000d-05	0.1724d+04
0.5500d-03	0.1200d-05	0.1724d+04
0.5500d-03	0.1400d-05	0.1724d+04
0.5500d-03	0.1600d-05	0.1724d+04
0.5500d-03	0.1800d-05	0.1724d+04
0.5500d-03	0.2000d-05	0.1724d+04
0.5500d-03	0.2200d-05	0.1724d+04
0.5500d-03	0.2400d-05	0.1724d+04
0.5500d-03	0.2600d-05	0.1724d+04

0.5500d-03	0.2800d-05	0.1724d+04
0.5500d-03	0.3000d-05	0.1724d+04
0.5500d-03	0.3200d-05	0.1724d+04
0.5500d-03	0.3400d-05	0.1724d+04
0.5500d-03	0.3600d-05	0.1724d+04
0.5500d-03	0.3800d-05	0.1724d+04
0.5500d-03	0.4000d-05	0.1724d+04
0.5500d-03	0.4200d-05	0.1724d+04
0.5500d-03	0.4400d-05	0.1723d+04
0.5500d-03	0.4600d-05	0.1723d+04
0.5500d-03	0.4800d-05	0.1723d+04
0.5500d-03	0.5000d-05	0.1723d+04
0.5500d-03	0.1000d-04	0.1722d+04
0.5500d-03	0.2000d-04	0.1718d+04
0.5500d-03	0.3000d-04	0.1714d+04
0.5500d-03	0.4000d-04	0.1708d+04
0.5500d-03	0.5000d-04	0.1702d+04
0.5500d-03	0.6000d-04	0.1695d+04
0.5500d-03	0.7000d-04	0.1687d+04
0.5500d-03	0.8000d-04	0.1679d+04
0.5500d-03	0.9000d-04	0.1670d+04
0.5500d-03	0.1000d-03	0.1661d+04
0.5500d-03	0.1100d-03	0.1651d+04
0.5500d-03	0.1200d-03	0.1641d+04
0.5500d-03	0.1300d-03	0.1630d+04
0.5500d-03	0.1400d-03	0.1619d+04
0.5500d-03	0.1500d-03	0.1608d+04
0.5500d-03	0.1600d-03	0.1596d+04
0.5500d-03	0.1700d-03	0.1584d+04
0.5500d-03	0.1800d-03	0.1572d+04
0.5500d-03	0.1900d-03	0.1560d+04
0.5500d-03	0.2000d-03	0.1547d+04
0.5500d-03	0.2100d-03	0.1535d+04
0.5500d-03	0.2200d-03	0.1522d+04
0.5500d-03	0.2300d-03	0.1509d+04
0.5500d-03	0.2400d-03	0.1496d+04
0.5500d-03	0.2500d-03	0.1483d+04
0.5500d-03	0.2600d-03	0.1470d+04
0.5500d-03	0.2700d-03	0.1457d+04
0.5500d-03	0.2800d-03	0.1443d+04
0.5500d-03	0.2900d-03	0.1430d+04
0.5500d-03	0.3000d-03	0.1417d+04
0.5500d-03	0.3100d-03	0.1404d+04
0.5500d-03	0.3200d-03	0.1391d+04
0.5500d-03	0.3300d-03	0.1378d+04
0.5500d-03	0.3400d-03	0.1365d+04
0.5500d-03	0.3500d-03	0.1352d+04
0.5500d-03	0.3600d-03	0.1339d+04
0.5500d-03	0.3700d-03	0.1327d+04
0.5500d-03	0.3800d-03	0.1314d+04
0.5500d-03	0.3900d-03	0.1301d+04
0.5500d-03	0.4000d-03	0.1283d+04
0.5500d-03	0.4100d-03	0.1271d+04
0.5500d-03	0.4200d-03	0.1259d+04
0.5500d-03	0.4300d-03	0.1252d+04
0.5500d-03	0.4400d-03	0.1240d+04

0.5600d-03	0.0000d+00	0.1688d+04
0.5600d-03	0.2000d-06	0.1688d+04
0.5600d-03	0.4000d-06	0.1688d+04
0.5600d-03	0.6000d-06	0.1688d+04
0.5600d-03	0.8000d-06	0.1688d+04
0.5600d-03	0.1000d-05	0.1688d+04
0.5600d-03	0.1200d-05	0.1688d+04
0.5600d-03	0.1400d-05	0.1688d+04
0.5600d-03	0.1600d-05	0.1688d+04
0.5600d-03	0.1800d-05	0.1688d+04
0.5600d-03	0.2000d-05	0.1688d+04
0.5600d-03	0.2200d-05	0.1688d+04
0.5600d-03	0.2400d-05	0.1688d+04
0.5600d-03	0.2600d-05	0.1688d+04
0.5600d-03	0.2800d-05	0.1688d+04
0.5600d-03	0.3000d-05	0.1688d+04
0.5600d-03	0.3200d-05	0.1688d+04
0.5600d-03	0.3400d-05	0.1688d+04
0.5600d-03	0.3600d-05	0.1688d+04
0.5600d-03	0.3800d-05	0.1687d+04
0.5600d-03	0.4000d-05	0.1687d+04
0.5600d-03	0.4200d-05	0.1687d+04
0.5600d-03	0.4400d-05	0.1687d+04
0.5600d-03	0.4600d-05	0.1687d+04
0.5600d-03	0.4800d-05	0.1687d+04
0.5600d-03	0.5000d-05	0.1687d+04
0.5600d-03	0.1000d-04	0.1686d+04
0.5600d-03	0.2000d-04	0.1683d+04
0.5600d-03	0.3000d-04	0.1679d+04
0.5600d-03	0.4000d-04	0.1674d+04
0.5600d-03	0.5000d-04	0.1668d+04
0.5600d-03	0.6000d-04	0.1662d+04
0.5600d-03	0.7000d-04	0.1655d+04
0.5600d-03	0.8000d-04	0.1647d+04
0.5600d-03	0.9000d-04	0.1639d+04
0.5600d-03	0.1000d-03	0.1630d+04
0.5600d-03	0.1100d-03	0.1621d+04
0.5600d-03	0.1200d-03	0.1612d+04
0.5600d-03	0.1300d-03	0.1602d+04
0.5600d-03	0.1400d-03	0.1591d+04
0.5600d-03	0.1500d-03	0.1580d+04
0.5600d-03	0.1600d-03	0.1569d+04
0.5600d-03	0.1700d-03	0.1558d+04
0.5600d-03	0.1800d-03	0.1547d+04
0.5600d-03	0.1900d-03	0.1535d+04
0.5600d-03	0.2000d-03	0.1523d+04
0.5600d-03	0.2100d-03	0.1511d+04
0.5600d-03	0.2200d-03	0.1499d+04
0.5600d-03	0.2300d-03	0.1487d+04
0.5600d-03	0.2400d-03	0.1474d+04
0.5600d-03	0.2500d-03	0.1462d+04
0.5600d-03	0.2600d-03	0.1449d+04
0.5600d-03	0.2700d-03	0.1437d+04
0.5600d-03	0.2800d-03	0.1424d+04
0.5600d-03	0.2900d-03	0.1411d+04
0.5600d-03	0.3000d-03	0.1399d+04

0.5600d-03	0.3100d-03	0.1386d+04
0.5600d-03	0.3200d-03	0.1374d+04
0.5600d-03	0.3300d-03	0.1361d+04
0.5600d-03	0.3400d-03	0.1349d+04
0.5600d-03	0.3500d-03	0.1336d+04
0.5600d-03	0.3600d-03	0.1324d+04
0.5600d-03	0.3700d-03	0.1311d+04
0.5600d-03	0.3800d-03	0.1299d+04
0.5600d-03	0.3900d-03	0.1287d+04
0.5600d-03	0.4000d-03	0.1269d+04
0.5600d-03	0.4100d-03	0.1258d+04
0.5600d-03	0.4200d-03	0.1251d+04
0.5600d-03	0.4300d-03	0.1240d+04
0.5600d-03	0.4400d-03	0.1228d+04
0.5700d-03	0.0000d+00	0.1654d+04
0.5700d-03	0.2000d-06	0.1653d+04
0.5700d-03	0.4000d-06	0.1653d+04
0.5700d-03	0.6000d-06	0.1653d+04
0.5700d-03	0.8000d-06	0.1653d+04
0.5700d-03	0.1000d-05	0.1653d+04
0.5700d-03	0.1200d-05	0.1653d+04
0.5700d-03	0.1400d-05	0.1653d+04
0.5700d-03	0.1600d-05	0.1653d+04
0.5700d-03	0.1800d-05	0.1653d+04
0.5700d-03	0.2000d-05	0.1653d+04
0.5700d-03	0.2200d-05	0.1653d+04
0.5700d-03	0.2400d-05	0.1653d+04
0.5700d-03	0.2600d-05	0.1653d+04
0.5700d-03	0.2800d-05	0.1653d+04
0.5700d-03	0.3000d-05	0.1653d+04
0.5700d-03	0.3200d-05	0.1653d+04
0.5700d-03	0.3400d-05	0.1653d+04
0.5700d-03	0.3600d-05	0.1653d+04
0.5700d-03	0.3800d-05	0.1653d+04
0.5700d-03	0.4000d-05	0.1653d+04
0.5700d-03	0.4200d-05	0.1653d+04
0.5700d-03	0.4400d-05	0.1653d+04
0.5700d-03	0.4600d-05	0.1653d+04
0.5700d-03	0.4800d-05	0.1653d+04
0.5700d-03	0.5000d-05	0.1653d+04
0.5700d-03	0.1000d-04	0.1652d+04
0.5700d-03	0.2000d-04	0.1649d+04
0.5700d-03	0.3000d-04	0.1645d+04
0.5700d-03	0.4000d-04	0.1641d+04
0.5700d-03	0.5000d-04	0.1635d+04
0.5700d-03	0.6000d-04	0.1630d+04
0.5700d-03	0.7000d-04	0.1623d+04
0.5700d-03	0.8000d-04	0.1616d+04
0.5700d-03	0.9000d-04	0.1609d+04
0.5700d-03	0.1000d-03	0.1601d+04
0.5700d-03	0.1100d-03	0.1592d+04
0.5700d-03	0.1200d-03	0.1583d+04
0.5700d-03	0.1300d-03	0.1574d+04
0.5700d-03	0.1400d-03	0.1564d+04
0.5700d-03	0.1500d-03	0.1554d+04
0.5700d-03	0.1600d-03	0.1543d+04

0.5700d-03	0.1700d-03	0.1533d+04
0.5700d-03	0.1800d-03	0.1522d+04
0.5700d-03	0.1900d-03	0.1511d+04
0.5700d-03	0.2000d-03	0.1499d+04
0.5700d-03	0.2100d-03	0.1488d+04
0.5700d-03	0.2200d-03	0.1476d+04
0.5700d-03	0.2300d-03	0.1465d+04
0.5700d-03	0.2400d-03	0.1453d+04
0.5700d-03	0.2500d-03	0.1441d+04
0.5700d-03	0.2600d-03	0.1429d+04
0.5700d-03	0.2700d-03	0.1417d+04
0.5700d-03	0.2800d-03	0.1405d+04
0.5700d-03	0.2900d-03	0.1393d+04
0.5700d-03	0.3000d-03	0.1381d+04
0.5700d-03	0.3100d-03	0.1369d+04
0.5700d-03	0.3200d-03	0.1356d+04
0.5700d-03	0.3300d-03	0.1344d+04
0.5700d-03	0.3400d-03	0.1332d+04
0.5700d-03	0.3500d-03	0.1320d+04
0.5700d-03	0.3600d-03	0.1308d+04
0.5700d-03	0.3700d-03	0.1297d+04
0.5700d-03	0.3800d-03	0.1285d+04
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0.5700d-03	0.4000d-03	0.1256d+04
0.5700d-03	0.4100d-03	0.1244d+04
0.5700d-03	0.4200d-03	0.1238d+04
0.5700d-03	0.4300d-03	0.1227d+04
0.5700d-03	0.4400d-03	0.1216d+04
0.5800d-03	0.0000d+00	0.1620d+04
0.5800d-03	0.2000d-06	0.1620d+04
0.5800d-03	0.4000d-06	0.1620d+04
0.5800d-03	0.6000d-06	0.1620d+04
0.5800d-03	0.8000d-06	0.1620d+04
0.5800d-03	0.1000d-05	0.1620d+04
0.5800d-03	0.1200d-05	0.1620d+04
0.5800d-03	0.1400d-05	0.1620d+04
0.5800d-03	0.1600d-05	0.1620d+04
0.5800d-03	0.1800d-05	0.1620d+04
0.5800d-03	0.2000d-05	0.1620d+04
0.5800d-03	0.2200d-05	0.1620d+04
0.5800d-03	0.2400d-05	0.1620d+04
0.5800d-03	0.2600d-05	0.1620d+04
0.5800d-03	0.2800d-05	0.1620d+04
0.5800d-03	0.3000d-05	0.1620d+04
0.5800d-03	0.3200d-05	0.1620d+04
0.5800d-03	0.3400d-05	0.1620d+04
0.5800d-03	0.3600d-05	0.1620d+04
0.5800d-03	0.3800d-05	0.1620d+04
0.5800d-03	0.4000d-05	0.1620d+04
0.5800d-03	0.4200d-05	0.1620d+04
0.5800d-03	0.4400d-05	0.1620d+04
0.5800d-03	0.4600d-05	0.1620d+04
0.5800d-03	0.4800d-05	0.1620d+04
0.5800d-03	0.5000d-05	0.1620d+04
0.5800d-03	0.1000d-04	0.1619d+04
0.5800d-03	0.2000d-04	0.1616d+04

0.5800d-03	0.3000d-04	0.1613d+04
0.5800d-03	0.4000d-04	0.1609d+04
0.5800d-03	0.5000d-04	0.1604d+04
0.5800d-03	0.6000d-04	0.1599d+04
0.5800d-03	0.7000d-04	0.1593d+04
0.5800d-03	0.8000d-04	0.1586d+04
0.5800d-03	0.9000d-04	0.1579d+04
0.5800d-03	0.1000d-03	0.1572d+04
0.5800d-03	0.1100d-03	0.1564d+04
0.5800d-03	0.1200d-03	0.1555d+04
0.5800d-03	0.1300d-03	0.1547d+04
0.5800d-03	0.1400d-03	0.1537d+04
0.5800d-03	0.1500d-03	0.1528d+04
0.5800d-03	0.1600d-03	0.1518d+04
0.5800d-03	0.1700d-03	0.1508d+04
0.5800d-03	0.1800d-03	0.1498d+04
0.5800d-03	0.1900d-03	0.1487d+04
0.5800d-03	0.2000d-03	0.1476d+04
0.5800d-03	0.2100d-03	0.1466d+04
0.5800d-03	0.2200d-03	0.1454d+04
0.5800d-03	0.2300d-03	0.1443d+04
0.5800d-03	0.2400d-03	0.1432d+04
0.5800d-03	0.2500d-03	0.1421d+04
0.5800d-03	0.2600d-03	0.1409d+04
0.5800d-03	0.2700d-03	0.1398d+04
0.5800d-03	0.2800d-03	0.1386d+04
0.5800d-03	0.2900d-03	0.1374d+04
0.5800d-03	0.3000d-03	0.1363d+04
0.5800d-03	0.3100d-03	0.1351d+04
0.5800d-03	0.3200d-03	0.1340d+04
0.5800d-03	0.3300d-03	0.1328d+04
0.5800d-03	0.3400d-03	0.1316d+04
0.5800d-03	0.3500d-03	0.1305d+04
0.5800d-03	0.3600d-03	0.1293d+04
0.5800d-03	0.3700d-03	0.1282d+04
0.5800d-03	0.3800d-03	0.1265d+04
0.5800d-03	0.3900d-03	0.1254d+04
0.5800d-03	0.4000d-03	0.1242d+04
0.5800d-03	0.4100d-03	0.1231d+04
0.5800d-03	0.4200d-03	0.1226d+04
0.5800d-03	0.4300d-03	0.1214d+04
0.5800d-03	0.4400d-03	0.1204d+04
0.5900d-03	0.0000d+00	0.1588d+04
0.5900d-03	0.2000d-06	0.1588d+04
0.5900d-03	0.4000d-06	0.1588d+04
0.5900d-03	0.6000d-06	0.1588d+04
0.5900d-03	0.8000d-06	0.1588d+04
0.5900d-03	0.1000d-05	0.1588d+04
0.5900d-03	0.1200d-05	0.1588d+04
0.5900d-03	0.1400d-05	0.1588d+04
0.5900d-03	0.1600d-05	0.1588d+04
0.5900d-03	0.1800d-05	0.1588d+04
0.5900d-03	0.2000d-05	0.1588d+04
0.5900d-03	0.2200d-05	0.1588d+04
0.5900d-03	0.2400d-05	0.1588d+04
0.5900d-03	0.2600d-05	0.1588d+04

0.5900d-03	0.2800d-05	0.1588d+04
0.5900d-03	0.3000d-05	0.1588d+04
0.5900d-03	0.3200d-05	0.1588d+04
0.5900d-03	0.3400d-05	0.1588d+04
0.5900d-03	0.3600d-05	0.1588d+04
0.5900d-03	0.3800d-05	0.1588d+04
0.5900d-03	0.4000d-05	0.1588d+04
0.5900d-03	0.4200d-05	0.1588d+04
0.5900d-03	0.4400d-05	0.1588d+04
0.5900d-03	0.4600d-05	0.1588d+04
0.5900d-03	0.4800d-05	0.1588d+04
0.5900d-03	0.5000d-05	0.1588d+04
0.5900d-03	0.1000d-04	0.1587d+04
0.5900d-03	0.2000d-04	0.1585d+04
0.5900d-03	0.3000d-04	0.1582d+04
0.5900d-03	0.4000d-04	0.1578d+04
0.5900d-03	0.5000d-04	0.1574d+04
0.5900d-03	0.6000d-04	0.1569d+04
0.5900d-03	0.7000d-04	0.1563d+04
0.5900d-03	0.8000d-04	0.1557d+04
0.5900d-03	0.9000d-04	0.1551d+04
0.5900d-03	0.1000d-03	0.1544d+04
0.5900d-03	0.1100d-03	0.1536d+04
0.5900d-03	0.1200d-03	0.1529d+04
0.5900d-03	0.1300d-03	0.1520d+04
0.5900d-03	0.1400d-03	0.1512d+04
0.5900d-03	0.1500d-03	0.1503d+04
0.5900d-03	0.1600d-03	0.1493d+04
0.5900d-03	0.1700d-03	0.1484d+04
0.5900d-03	0.1800d-03	0.1474d+04
0.5900d-03	0.1900d-03	0.1464d+04
0.5900d-03	0.2000d-03	0.1454d+04
0.5900d-03	0.2100d-03	0.1444d+04
0.5900d-03	0.2200d-03	0.1433d+04
0.5900d-03	0.2300d-03	0.1422d+04
0.5900d-03	0.2400d-03	0.1412d+04
0.5900d-03	0.2500d-03	0.1401d+04
0.5900d-03	0.2600d-03	0.1390d+04
0.5900d-03	0.2700d-03	0.1379d+04
0.5900d-03	0.2800d-03	0.1368d+04
0.5900d-03	0.2900d-03	0.1357d+04
0.5900d-03	0.3000d-03	0.1345d+04
0.5900d-03	0.3100d-03	0.1334d+04
0.5900d-03	0.3200d-03	0.1323d+04
0.5900d-03	0.3300d-03	0.1312d+04
0.5900d-03	0.3400d-03	0.1301d+04
0.5900d-03	0.3500d-03	0.1290d+04
0.5900d-03	0.3600d-03	0.1278d+04
0.5900d-03	0.3700d-03	0.1267d+04
0.5900d-03	0.3800d-03	0.1251d+04
0.5900d-03	0.3900d-03	0.1240d+04
0.5900d-03	0.4000d-03	0.1229d+04
0.5900d-03	0.4100d-03	0.1224d+04
0.5900d-03	0.4200d-03	0.1213d+04
0.5900d-03	0.4300d-03	0.1202d+04
0.5900d-03	0.4400d-03	0.1191d+04

0.6000d-03	0.0000d+00	0.1558d+04
0.6000d-03	0.2000d-06	0.1558d+04
0.6000d-03	0.4000d-06	0.1558d+04
0.6000d-03	0.6000d-06	0.1558d+04
0.6000d-03	0.8000d-06	0.1558d+04
0.6000d-03	0.1000d-05	0.1558d+04
0.6000d-03	0.1200d-05	0.1558d+04
0.6000d-03	0.1400d-05	0.1558d+04
0.6000d-03	0.1600d-05	0.1558d+04
0.6000d-03	0.1800d-05	0.1558d+04
0.6000d-03	0.2000d-05	0.1558d+04
0.6000d-03	0.2200d-05	0.1558d+04
0.6000d-03	0.2400d-05	0.1558d+04
0.6000d-03	0.2600d-05	0.1558d+04
0.6000d-03	0.2800d-05	0.1558d+04
0.6000d-03	0.3000d-05	0.1558d+04
0.6000d-03	0.3200d-05	0.1558d+04
0.6000d-03	0.3400d-05	0.1558d+04
0.6000d-03	0.3600d-05	0.1558d+04
0.6000d-03	0.3800d-05	0.1557d+04
0.6000d-03	0.4000d-05	0.1557d+04
0.6000d-03	0.4200d-05	0.1557d+04
0.6000d-03	0.4400d-05	0.1557d+04
0.6000d-03	0.4600d-05	0.1557d+04
0.6000d-03	0.4800d-05	0.1557d+04
0.6000d-03	0.5000d-05	0.1557d+04
0.6000d-03	0.1000d-04	0.1557d+04
0.6000d-03	0.2000d-04	0.1555d+04
0.6000d-03	0.3000d-04	0.1552d+04
0.6000d-03	0.4000d-04	0.1549d+04
0.6000d-03	0.5000d-04	0.1545d+04
0.6000d-03	0.6000d-04	0.1540d+04
0.6000d-03	0.7000d-04	0.1535d+04
0.6000d-03	0.8000d-04	0.1530d+04
0.6000d-03	0.9000d-04	0.1523d+04
0.6000d-03	0.1000d-03	0.1517d+04
0.6000d-03	0.1100d-03	0.1510d+04
0.6000d-03	0.1200d-03	0.1503d+04
0.6000d-03	0.1300d-03	0.1495d+04
0.6000d-03	0.1400d-03	0.1487d+04
0.6000d-03	0.1500d-03	0.1478d+04
0.6000d-03	0.1600d-03	0.1469d+04
0.6000d-03	0.1700d-03	0.1460d+04
0.6000d-03	0.1800d-03	0.1451d+04
0.6000d-03	0.1900d-03	0.1442d+04
0.6000d-03	0.2000d-03	0.1432d+04
0.6000d-03	0.2100d-03	0.1422d+04
0.6000d-03	0.2200d-03	0.1412d+04
0.6000d-03	0.2300d-03	0.1402d+04
0.6000d-03	0.2400d-03	0.1392d+04
0.6000d-03	0.2500d-03	0.1381d+04
0.6000d-03	0.2600d-03	0.1371d+04
0.6000d-03	0.2700d-03	0.1360d+04
0.6000d-03	0.2800d-03	0.1350d+04
0.6000d-03	0.2900d-03	0.1339d+04
0.6000d-03	0.3000d-03	0.1328d+04

0.6000d-03	0.3100d-03	0.1318d+04
0.6000d-03	0.3200d-03	0.1307d+04
0.6000d-03	0.3300d-03	0.1296d+04
0.6000d-03	0.3400d-03	0.1285d+04
0.6000d-03	0.3500d-03	0.1275d+04
0.6000d-03	0.3600d-03	0.1264d+04
0.6000d-03	0.3700d-03	0.1248d+04
0.6000d-03	0.3800d-03	0.1237d+04
0.6000d-03	0.3900d-03	0.1227d+04
0.6000d-03	0.4000d-03	0.1216d+04
0.6000d-03	0.4100d-03	0.1211d+04
0.6000d-03	0.4200d-03	0.1200d+04
0.6000d-03	0.4300d-03	0.1190d+04
0.6000d-03	0.4400d-03	0.1180d+04
0.6100d-03	0.0000d+00	0.1529d+04
0.6100d-03	0.2000d-06	0.1529d+04
0.6100d-03	0.4000d-06	0.1529d+04
0.6100d-03	0.6000d-06	0.1529d+04
0.6100d-03	0.8000d-06	0.1529d+04
0.6100d-03	0.1000d-05	0.1529d+04
0.6100d-03	0.1200d-05	0.1529d+04
0.6100d-03	0.1400d-05	0.1528d+04
0.6100d-03	0.1600d-05	0.1528d+04
0.6100d-03	0.1800d-05	0.1528d+04
0.6100d-03	0.2000d-05	0.1528d+04
0.6100d-03	0.2200d-05	0.1528d+04
0.6100d-03	0.2400d-05	0.1528d+04
0.6100d-03	0.2600d-05	0.1528d+04
0.6100d-03	0.2800d-05	0.1528d+04
0.6100d-03	0.3000d-05	0.1528d+04
0.6100d-03	0.3200d-05	0.1528d+04
0.6100d-03	0.3400d-05	0.1528d+04
0.6100d-03	0.3600d-05	0.1528d+04
0.6100d-03	0.3800d-05	0.1528d+04
0.6100d-03	0.4000d-05	0.1528d+04
0.6100d-03	0.4200d-05	0.1528d+04
0.6100d-03	0.4400d-05	0.1528d+04
0.6100d-03	0.4600d-05	0.1528d+04
0.6100d-03	0.4800d-05	0.1528d+04
0.6100d-03	0.5000d-05	0.1528d+04
0.6100d-03	0.1000d-04	0.1528d+04
0.6100d-03	0.2000d-04	0.1526d+04
0.6100d-03	0.3000d-04	0.1523d+04
0.6100d-03	0.4000d-04	0.1520d+04
0.6100d-03	0.5000d-04	0.1517d+04
0.6100d-03	0.6000d-04	0.1513d+04
0.6100d-03	0.7000d-04	0.1508d+04
0.6100d-03	0.8000d-04	0.1503d+04
0.6100d-03	0.9000d-04	0.1497d+04
0.6100d-03	0.1000d-03	0.1491d+04
0.6100d-03	0.1100d-03	0.1484d+04
0.6100d-03	0.1200d-03	0.1477d+04
0.6100d-03	0.1300d-03	0.1470d+04
0.6100d-03	0.1400d-03	0.1462d+04
0.6100d-03	0.1500d-03	0.1454d+04
0.6100d-03	0.1600d-03	0.1446d+04

0.6100d-03	0.1700d-03	0.1438d+04
0.6100d-03	0.1800d-03	0.1429d+04
0.6100d-03	0.1900d-03	0.1420d+04
0.6100d-03	0.2000d-03	0.1411d+04
0.6100d-03	0.2100d-03	0.1401d+04
0.6100d-03	0.2200d-03	0.1392d+04
0.6100d-03	0.2300d-03	0.1382d+04
0.6100d-03	0.2400d-03	0.1372d+04
0.6100d-03	0.2500d-03	0.1362d+04
0.6100d-03	0.2600d-03	0.1352d+04
0.6100d-03	0.2700d-03	0.1342d+04
0.6100d-03	0.2800d-03	0.1332d+04
0.6100d-03	0.2900d-03	0.1322d+04
0.6100d-03	0.3000d-03	0.1311d+04
0.6100d-03	0.3100d-03	0.1301d+04
0.6100d-03	0.3200d-03	0.1291d+04
0.6100d-03	0.3300d-03	0.1280d+04
0.6100d-03	0.3400d-03	0.1270d+04
0.6100d-03	0.3500d-03	0.1260d+04
0.6100d-03	0.3600d-03	0.1249d+04
0.6100d-03	0.3700d-03	0.1234d+04
0.6100d-03	0.3800d-03	0.1224d+04
0.6100d-03	0.3900d-03	0.1213d+04
0.6100d-03	0.4000d-03	0.1203d+04
0.6100d-03	0.4100d-03	0.1198d+04
0.6100d-03	0.4200d-03	0.1188d+04
0.6100d-03	0.4300d-03	0.1178d+04
0.6100d-03	0.4400d-03	0.1168d+04
0.6200d-03	0.0000d+00	0.1500d+04
0.6200d-03	0.2000d-06	0.1500d+04
0.6200d-03	0.4000d-06	0.1500d+04
0.6200d-03	0.6000d-06	0.1500d+04
0.6200d-03	0.8000d-06	0.1500d+04
0.6200d-03	0.1000d-05	0.1500d+04
0.6200d-03	0.1200d-05	0.1500d+04
0.6200d-03	0.1400d-05	0.1500d+04
0.6200d-03	0.1600d-05	0.1500d+04
0.6200d-03	0.1800d-05	0.1500d+04
0.6200d-03	0.2000d-05	0.1500d+04
0.6200d-03	0.2200d-05	0.1500d+04
0.6200d-03	0.2400d-05	0.1500d+04
0.6200d-03	0.2600d-05	0.1500d+04
0.6200d-03	0.2800d-05	0.1500d+04
0.6200d-03	0.3000d-05	0.1500d+04
0.6200d-03	0.3200d-05	0.1500d+04
0.6200d-03	0.3400d-05	0.1500d+04
0.6200d-03	0.3600d-05	0.1500d+04
0.6200d-03	0.3800d-05	0.1500d+04
0.6200d-03	0.4000d-05	0.1500d+04
0.6200d-03	0.4200d-05	0.1500d+04
0.6200d-03	0.4400d-05	0.1500d+04
0.6200d-03	0.4600d-05	0.1500d+04
0.6200d-03	0.4800d-05	0.1500d+04
0.6200d-03	0.5000d-05	0.1500d+04
0.6200d-03	0.1000d-04	0.1500d+04
0.6200d-03	0.2000d-04	0.1498d+04

0.6200d-03	0.3000d-04	0.1496d+04
0.6200d-03	0.4000d-04	0.1493d+04
0.6200d-03	0.5000d-04	0.1490d+04
0.6200d-03	0.6000d-04	0.1486d+04
0.6200d-03	0.7000d-04	0.1482d+04
0.6200d-03	0.8000d-04	0.1477d+04
0.6200d-03	0.9000d-04	0.1471d+04
0.6200d-03	0.1000d-03	0.1466d+04
0.6200d-03	0.1100d-03	0.1460d+04
0.6200d-03	0.1200d-03	0.1453d+04
0.6200d-03	0.1300d-03	0.1446d+04
0.6200d-03	0.1400d-03	0.1439d+04
0.6200d-03	0.1500d-03	0.1431d+04
0.6200d-03	0.1600d-03	0.1424d+04
0.6200d-03	0.1700d-03	0.1415d+04
0.6200d-03	0.1800d-03	0.1407d+04
0.6200d-03	0.1900d-03	0.1399d+04
0.6200d-03	0.2000d-03	0.1390d+04
0.6200d-03	0.2100d-03	0.1381d+04
0.6200d-03	0.2200d-03	0.1372d+04
0.6200d-03	0.2300d-03	0.1363d+04
0.6200d-03	0.2400d-03	0.1353d+04
0.6200d-03	0.2500d-03	0.1344d+04
0.6200d-03	0.2600d-03	0.1334d+04
0.6200d-03	0.2700d-03	0.1324d+04
0.6200d-03	0.2800d-03	0.1315d+04
0.6200d-03	0.2900d-03	0.1305d+04
0.6200d-03	0.3000d-03	0.1295d+04
0.6200d-03	0.3100d-03	0.1285d+04
0.6200d-03	0.3200d-03	0.1275d+04
0.6200d-03	0.3300d-03	0.1265d+04
0.6200d-03	0.3400d-03	0.1255d+04
0.6200d-03	0.3500d-03	0.1245d+04
0.6200d-03	0.3600d-03	0.1230d+04
0.6200d-03	0.3700d-03	0.1220d+04
0.6200d-03	0.3800d-03	0.1210d+04
0.6200d-03	0.3900d-03	0.1200d+04
0.6200d-03	0.4000d-03	0.1195d+04
0.6200d-03	0.4100d-03	0.1185d+04
0.6200d-03	0.4200d-03	0.1176d+04
0.6200d-03	0.4300d-03	0.1166d+04
0.6200d-03	0.4400d-03	0.1156d+04
0.6300d-03	0.0000d+00	0.1473d+04
0.6300d-03	0.2000d-06	0.1473d+04
0.6300d-03	0.4000d-06	0.1473d+04
0.6300d-03	0.6000d-06	0.1473d+04
0.6300d-03	0.8000d-06	0.1473d+04
0.6300d-03	0.1000d-05	0.1473d+04
0.6300d-03	0.1200d-05	0.1473d+04
0.6300d-03	0.1400d-05	0.1473d+04
0.6300d-03	0.1600d-05	0.1473d+04
0.6300d-03	0.1800d-05	0.1473d+04
0.6300d-03	0.2000d-05	0.1473d+04
0.6300d-03	0.2200d-05	0.1473d+04
0.6300d-03	0.2400d-05	0.1473d+04
0.6300d-03	0.2600d-05	0.1473d+04

0.6300d-03	0.2800d-05	0.1473d+04
0.6300d-03	0.3000d-05	0.1473d+04
0.6300d-03	0.3200d-05	0.1473d+04
0.6300d-03	0.3400d-05	0.1473d+04
0.6300d-03	0.3600d-05	0.1473d+04
0.6300d-03	0.3800d-05	0.1473d+04
0.6300d-03	0.4000d-05	0.1473d+04
0.6300d-03	0.4200d-05	0.1473d+04
0.6300d-03	0.4400d-05	0.1473d+04
0.6300d-03	0.4600d-05	0.1473d+04
0.6300d-03	0.4800d-05	0.1473d+04
0.6300d-03	0.5000d-05	0.1473d+04
0.6300d-03	0.1000d-04	0.1473d+04
0.6300d-03	0.2000d-04	0.1471d+04
0.6300d-03	0.3000d-04	0.1469d+04
0.6300d-03	0.4000d-04	0.1467d+04
0.6300d-03	0.5000d-04	0.1464d+04
0.6300d-03	0.6000d-04	0.1460d+04
0.6300d-03	0.7000d-04	0.1456d+04
0.6300d-03	0.8000d-04	0.1452d+04
0.6300d-03	0.9000d-04	0.1447d+04
0.6300d-03	0.1000d-03	0.1441d+04
0.6300d-03	0.1100d-03	0.1435d+04
0.6300d-03	0.1200d-03	0.1429d+04
0.6300d-03	0.1300d-03	0.1423d+04
0.6300d-03	0.1400d-03	0.1416d+04
0.6300d-03	0.1500d-03	0.1409d+04
0.6300d-03	0.1600d-03	0.1402d+04
0.6300d-03	0.1700d-03	0.1394d+04
0.6300d-03	0.1800d-03	0.1386d+04
0.6300d-03	0.1900d-03	0.1378d+04
0.6300d-03	0.2000d-03	0.1370d+04
0.6300d-03	0.2100d-03	0.1361d+04
0.6300d-03	0.2200d-03	0.1352d+04
0.6300d-03	0.2300d-03	0.1344d+04
0.6300d-03	0.2400d-03	0.1335d+04
0.6300d-03	0.2500d-03	0.1325d+04
0.6300d-03	0.2600d-03	0.1316d+04
0.6300d-03	0.2700d-03	0.1307d+04
0.6300d-03	0.2800d-03	0.1298d+04
0.6300d-03	0.2900d-03	0.1288d+04
0.6300d-03	0.3000d-03	0.1279d+04
0.6300d-03	0.3100d-03	0.1269d+04
0.6300d-03	0.3200d-03	0.1260d+04
0.6300d-03	0.3300d-03	0.1250d+04
0.6300d-03	0.3400d-03	0.1240d+04
0.6300d-03	0.3500d-03	0.1231d+04
0.6300d-03	0.3600d-03	0.1216d+04
0.6300d-03	0.3700d-03	0.1207d+04
0.6300d-03	0.3800d-03	0.1197d+04
0.6300d-03	0.3900d-03	0.1188d+04
0.6300d-03	0.4000d-03	0.1183d+04
0.6300d-03	0.4100d-03	0.1173d+04
0.6300d-03	0.4200d-03	0.1164d+04
0.6300d-03	0.4300d-03	0.1154d+04
0.6300d-03	0.4400d-03	0.1145d+04

0.6400d-03	0.0000d+00	0.1447d+04
0.6400d-03	0.2000d-06	0.1447d+04
0.6400d-03	0.4000d-06	0.1447d+04
0.6400d-03	0.6000d-06	0.1447d+04
0.6400d-03	0.8000d-06	0.1447d+04
0.6400d-03	0.1000d-05	0.1447d+04
0.6400d-03	0.1200d-05	0.1447d+04
0.6400d-03	0.1400d-05	0.1447d+04
0.6400d-03	0.1600d-05	0.1447d+04
0.6400d-03	0.1800d-05	0.1447d+04
0.6400d-03	0.2000d-05	0.1447d+04
0.6400d-03	0.2200d-05	0.1447d+04
0.6400d-03	0.2400d-05	0.1447d+04
0.6400d-03	0.2600d-05	0.1447d+04
0.6400d-03	0.2800d-05	0.1447d+04
0.6400d-03	0.3000d-05	0.1447d+04
0.6400d-03	0.3200d-05	0.1447d+04
0.6400d-03	0.3400d-05	0.1447d+04
0.6400d-03	0.3600d-05	0.1447d+04
0.6400d-03	0.3800d-05	0.1447d+04
0.6400d-03	0.4000d-05	0.1447d+04
0.6400d-03	0.4200d-05	0.1447d+04
0.6400d-03	0.4400d-05	0.1447d+04
0.6400d-03	0.4600d-05	0.1447d+04
0.6400d-03	0.4800d-05	0.1447d+04
0.6400d-03	0.5000d-05	0.1447d+04
0.6400d-03	0.1000d-04	0.1447d+04
0.6400d-03	0.2000d-04	0.1445d+04
0.6400d-03	0.3000d-04	0.1444d+04
0.6400d-03	0.4000d-04	0.1441d+04
0.6400d-03	0.5000d-04	0.1439d+04
0.6400d-03	0.6000d-04	0.1435d+04
0.6400d-03	0.7000d-04	0.1431d+04
0.6400d-03	0.8000d-04	0.1427d+04
0.6400d-03	0.9000d-04	0.1423d+04
0.6400d-03	0.1000d-03	0.1418d+04
0.6400d-03	0.1100d-03	0.1412d+04
0.6400d-03	0.1200d-03	0.1406d+04
0.6400d-03	0.1300d-03	0.1400d+04
0.6400d-03	0.1400d-03	0.1394d+04
0.6400d-03	0.1500d-03	0.1387d+04
0.6400d-03	0.1600d-03	0.1380d+04
0.6400d-03	0.1700d-03	0.1373d+04
0.6400d-03	0.1800d-03	0.1365d+04
0.6400d-03	0.1900d-03	0.1358d+04
0.6400d-03	0.2000d-03	0.1350d+04
0.6400d-03	0.2100d-03	0.1342d+04
0.6400d-03	0.2200d-03	0.1333d+04
0.6400d-03	0.2300d-03	0.1325d+04
0.6400d-03	0.2400d-03	0.1316d+04
0.6400d-03	0.2500d-03	0.1308d+04
0.6400d-03	0.2600d-03	0.1299d+04
0.6400d-03	0.2700d-03	0.1290d+04
0.6400d-03	0.2800d-03	0.1281d+04
0.6400d-03	0.2900d-03	0.1272d+04
0.6400d-03	0.3000d-03	0.1263d+04

0.6400d-03	0.3100d-03	0.1254d+04
0.6400d-03	0.3200d-03	0.1244d+04
0.6400d-03	0.3300d-03	0.1235d+04
0.6400d-03	0.3400d-03	0.1226d+04
0.6400d-03	0.3500d-03	0.1212d+04
0.6400d-03	0.3600d-03	0.1202d+04
0.6400d-03	0.3700d-03	0.1193d+04
0.6400d-03	0.3800d-03	0.1184d+04
0.6400d-03	0.3900d-03	0.1175d+04
0.6400d-03	0.4000d-03	0.1170d+04
0.6400d-03	0.4100d-03	0.1161d+04
0.6400d-03	0.4200d-03	0.1152d+04
0.6400d-03	0.4300d-03	0.1142d+04
0.6400d-03	0.4400d-03	0.1133d+04
0.6500d-03	0.0000d+00	0.1422d+04
0.6500d-03	0.2000d-06	0.1422d+04
0.6500d-03	0.4000d-06	0.1422d+04
0.6500d-03	0.6000d-06	0.1422d+04
0.6500d-03	0.8000d-06	0.1422d+04
0.6500d-03	0.1000d-05	0.1422d+04
0.6500d-03	0.1200d-05	0.1422d+04
0.6500d-03	0.1400d-05	0.1422d+04
0.6500d-03	0.1600d-05	0.1422d+04
0.6500d-03	0.1800d-05	0.1422d+04
0.6500d-03	0.2000d-05	0.1422d+04
0.6500d-03	0.2200d-05	0.1422d+04
0.6500d-03	0.2400d-05	0.1422d+04
0.6500d-03	0.2600d-05	0.1422d+04
0.6500d-03	0.2800d-05	0.1422d+04
0.6500d-03	0.3000d-05	0.1422d+04
0.6500d-03	0.3200d-05	0.1422d+04
0.6500d-03	0.3400d-05	0.1422d+04
0.6500d-03	0.3600d-05	0.1422d+04
0.6500d-03	0.3800d-05	0.1422d+04
0.6500d-03	0.4000d-05	0.1422d+04
0.6500d-03	0.4200d-05	0.1422d+04
0.6500d-03	0.4400d-05	0.1422d+04
0.6500d-03	0.4600d-05	0.1422d+04
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0.6500d-03	0.5000d-05	0.1422d+04
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UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY 2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release, distribution is unlimited
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We study the use of laser-beam melting of silicon for the purpose of forming electrical links between two adjacent diodes. The diodes, which are formed by ion-implantation and diffusion in a conventional CMOS process, are positioned such that when desired they may be used to obtain an electrical link between two otherwise separate sections of the integrated circuit. Electrical connections so obtained enable the realization of wafer-scale ICs, as demonstrated in recent applications. We discuss the theory of laser-beam application to silicon, and show how the various beam and substrate parameters affect the properties of the diode links. We pay particular attention to the important issue of the reflectivity from the composite system. Careful analytical examinations of the resulting molten zone properties have been performed in order to fully qualify the use of laser radiation in this technology. Both scanning electron microscopy and secondary-ion mass spectrometry were used to examine such parameters as the lateral and in-depth extension of the molten zone. In addition, electrical measurements were carried out. The results for the various observables compare well with the theoretical predictions.

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