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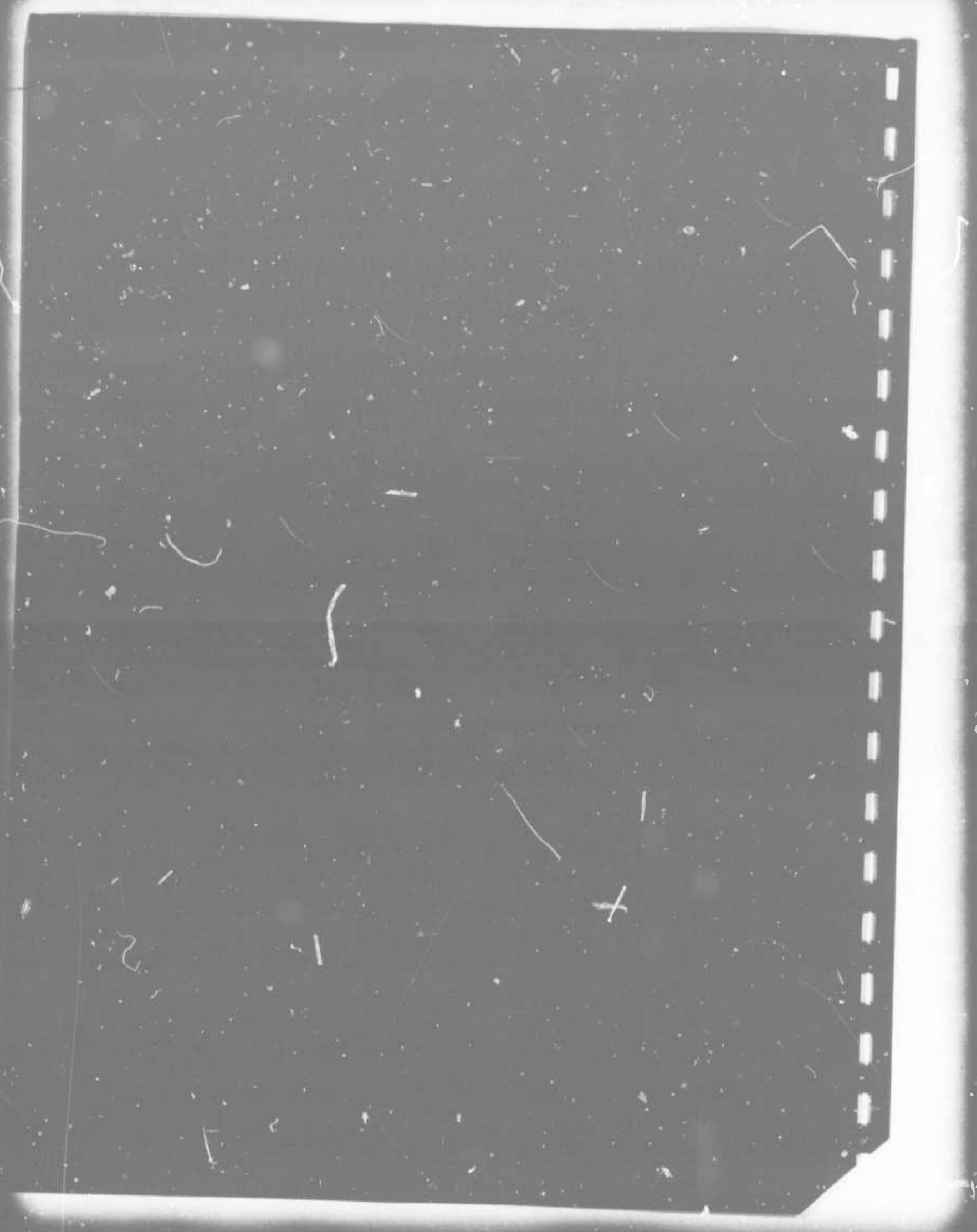
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This is a collection of brief abstracts on miscellaneous topics from the current Soviet technical literature. The intent is to supply a quick look at items of possible interest, including topics not necessarily named in the DARPA interest profile, as a supplement to our reportage on specified topics. It is intended to publish this collection on a monthly basis, to continue to provide prompt coverage of numerous aspects of Soviet R&D. As an added feature, all recently acquired books will be listed as they are received. A list of source abbreviations is appended.		

INTRODUCTION

This is a collection of brief abstracts on miscellaneous topics from the current Soviet technical literature. The intent is to supply a quick look at items of possible interest, including topics not necessarily named in the DARPA interest profile, as a supplement to our reportage on specified topics.

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For further information the reader is invited to call Stuart Hibben or Lee Boylan at Informatics on (301)-770-3000.

Spectral Response of Optical Transmission in Water (verbatim)

Spectral transmission was measured by means of a device composed of an underwater flash lamp with 900 j discharge energy and an onboard direct-reading spectrometer with a photomultiplier acting as the receiver. Spectral transmission was given as the ratio of photocurrent pulse amplitude from the immersed source to that from a flash lamp above water with spectrometer adjusted to the same wavelength. Measurements were made through water layers up to 200 m wide at 13 oceanic stations. In all cases, a rapid attenuation of long wave radiation owing to light absorption by water was observed as the layer width between the source and the receiver was increased. Spectral transmission in the short-wave visible range and UV to 313 m μ range differed significantly from station to station. In many instances, transmission in the near UV range was found to be relatively close to transmission in the 475 m μ transparency window of seawater. [Yeremin, V. I., G. G. Karlsen, and L. I. Lobov. Spectral transmission of optical radiation through thick oceanic layers. IN: Sb. Gidrofiz. i gidrooptich. issled. v Atlant. i Tikhom okeanakh. Moskva, Izd-vo Nauka, 1974, 198-202. (RZhGeofiz, 12/74, no. 12V145). (Translation)].

Bioluminescence in Seawater (verbatim)

The bioluminescence signal (BS) was measured in the active layers of the Atlantic and the Pacific Ocean to determine the HF component of the BS and the efficiency of optical stimulation of bioluminescence. A direct-reading submersible photometer was used as BS pickup. The output signal of the photometer was either recorded by a loop oscilloscope or fed directly to an onboard computer. BS distribution parameters, its autocorrelation function, and spectrum in the 1 to 250 Hz frequency range were evaluated by signal processing.

It was established that the BS distribution is usually far from Gaussian, and often the coefficient of BS variation exceeds 100%. The order of magnitude of the correlation range (0.1 to 0.5 sec) is identical with the typical lifetime of an optical pulse from an individual luminescent organism. The BS spectral density in the 3-5 to 100-200 Hz range decreased as f^{-k} , where $k = 1.9$ to 2.4 . In contradiction to data reported elsewhere, highpower light pulses from a submerged lamp did not stimulate bioluminescence in plankton. A significant difference was also observed in BS time dependence in the HF range between the open ocean and inland seas. [Karabashev, G. S., and A. N. Solov'yev. Optical effects of bioluminescence in the ocean. IN: Sb. Gidrofiz. i gidrooptich. issled. v Atlant. i Tikhom okeanakh. Moskva. Izd-vo Nauka, 1974, 217-228. (RZhGeofiz, 12/74, no. 12V147). (Translation)].

Pulsed Laser Studies in the Ocean (abstract)

The purpose of this study was to explore the laws governing power attenuation, shape distortion, and delay of laser pulses, as well as change in polarization of laser radiation, in oceanic waters. An Nd glass laser, emitting 20 nsec pulses at 10 to 40 kw peak power at 530 m μ , served as the transmitter. A direct-reading photometer with a 10 degree view angle and a photomultiplier was used as the receiver. The signal from the photomultiplier was fed by cable to an oscilloscope. The distance between the source and the receiver and their reciprocal orientation were controlled by a special device.

It was found that delay of a received pulse depends solely on the distance z between the source and the receiver. Pulse shape and radiation polarization vary little for $z \leq 150$ m, when the source and the receiver are in sight of each other, a fact which is due to the resolving action of photons scattered at a small angle. The [in]dependence of pulse shape and power from orientation of the source and the receiver is in agreement with the optical reciprocity theorem. The method of approach as well as the results of determination of the Green function in a nonstationary problem are described for a series of points in an optical field. [Gol'din, Yu. A., V. A. Gashko, G. G. Karlisen, V. N. Pelevin, and K. S. Shifrin. Experimental study of a nonstationary optical field in the ocean. IN: Sb. Gidrofiz. i gidrooptich. issled. v Atlant. i Tikhom okeanakh, Moskva Izd-vo Nauka, 1974, 228-241. (Translation)]

Fluctuation in Underwater Illuminance (verbatim)

Underwater illuminance fluctuation $E(t)$ caused by sea waves was recorded for 3 to 6 min. intervals at four stations in the tropical zone of the Pacific Ocean at water depths to 100 m and with the sun near zenith. The records were used to calculate statistical characteristics of $E(t)$ fluctuations as functions of depth z , specifically the coefficient of variation δ , the autocorrelation function $R(\tau)$, and the spectrum $G(\omega)$. In all cases, $\delta(z)$ decreased at greater depth starting at a certain z value.

A theory is developed to explain the observed effects. The theory assumes the decisive role of direct solar radiation in $E(t)$ fluctuations, and represents of sea surface as the sum of elementary areas with statistically varying orientation, whose effect is that of an independent collimated radiation source impinging on a photoelectric receiver. The formulas derived for $R(\tau)$ and $G(\omega)$ give a good approximation of these functions in the HF range. An even better agreement between theoretical and experimental $R(\tau)$ and $G(\omega)$ was achieved by taking large-scale turbulence into account. The latter finding suggests the possibility of determining ocean turbulence from the characteristics of $E(t)$. [Sud'bin, A. I., V. N. Pelevin, and K. S. Shifrin. Fluctuations of underwater illuminance. IN: Sb. Gidrofiz i gidrooptich issled. v Atlant. i Tikhom okeanakh. Moskva, Izd-vo Nauka, 1974, 202-213. (RZhGeofiz, 12/74, no. 12V146). (Translation)].

Study of Inertial Hydroacoustic Sensors (verbatim)

A method of studying vortex formation in inertial hydroacoustic sensors is described. The method essentially consists of comparing phase shift of a received acoustic signal relative to a reference signal. After conversion, beats with amplitude proportional to phase shift are separated out. A block-diagram of the instrumentation is given. The experimental data obtained with the described instrument indicate an angular sensitivity of the order of 10^{-7} . [Inozemtseva, A. G., Yu. A. Kukushkin, V. F. Nozdrev, V. V. Nevzorov, V. G. Paramonov, and V. F. Chernov.

Microphasometric study of vortex formation in inertial hydroacoustic sensors. IN: Sb. Materialy 2-y Vses. konf. po vopr. metodiki i tekhn. ul'trazvuk. spektroskopii, Vil'nyus, 1973. Kaunas, 1974, 50-52. (RZhF, 1/75, no. 1Zh1082). (Translation)].

Soviet "Mohole" Project Reaches 7263 Meters (23, 828 feet) on Kola Peninsula (abstract)

The first stage in drilling a 15,000-meter (49,200 feet) "Mohole" has been completed at 7263 meters, and the first drilling is being dismantled. A second rig, the newly built BU-15,000 is being readied to continue drilling. The rock encountered has been primarily crystalline and only about 8-10 meters are being drilled per bit and per shift. Corings being made during the drilling and their handling are accounting for much of the time expenditure. Thus far, the borehole has stayed within the 6.5° vertical deviation (slant) limits set. During the stage, there was an unexpected drop in rock density at one point, and also mineral water was encountered at 7000 meters at a temperature of 120°C , i. e., 60 to 70° hotter than was anticipated. [Belov, V. What's there, inside the Earth. Izvestiya, 13 May 1975, p. 6, cols. 1-8].

Superheated Metastable Liquid Phase (abstract)

Electrical conductivity and molar enthalpy change measurements in the Zn, Cd, and Pb liquid phases, just prior to their electrical explosion, are given and discussed on the basis of the electrical explosion theory developed by Martynyuk (ZhTF, 1974, 1262). The main purpose of the study was to prove the existence of superheated liquid metal under conditions of impulsive heating, and to determine the temperature T_3 at explosion initiation. Measurements were made by a pulsed oscillographic method, with wire specimens exploded in air or water by aperiodic impulsive discharges of 15-25 μsec duration ranging up to 10 ka. Results indicate that the enthalpy H_3 of all three metals at the time of explosion initiation, T_3 , is far greater than their liquid phase enthalpy H_{nb} at normal boiling point. Consequently, the range of metastable liquid phase is extended at a sufficiently rapid heating rate.

The critical temperature and critical pressure values of the metals evaluated from the cited theory and experimental data confirmed the existence of the superheated metastable liquid metal phase under experimental conditions. The nature of the liquid-to-vapor transition at T_3 is explosive (phase explosion) owing to the excess enthalpy ($H_3 - H_{nb}$) of superheated liquid metal. T_3 values were calculated to be 2333, 2230, and 3570 K for Zn, Cd, and Pb, respectively. [Martynyuk, M. M., and I. Karimkhodzhayev. Electrical explosion of metastable zinc, cadmium, and lead liquid phases. ZhTF, no. 11, 1974, 2360-2366].

Nonmagnetic Containment of Plasma (abstract)

The theoretical possibility of fusion plasma containment by rigid walls at a relatively moderate magnetic field intensity (nonmagnetic containment) is analyzed, assuming a simplified model of plasma behavior. The model considers the plasma layer at a temperature $T \geq 10$ eV and the wall at a temperature high enough to exclude near-wall effects such as incomplete plasma ionization, recombination radiation, wall failure, etc. The presence of a cold near-wall plasma layer of very high density n may admittedly cause plasma flow toward the walls and increased radiation loss by bremsstrahlung. The effects of these specific phenomena on dynamics of dense ($n = 10^{17} - 10^{18} \text{ cm}^{-3}$) plasma heating and plasma containment time τ are analyzed by numerically solving the equations of plasma transport across the magnetic field. The cases of classical and Bohm thermal conductivity mechanisms of the transport process are treated separately.

Plasma flow and formation of a near-wall layer are confirmed to be specific characteristics of nonmagnetic containment. These characteristics cause additional energy loss of relative magnitude of the order of unity. Hence, τ remains at least on the same order of magnitude as in the case of a pure thermal conductivity mechanism for plasma heating, i. e., τ satisfies the Lawson criterion. Thus it is shown that in principle, nonmagnetic containment of a dense plasma is possible, with tolerable losses, at a temperature gradient from thermonuclear down to $\sim 10^5$ K. [Vekshteyn, G. Ye., D. D. Ryutov, M. D. Spektor, and P. Z. Chebotayev. Nonmagnetic containment of a dense plasma. ZhPMTF, no. 6, 1974, 3-13].

Data on Tonus Accelerator (abstract)

A recent collection of articles published by Tomsk Polytechnical Institute contains a number of articles on operating features of the Tonus electron accelerator. Items covered include the pulse-forming network, commutator, electron gun, the TREK accessory for forming electron rings, and methods for monitoring ring position and electron density.

The same source also describes two similar but smaller e-beam generators developed at the same institute, one of 20 ka at 60 Kev, the other of 5 ka at 1 Mev. [Nanosekunduyye sil'notechnyye uskoriteli (Nanosecond high current accelerators). Collection of articles. Trudy NII yader. fiz., elektron. i avtomatiki pri Tomsk. politekhn. in-te. no. 4, Moskva, Atomizdat, 1974, 84 p. (RZhElektr, 1/75, no. 1A189 K; RZhF, 2/75, no. 2V315-2V332)].

E-Beam Destruction of Crystals (abstract)

The mechanism of brittle fracture initiation in ionic crystals exposed to an e-beam was studied experimentally. Experiments were done with 100 to 300 μ thick NaCl and KCl crystals exposed to 2--30 nanosec electron pulses with 0.3 MeV peak energy at $0.01-1 \times 10^3$ a/cm² current density. Simultaneously a $\sim 5 \times 10^4$ v/cm electric field was applied to the target face to determine the onset of fracture; the time of fracture t_{fr} was thus recorded as the time lag for scope registry of a spark across the newly-formed crack. An increase in crack propagation rate v_{fr} with the increase in thickness points to the accelerated propagation of cracks. Cracks are formed at an excitation density slightly higher than the fracture threshold density. The experimental plot shows that v_{fr} of thick specimens exceeds the propagation rate of elastic waves (~ 4500 m/sec) through the crystals. This result is taken as direct proof of crack initiation within the crystal, rather than at its surface. [Vaysburd, D. I., and G. I. Gering. Brittle fracture propagation rate in ionic crystals under pulsed irradiation by a high-power electron beam. FTT, no. 10, 1974, 3178-3179].

E-Beam Reflection Characteristics (abstract)

Experimental data are reported on reflection of 0.6 and 1.0 Mev relativistic e-beams from a copper plate, at ambient air pressures which ensured beam self-focusing. The experiments were done in the Tonus accelerator (cf. SOVRaD, 1,), 1975, 9). Drift chamber photographs of electron beams reflected from the target at different angles β under 0.09 torr pressure show characteristic spikes which are unconnected with electron losses. At that pressure and a beam incidence $\alpha \leq 30^\circ$ current loss due to reflection was minimal.

A sharp decrease in current was observed only at α near some critical value α_{cr} which varies from 40 to 48 $^\circ$ as pressure is decreased from 2 to 0.04 torr. The correlation between α and β is explained by variations of the initial distance d from beam axis to the conducting surface concurrently with a change of α . Beam interaction with the conducting surface is shown to be weaker than predicted by theory. The cited data are pertinent to the development of methods for controlling high-power e-beam trajectory.

A later abstract by the same authors evidently refers to the same experiment (RZhElektr, 2/75, no. 2A201). [Didenko, A. N., A. I. Ryabchikov, V. A. Tuzov, and Yu. P. Usov. Characteristics of heavy-current relativistic electron beam reflection from a conducting surface. ZhTF, no. 12, 1974, 2613-2615].

New Linac With Inductive Feed (abstract)

Characteristics of a high-power pulsed e-beam accelerator with inductive storage are analyzed, and a newly developed model of such an accelerator, the Indus-1, is described. The main feature of the Indus-1 is the quick-break switch which is connected in parallel with the low-voltage

primary of the inductor-transformer. Two circuit-breakers use electric explosion of copper foil to equate the break time at maximum charge current to minimum pulse length = 10^{-5} to 10^{-7} sec at a sufficient energy stored in the inductor. This results in maximum stored power transmitted to the electron beam. The optimum accelerating gap between a cold field-emission cathode and the anode was found to be 7.5 cm. The gap is placed in the inductor magnetic field which, together with the field of the focusing solenoid, produces the electron beam. Tests show a peak current of 1 ka at 300 kw and $\tau = 5 \mu$ sec. The efficiency of energy transfer was 6%.

The authors conclude in general that it pays to change from electric to magnetic storage for energies around the order of 10^7 j or above. [Dubovoy, L. V., L. M. Royfe, Ye. V. Seredenko, B. A. Stekol'nikov, and V. B. Shapiro. Heavy-current accelerator of microsecond electrons. *Atomnaya energiya*, v. 38, no. 2, 1975, 87-89].

Beam-Plasma Interaction (verbatim)

A stationary interaction is analyzed accounting for plasma electron collisions with heavy particles. It is assumed that the beam-plasma system is confined in a cylindrical waveguide with ideally conducting walls, and that radial divergence of the beam is prevented by application of a longitudinal magnetic field. The system is described by two-fluid hydrodynamic equations for a cold plasma with allowance for collisions, and by the potential equation $E = -\nabla\Phi$. Cases of both monoenergetic and nonmonoenergetic electron beams are examined.

It is shown that interaction of a monoenergetic beam of relativistic plasma electrons with heavy particles tends to instability. The instability increment depends on collision frequency, and has a finite value even at an arbitrarily small beam current. The magnitude of the beam critical current is determined as a function of system parameters, for the case in which allowance is made for longitudinal energy variance of beam electrons. [Grigor'yev, V. P., and N. S. Shulayev. Interaction of a relativistic electron beam with confined dissipative plasma. IN: *Tr. NII yader. fiz. elektron i avtomatiki pri Tomsk. politekhn in-te*, no. 4, 1974, 79-84. (RZhF, 1/75, no. 1G79). (Translation)].

Hydrodynamic Drag Reduction Studies (abstract)

Experimental research carried out in the model basin of the Ukrainian Academy of Sciences' Institute of Hydromechanics has been concerned with the effect of boundary layer draw-off on the hydrodynamic drag of a body of revolution moving in water at a zero angle of attack. The experiments have demonstrated the effectiveness of boundary layer control by drawing off a small volume of fluid from the boundary layer. A two-fold reduction of drag was achieved for a boundary layer controlled segment of a surface in the range

of Reynolds numbers from 1 to 3.5×10^6 , with a draw-off rate $c_Q = 6 \times 10^{-4}$. [Kozlov, L. F., and A. I. Tsganyuk. Hydrodynamic drag of a body of revolution with (boundary-layer) draw off. *Gidromekhanika*, no. 30, 1974, 3-6. (RZh. Vodnyy transport, no. 4, 1975, Abs. 4A80)].

Computer Processing of Tracking Data (verbatim)

The use of digital computers in processing data from a side-look radar is discussed as a means of solving the problem of automatic range tracking. Computer-adapted algorithms for solving fundamental problems of automatic tracking are synthesized, and specific circuit designs incorporating these algorithms are discussed. It is shown that parallel computer operation is the optimum system for solving the tracking problem in real time. Advantages of the proposed system in comparison with known systems are formulated on the basis of error analysis. [Chernyshev, V. O., and Ya. L. Mel'tser. Using digital computer to process radar information. IN: *Sb. Odnorod tsifrovyye vychisl. i integrirnyushch. struktury*, no. 2, Taganrog. 1974, 95-106. (RZhRadiot, 3/75, no. 3G4). (Translation)].

Fuel Cell (verbatim)

A high-temperature hydrogen-oxygen fuel cell with a solid electrolyte matrix impregnated with an Na-K-Li carbonate eutectic melt was studied. The matrix with 25% porosity was made by smelting a 1:2:4 mixture of Al_2O_3 , SiO_2 , and Li_2CO_3 powders at 1200 C. This melt was pulverized, with the 0.05 to 0.1 mm fraction of the melt being compacted into tablets which were remelted at 800 C. A test cell with porous Ag and Ni electrodes clamped to the matrix operated for about 3,000 hours at 600° under constant load and thermal cycling at 0.8 v. The initial power density of 50 mw/cm was maintained throughout the experiment. Some Ag corrosion was noted. [Arkhipov, G. G., G. K. Stepanov, and V. V. Burda. A high-temperature hydrogen-oxygen cell with matrix electrolyte. IN: *Trudy. In-ta elektrokhimii Ural'sk. nauch. tsentr AN SSSR*. no. 21, 1974, 95-98. (RZhKh, 19AB, 2/75, no. 2B1296). (Translation)].

Radar Detects Underground Water (abstract)

Airborne radar detection of fresh ground water and other inhomogeneities below a sand layer was done in a 1973 experiment carried out over the Karakum Desert. A method of shock excitation of the antenna at a resonance frequency of 70 MHz was applied, as described by earlier in applications to radar probing of ice (DAN v. 203, no. 3, 1972, 578 and RiE, v. 17, no. 10, 1972, 2107). The use of short excitation pulses ($\tau_e = 7$ nsec) and a broad-band VLF antenna minimized r-f damping in the ground and ensured a

high resolution across the layer. Altitude was 200--400 m at 160 km/hr flight speed.

Scope traces of the radar echoes from the air-sand and sand-ground water (or other inhomogeneity) interfaces showed that the sand layer was 7.5 to 26 m. deep. This data is in agreement with geological data for the same testing area. The practical feasibility of depth sounding by a fairly simple radar is thus proved, which the authors view as a useful new technique in geological prospecting. [Finkel'shteyn, M. I., V. A. Kutev, and O. P. Vlasov. Radar sensing of ground water below a sand layer. DAN SSSR, v. 219, no. 6, 1974, 1427-1429].

Radar Altimeter Error (verbatim)

It is shown that the spectrum of measurement error [in radar altimetry] can be derived directly from the three-dimensional spectrum of a "frozen" wave surface. Simple expressions are found for the spectrum and the autocorrelation function of the altitude measurement error during target motion in an arbitrary direction and an arbitrary sea state. [Besekerskiy, V. A., V. B. Diomidov, A. V. Nebylov, and E. I. Yarovoy. Spectral model of error in measurements with a radar altimeter of the altitude of an object moving close to a rough sea surface. IN: Tr. Leningr institut aviats, priborostr, no. 88, 1974, 3-11. (RZhRadiot, 2/75, no. 2G104). (Translation)].

Ball Lightning Model (verbatim)

A model of ball lightning is introduced, which comprises the most significant characteristics selected from published descriptions of the observed phenomenon. The model includes parameters of energy, lifetime, characteristics of spatial propagation, shape, color, electrical and magnetic characteristics of ball lightning. The fundamental concepts of the model may be used for producing a stable high-temperature plasma. [Grigor'yev, A. I., G. M. Grebnova, and L. D. Grigor'yeva. O stroyenii sharovoy molnii (Structure of ball lightning). Deposit at VINITI 26 Aug 1974, no. 2333-74, 18 p. (RZhGeofiz, 12/74, no. 12B208 DEP)].

Limit Strength of Carbon-Carbyne Polymer (abstract)

Limit strength characteristics are evaluated for carbyne, the new carbon chain polymer which is expected to exhibit the highest possible theoretical and actual mechanical strength. This expectation is based on considerations of chemical bonding, structure, and degree of polymerization of carbyne, as compared to the corresponding characteristics of layered structures such as graphite, boron nitride or silicon carbide. Simplified theoretical formulas are derived for calculating theoretical strength σ_{th} , elastic modulus

E_{th} , and structural factor γ_{th} for a perfect single crystal at 0° K. Calculations are also made of limit strength σ_{lim} of a perfect single crystal at any given temperature T and time to failure, τ .

Results for these parameters of the β -carbyne modification are nearly double those of graphite, and several times higher than those of polyethylene. The authors conclude that higher experimental values may be expected for carbyne than for other chain and layered polymers. Defect-free carbyne whiskers or single-crystal fibers could thus be the strongest known material. [Perepelkin, K. Ye., V. V. Korshak, and V. I. Kasatochkin. Estimating ultimate mechanical characteristics of the carbon-carbyne chain polymer. DAN SSSR, v. 220, no. 6, 1975, 1376-1379].

Destruction Probability of Composites (verbatim)

A new approach is presented for evaluating the probable strength of a solid, in which a specific destruction probability is assigned to every possible failure surface before analyzing a regular composite structure. The latter is assumed to be a plane system of densely packed hexahedrons of given orientation. This approach to the problem, in which destruction appears possible at a finite number of failure surfaces rather than in a continuous manner as in a homogeneous solid, allows a detailed evaluation of the process. A numerical method is developed for evaluating destruction probability of regular discrete systems.

The described model is seen as basic to development of a destruction theory for composite materials having a high fill factor and nearly symmetrical elements, such as concrete or polymer concrete. [Palley, I. Z., and G. A. Vayts. Determining destruction probability of regular composite structures. IN: Sb. Vopr. dinamiki i prochnosti, no. 29. Riga, Zinatne, 1974, 138-144. (RZhMekh, 12/74, no. 12V1210)].

Metal-Diamond Composites for High Pressure Studies (abstract)

Researchers at the Institutes of High Pressure Physics have recently reported on experiments in obtaining metal-diamond composites under pressure, with the object of developing structural materials suitable for pressure tests in the megabar range. The plan is to fill interstices in the diamond lattice with a binder to provide a stable composite with hardness at least no worse than that of diamond.

Semerchan et al. describe the impregnation of synthetic diamond dust with a copper-titanium alloy at 1200 C and pressures to 40 kbar, in which the Ti content was varied from 30 to 70 % by weight. Briquets thus formed were 5 mm high by 12 mm diameter. Pressure tests showed that at an optimum Ti content in the 50--55% range, compressive strength of the composite attained 450 kg/mm².

A subsequent paper by Alikhanov et al. in the same institute reports further on the nature of the Ti-Cu-diamond composite. Neutron diffraction studies showed that Ti in the briquet converts to ω -Ti as well as to a substantial fraction of TiC in the forming process. Density calculated from neutron diffraction data was consistently higher than measured density, indicating residual porosity in the composite; the authors estimate that with improved impregnation techniques the fill factor could be raised to 10%. Using a mix of diamond particles with a 3:10 size ratio is also suggested as a way of strengthening the composite. [Semerchan, A. A., Zh. G. Malikova, V. P. Modenov, and S. G. Nuzhdina. On controlled impregnation of diamond dust at high pressure. DAN SSSR, v. 220, no. 1, 1975, 78-81. Alikhanov, R. A., Ye. S. Chebotareva, S. G. Nuzhdina, and V. P. Modenov. Composition of a diamond alloy. Op. cit., no. 2, 1975, 325-327].

New High-Temperature Concrete (verbatim)

A procedure is introduced for producing a concrete which is particularly suitable for heat-insulating monolithic structures or composite fireproof structural elements with enhanced heat insulation characteristics, suitable for buildings. The concrete mix is prepared from light fillers, mainly keramsit; dense fillers, mainly chamotte with up to 4 mm grain size; ceramic stabilizer (microfiller), mainly chamotte powder with up to 0.1 mm grain size; and a binder of Portland cement, alumina cement or waterglass. The cited concrete composition has good heat-insulation characteristics and adequate strength. It can be used for sectional or monolithic structures at up to 1300° C. [Jung, M., M. Haewecker, and B. Reinhardt, A process for obtaining heat-resistant, light structural concrete. East German Patent no. 103881, published Feb. 12, 1974. (RZhKh 19M, 5/75, no. 5M309 P). (Translation)].

Stress Tests on Organic Composites (abstract)

Displacement of various organic compounds from combined effects of high pressure P and shear σ is reported, in order to test the hypotheses of Bridgman and Vereshchagin. All compounds studied were divided into three groups according to their $\sigma(P)$ behavior: (a) compounds such as propionamide or paraffin, which display a monotonic increase in σ with increase in P from 10 to 100 kbar; (b) those such as 3-ethylenediamine, with σ levelling off after an initial rise; and (c) those such as acrylamide or naphthalene, which display a further increase in σ after a plateau. All experiments were carried out with composite specimens.

Horizontal displacement of matter in group A specimens was visible only on the surface. At $P > 20$ kbar, a transition from surface friction to slip (plastic flow) within a single layer, or between adjacent layers, was observed in specimens of the B and C group compounds respectively. The interlayer transition was shown to be uniformly distributed in height of C group specimens. The authors conclude that forming polymers at high pressure accompanied by shear strain is associated with initial internal shear in the specimen. [Zhorin, V. A., A. A. Zharov, A. G. Kazakevich, and N. S. Yenikolopyan. Material displacement on a Bridgman anvil under high pressure coupled with shearing strain. FTT, no. 2, 1975, 393-396].

Ablation Fragmentation (abstract)

Fundamental characteristics of ablation processes on the surface of carbon reinforced plastics are evaluated on the basis of the authors' earlier experimental kinetic data (DAN UKrSSR. Ser. A, no. 11, 1974, 1047). A simplified ablation model is used to calculate temperature distribution $T(x, \tau)$, where x is the distance from the ablating surface and τ is time. Using the expression for $T(x, \tau)$ and the kinetic equation for the heating process, the authors compute the change in linear dimension of the carbon-reinforced plastic. This is done for three steps of the kinetic process at different heating rates or different x values, but at constant ablation rates $V = 0, 0.05, \text{ and } 0.10 \text{ mm/sec}$ and a constant τ in the 16 to 121 sec range. The data thus computed show the initial increase in $(l - l_0)/l_0$ due to relaxation of stresses accumulated in the reinforced material at the time of compression. Corrections are made to allow for resistance of the matrix and thermal expansion.

The corrected data show that the region of physicochemical transformations shrinks considerably at increasing ablation rates. It may be assumed that propagation of cracks generated by fragmentation of the surface is limited by the coordinates corresponding to maximum $(l - l_0)/l_0$ values. This was confirmed by measuring the depth of crack propagation in a carbon-reinforced plastic after heating it for 120 sec in a high-temperature gas flow. In this way the main cause of surface fragmentation was established and the possibility was shown of evaluating the depth of crack propagation. [Bulanov, V. N., A. V. Vasil'yev, I. N. Frantsevich, and V. Ya. Shevchenko. Fragmentation of heat shield materials in the process of ablation. DAN SSSR, v. 220, no. 3, 1975, 571-574].

Conference on Composite Materials (abstract)

The Third All-Union Conference on Composites was held June 17-19 1974 under joint sponsorship of the Baykov Institute of Metallurgy, the All-Union Scientific Research Institute of Aviation Materials, and the Institute on the Problems of Science of Materials, Ukrainian Academy of Sciences. Over 500 representatives of 85 Soviet scientific research institutes, industrial branch institutes, design bureaus, and factories from 25 Soviet cities were present. Some 200 published theses and over 60 papers were presented. Academician N. M. Zhavoronkov opened the sessions and A. T. Tumanov, a corresponding member of the Academy of Sciences, gave the introductory lecture on the practical significance of composites.

Review papers were given on preparation methods and properties of reinforcing fibers and whiskers, optimization of reinforcement technical flow charts, physico-chemical bases of preparation and compatibility of composites, polymer composites, and other topics. The most important papers are summarized briefly, and the concluding resolution urges a broad and expanded effort in all aspects of composite development. [Shorshorov, M. Kh., and V. I. Bakarino. Composite materials: Conference in Moscow. VAN, no. 12, 1974, 110-113].

New Organic Polymer Semiconductor (abstract)

A joint team from the Academy's Institute of Chemical Physics and the Cybernetics Institute of the Georgian Academy report semiconductor switching in polymeric ion-radical salts of tetracyanoquinodimethane (TTsKhM) and poly(-2-methyl-5-ethynyl-pyridine). Films of the ion-radical salt from 20 to 50 μ were vapor deposited on a substrate, after which voltages up to 100 v were applied to the electrodes. Results consistently showed a critical voltage, at which switching to a low-resistance characteristic occurred. The effect was reversible for several hundred switch cycles, and was independent of polarity or electrode material. A change in temperature vs. resistance characteristic was also observed in the switched mode.

The tests thus add polymer systems to the list of potential organic thin-film switching elements. [Brodzeli, M. I., M. D. Dokhner, et al. Switching effect in organic semiconductors. Vysokomolek. Soyek. Kratk. soobshchen., no. 12, 1974, 882-883].

Soft X-Radiation Source (abstract)

An electron plasma gun is the basic component of a source of stable soft x-ray pulses, which is described. The x-ray pulses are generated by bombarding a tungsten target (anticathode) with an electron beam at 80 kv accelerating voltage and 50 kAmp per pulse for ~ 200 nsec duration. The coefficient of current transmission is 90%. The bremsstrahlung parameters were measured by a LiF crystal detector, and the spectral composition of the x-rays was determined by an absorption method, using aluminum absorbers. The anticathodic current peaks after 10 to 30 nsec to a value close to the total current, or 58 kA. Measured x-radiation dose was inversely proportional to the square of the distance from the target to the detector, as predicted by theory. Measured dose was about 80 rad/pulse at 5 cm from the target and the dose rate was $\sim 10^9$ rad/sec. [Iremashvili, D. V., and T. A. Osepashvili. A source of high-power soft bremsstrahlung pulses. PTE, no. 1, 1975, 213-214].

High-Power Sources of UV and X-Rays (abstract)

A brief review is made of reported Soviet and Western data on characteristics of synchrotron radiation from circular electron accelerators and electron storage rings. Radiation spectral regions of 50 to 2,500 \AA and of the order of a few angstroms are covered, as being the most interesting for solid state physics, inert gas studies, photochemistry, and molecular biology. Undulatory radiation and some of its intermediate variants are treated separately from the viewpoint of practical applications.

Characteristics are compared of Soviet accelerators, either working, such as ARUS (Yerevan'), FIAN's 0.68 GeV, TP1 (Tomsk), or under construction (FIAN's 1.3 GeV), and storage rings, such as VEPP-2 and VEPP-3

being tested at the Institute of Nuclear Physics of the Academy's Siberian Branch. The cited accelerators and storage rings may be used as sources of vacuum UV and X-radiation. The review covers literature up through 1973 inclusive; Soviet sources make up about 65% of all references. [Yakimenko, M. N. High-power sources of ultraviolet and x-rays. UFN, v. 114, no. 1, 1974, 55-66].

Imaging at Submillimeter Wavelengths (abstract)

A system for submillimeter imaging of metallic or semi-conducting flat objects is described. The system uses the 0.337 mm radiation from an electrically pumped HCN laser, with 20 Mw output power and 2° beam divergence, to scan the test object rotated in a cylindrical scanning device. The modulated beam focused on the object surface is transmitted to a InSb-Be bronze detector operating at room temperature, with sensitivity to 10^{-10} w/sec^{1/2}. The amplified signal from the detector is displayed on a long memory CR tube.

The system has been tested for its operability, resolution, image distortion and interference. The best resolution of 1.8λ was obtained with a 0.6 mm wide transmission window in the focal region, the electric field vector being normal to the window, and the signal level at 0.5 of the maximum. Photographic images are shown of a copper foil with engraved text and a paper sheet with pencil- or aquadag-written text. It is concluded that high-contrast objects and objects with dimensions on the order of the wavelength of the incident beam can thus be observed by submillimeter wave transmission. [Malykh, N. I., A. G. Nagornyy, and Ye. S. Yampol'skiy. Image visualization at submillimeter wavelengths. PTE, no. 1, 1975, 159-161].

Laser For Selective Photochemistry (abstract)

A Q-switched Nd glass laser emitting at 1060 nm with second, third and fourth harmonic generation is described. Continuous tuning of the flash-pumped laser over 20 nm range at each nominal wavelength was achieved by using an intracavity Fabry-Perot interferometer simultaneously with a diffraction grating coupled with a Galilean telescope. Generation frequency was stabilized to a $2 \cdot 10^{-6}$ relative value of spectral bandwidth; harmonics were generated by KDP crystals. Peak output power of a laser pulse varied from 10^6 to 10^8 w. The third harmonic was used to study the spectrum of the H₂CO molecule and a selective predissociation of the D₂CO molecule in a 1:1 H₂CO-D₂CO mixture. Mass spectrometric analysis of the irradiated mixture revealed that the H₂:D₂ ratio increased to 1:9. The authors conclude that a laser of the described type can be used for high resolution spectroscopy, atmosphere probing, and selective photochemistry (presumably isotope separation, since the authors are active in this field). [Ambartsumyan, R. V., V. M. Apatin, V. S. Letokhov, and V. I. Mishin. High-power, narrowband emission neodymium glass laser tunable in the ultra-violet, visible, and infrared frequency ranges for selective photochemistry. Kvantovaya elektronika, no. 2, 1975, 337-342].

Optical Plus Electrical Ionization (abstract)

The possibility is analyzed of selective ionization of an atom by combined effects of laser radiation and an applied electric field. Theoretically laser radiation should excite an atom to a quantum state near ionization potential, i.e., a state with a large value of the principal quantum number, η . In the presence of an electric field, the laser-excited atom states partially decay to autoionized states. The larger the η value, the greater the probability of ionizing decay.

Realization of the proposed ionization method is evaluated by calculating the probability W of ionization of highly excited atoms in an electric field. Autoionization of an H-like atom by application of a d.c. field on a pulsed electric field is also analyzed, assuming that the effect of the electron shell reduces to shielding of the nuclear charge. The process is found to be efficient only when the applied pulse duration is shorter than radiative decay time.

As an example, calculation of characteristics of the fastest decaying Rb atomic states with $\eta = 7$ to 12 at $\epsilon = 3 \times 10^4$ v/cm shows that the electron shell effect increases the η -dependence of W even more. Thus it is shown that this selective ionization method is theoretically feasible using a relatively weak (<30 kv/cm) electric field. [Ivanov, L. N., and V. S. Letokhov. Selective ionization of atoms in optical and electric fields. Kvantovaya elektronika, no. 3, 1975, 585-590].

Lasers for Weather Forecasting (abstract)

Scientists at the Tomsk Institute for Optics of the Atmosphere report the theoretical possibility of using lasers to improve accuracy of weather forecasting, and describe some progress in remote air sounding with a laser. They calculate that in the next two or three years atmospheric density, temperature, pressure, and humidity data, size of aerosol particles, cloud thickness, and other data necessary for weather forecast could be deduced from laser atmospheric probe data at altitudes to 30 km. Presently, laser systems have been used to measure density, temperature, and pressure at 30 to 100 km altitudes, to determine the lower boundary of cloud strata, water content of the lower clouds, and vertical humidity profiles up to 3-4 km. The same scientists also report the successful application of laser atmospheric sounding in controlling air pollution above Soviet industrial centers, in natural gas prospecting, and in rupture detection in petroleum pipelines. [Antonov, V. Laser in weather forecast. Sov. Rossiya, no. 82, 8 Apr 1975, p. 4].

Eye Damage From Reflected Laser Light (abstract)

A report in a Soviet military medical journal details a study of eye damage caused by diffuse reflected laser radiation. The authors point out that while laboratory precautions are normally taken to shield eyes from a direct or mirrored beam, the same care is not often taken against reflection from non-reflector or diffusing surfaces, which can also be dangerous.

This was verified in tests on rabbits' eyes exposed to a free-running ruby laser beam reflected from a sheet of white drafting paper. Incident laser power was held constant and focused to a 1 cm spot in the paper; the rabbit's eye was exposed at 45° to the plane of the paper and at distances of 8 to 80 cm from the target spot. Significant and nearly instantaneous retinal damage was observed at ranges up to 40 cm; the physiology of the damage spot was then recorded for periods up to several weeks. While the damage area decreased linearly with distance, the reflected energy density remained effectively the same up to 40 cm range. No damage was detected at 80 cm, at least by ophthalmoscope.

The test thus demonstrates the need for stringent eye protection against reflected laser radiation from any kind of surface whatsoever. [Batman, A. B., Yu. P. Gudakovskiy, R. I. Kovach, and A. I. Semenov. Experimental study on effects of reflected laser radiation on the eye. *Voyenno-meditsinskiy zhurnal*, no. 3, 1975, 53-55].

Designing Shipboard Electronics Against Nuclear Explosion (verbatim)

A nuclear explosion imposes specific operating problems on shipboard electrical and electronic equipment. The pulse effect causes such damaging factors as shock wave, optical radiation, penetrating radiation, and electromagnetic effects. These factors in turn cause dynamic overloads in electrical and electronic equipment, serious enough to put the equipment out of operation. In an effort to reduce possible damage and improve equipment, resistance to the damaging effects of a nuclear explosion, these effects must be taken into account in the equipment development stage. A general rule in this regard is to design equipment so that it can be easily repaired in the event of damage. The article formulates the requirements for automatic-control system components, imposed by a potential nuclear explosion. Methods of computing the parameters of nuclear explosion effects under which equipment must function, are proposed. [Loginov, I. L. Requirements for electrical and electronic equipment in ship control systems, as imposed by a nuclear explosion. *Izvestiya Leningradskogo elektrotekhnicheskogo instituta*, no. 3, 1975, Abs. 3A435].

Recent Publications

Apollonov, V. V., and E. M. Shefter. Termicheskoye vozdeystviye mozhnogo lazernogo izlucheniya na poverkhnost' tverdogo tela (Thermal action of powerful laser radiation on a solid surface). FIAN Preprint no. 105, Moskva, 1974, 32 p. (KLDV, 3/75, no. 3936)

Fizika morya i atmosfery (Materialy Soveshchaniya, fevral' 1974) (Physics of the ocean and atmosphere. Conference proceedings, February 1974). Moskva, Izd-vo Nauka, 1974, 97 p. (RBL, 1/2 1975, no. 534)

Nanosekundnyye sil'notochnyye uskoriteli i ikh ispol'zovaniye. Annot. dokl. vsesoyuz. soveshch-seminar, Tomsk, 3-7 okt 1974 (Heavy-current nanosecond accelerators and their use. Annotated papers from All-Union Seminar, Tomsk, Oct. 3-7, 1974). Tomsk politekhn. in-t im. S. M. Kirova, 1974. (KLDV, 3/75, no. 4038)

Prikladnyye zadachi rasseyaniya i difraktsii radiolokatsionnykh signalov (Applied problems in scattering and diffraction of radar signals). Leningrad, 1974 (RZhF, 3/75, no. 3Zh104)

Problema vysokotemperaturnoy sverkhprovodimosti (The problem of high-temperature superconductivity). FIAN Preprint no. 74. Moskva, 1974. 102 p. (KLDV, 3/75, no. 4058)

Sannikov, B. P. Ispol'zovaniye tonkikh plastin polimerov dlya diagnostiki sil'notochnykh puchkov elektronov (Using thin polymer sheets in diagnosing heavy current e-beams). In-t yadernoy fiziki, SOAN, Preprint no. IYaF74-47, Novosibirsk, 1974, 10 p. (KLDV, 3/75, no. 4069)

Voprosy issledovaniya nizhnoy atmosfery i geomagnetizma (Problems in the study of geomagnetism and the lower atmosphere). Novosibirsk, 1974. (RZhF, 3/75, no. 3Zh153)

SOURCE IDENTIFICATION

DAN SSSR	-	Akademiya nauk SSSR. Doklady
FTT	-	Fizika tverdogo tela
KLDV	-	Cited in Knizhnaya letopis', dopolnitel'nyy vypusk
PTE	-	Pribory i tekhnika eksperimenta
RBL	-	Cited in Russian Book List
RZhElektr	-	Referativnyy zhurnal. Elektronika
RZhF	-	Referativnyy zhurnal. Geofizika
RZhGeofiz	-	Referativnyy zhurnal. Khimiya
RZhMekh	-	Referativnyy zhurnal. Mekhanika
RZhRadiot	-	Referativnyy zhurnal. Radiotekhnika
UFN	-	Uspekhi fizicheskikh nauk
VAN	-	Vestnik akademii nauk
ZhPMTF	-	Zhurnal prikladnoy mekhaniki i tekhnicheskoy fiziki
ZhTF	-	Zhurnal tekhnicheskoy fiziki