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TABLES OF CALCULATED TRANSITION PROBABILITIES FOR THE A-X SYSTEM OF OH

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June 1981

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Calculations have been carried out for the electronic transition probabilities as a function of vibrational and rotational level for the A-X system of the OH molecule. The electronic transition moment used is of hyperbolic form, combining a linear form at small internuclear distance with a smooth asymptotic behavior at large internuclear distance patterned after ab initio calculations. Wavefunctions were obtained using the RKR method.

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20. ABSTRACT: (Cont'd)

Presented in this report are full tables of transition probabilities, Einstein emission coefficients, and Einstein absorption coefficients for a wide range of levels.

TABLE OF CONTENTS

I. INTRODUCTION

Spectroscopic observations furnish a non-intrusive thermometer for use in gaseous systems over a wide range of temperature. From measurements of the relative intensities of lines or bands of some molecular electronic transition can be obtained the population distribution over a specified set of states. Under the presumption that thermal equilibrium does obtain, this distribution may be used to calculate a temperature for the internal degree of freedom corresponding to that particular set of states. When thermal equilibrium is not the case - as in a set of product states formed from some exoergic, perhaps chemiluminescent, reaction - then the population distribution itself is often of direct interest.

The techniques traditionally employed for this purpose have been absorption and emission measurements, providing vibrational and/or rotational population distributions for ground and excited electronic states, respectively. In the past few years, the method of laser-excited fluorescence (LEF) has been seen to furnish a very sensitive means of carrying out what is, essentially, an absorption measurement on a variety of (typically free radical) transient species. In addition to the high sensitivity, LEF also offers high spectral resolution and excellent spatial and temporal resolution.

Obtaining accurate population distributions from any of these three methods requires in turn accurate values of the electronic transition probability, i.e., that quantity connecting the intensity of a given line or band with the population of the level (or set of levels) responsible for its occurrence. The spectroscopy of the hydroxyl radical is of particular importance in this connection. First, OH is a nearly ubiquitous molecule in any high temperature system containing hydrogen and oxygen, and is a key participant in many reaction networks involved in combustion chemistry. It is easily monitored in emission, and has been studied relatively widely in absorption as well. In particular, it is a choice candidate for study by LEF, due both to its importance and the fact that the A-X system falls serendipitously in the wavelength region corresponding to the frequency-doubled output of some of the most efficient laser dyes. Second, the OH molecule is unusual in that the transition probability depends markedly on rotational level, a consequence of the strong variation in the electronic transition moment with internuclear distance coupled with the high degree of centrifugal distortion in this light molecule.

A recent series of papers[1-3] has addressed the specific problem of the accurate determination of transition probabilities as a function of vibrational and rotational levels for the $A^2\Sigma^+ - X^2\Pi_i$ system of the OH radical.

In I, laser excitation was used to populate individual v', J' levels of the A-state, and the intensity of emitted fluorescence returning to different v" levels of the X-state was measured. Ten bands were measured, providing seven independent ratios of transition probabilities with no necessary presumptions concerning the upper state vibrational temperature. These ratios were then examined in the light of predictions from assumed forms of the electronic transition moment and Morse oscillator wavefunctions. It was concluded that a linear form of the electronic transition moment best fitted the experimental data. Earlier experimental evidence, and prior theoretical calculations, were critically scrutinized for an overall consideration of the form of the transition moment. It was concluded that the "good" experimental data (not all the available numbers are of uniform quality, a fact not always recognized) best conformed to the predictions of the linear moment. While these considerations included only values of transition probabilities for low values of the rotational quantum number, they had implications for the rotational dependence of the transition probability as well.

In II, a similar series of experiments (providing six independent ratios) and a similar examination of prior literature data were undertaken for the OD isotopic species. The same conclusion was reached, that a linear form of the transition moment with the same value of slope as in I, best fitted the available data. This represents valid independent confirmation since the vibrational and rotational wavefunctions differ with mass, but the electronic transition moment, a property of the electronic wavefunctions, should not.

It was recognized that a linear electronic transition moment is not physically realistic, since the transition probability should not abruptly approach zero. Rather, there should exist a smooth tailing toward zero as the internuclear distance becomes quite large. This did not affect the important low-J ratios considered in I and II, but does have

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[1] *D. R. Crosley and R. K. Lengel, "Relative Transition Probabilities and the Electronic Transition Moment in the A-X System of OH", J. Quant. Spect. Radiat. Trans. 15, 579-591 (1975), referred to as I.*

[2] *D. R. Crosley and R. K. Lengel, "Relative Transition Probabilities in the A-X System of OD", J. Quant. Spect. Radiat. Trans. 17, 59-71 (1977), referred to as II.*

[3] *I. L. Chidsey and D. R. Crosley, "Calculated Rotational Transition Probabilities for the A-X System of OH", J. Quant. Spect. Radiat. Trans., to be published, 1980, referred to as III.*

noticeable influence on the transition probabilities for higher J of the more intense bands, and for certain weaker bands which effectively sample larger values of the internuclear distance.

Consequently, in order to provide values of transition probabilities over a large range of J useful for the determination of rotational temperatures, a more complex form of the transition moment must be considered. In III, the linear moment at small internuclear distance was combined with a smooth tail patterned after ab initio calculations of the transition moment, and a hyperbolic form of the transition moment was chosen as the simplest representation of the overall functional form. This moment was then used in conjunction with wavefunctions obtained from RKR construction of potential curves in order to calculate transition probabilities for a wide range of vibrational and rotational levels in the A-X system.

Aspects of the experiments, the comparison of data and calculations, the determination of the pertinent parameters of the models, and discussions of the results are presented in detail in I, II and III. In this report, we present the calculated values of the transition probabilities, and the Einstein emission and absorption coefficients, resulting from the use of the hyperbolic moment and the RKR wavefunctions, for the full range of vibrational and rotational levels described in III. (In that paper, only excerpted sets of these quantities -- for the more important bands -- were presented due to lack of available space.)

II. DEFINING EQUATIONS

In this section we collect the set of equations defining the quantities appearing in the tables, as well as some related ones. Single and double primes denote, respectively, the excited (A) and ground (X) states. v and J refer to vibrational and rotational quantum numbers.

For a dipole operator M_e and electronic wavefunctions ψ_e, the electronic transition moment R_e is given by

$$R_e(r) = \int_0^\infty \psi_e'(r,r_e) M_e(r,r_e) \psi_e''(r,r_e) dr_e \,. \tag{1}$$

Here r is the internuclear distance, and r_e signifies all electron coordinates. The transition probability for two vibrational-rotational levels is

$$p_{v''J''}^{v'J'} = \left| \int_0^\infty \Psi_{v'J'}(r) R_e(r) \psi_{v''J''}(r) dr \right|^2. \tag{2}$$

If R_e can be expressed as a linear function of r, p can be easily written in terms of the Franck-Condon factor

$$q_{v''J''}^{v'J'} = \left| \int_o^\infty \psi_{v'J'}(r)\psi_{v''J''}(r)dr \right|^2 \tag{3}$$

and the r-centroid

$$\bar{r}_{v''J''}^{v'J'} = \int_o^\infty \psi_{v'J'}(r)r\psi_{v''J''}(r)dr \Big/ \int_o^\infty \psi_{v'J'}(r)\psi_{v''J''}(r)dr. \tag{4}$$

The Einstein A-coefficient, or rate of emission (sec^{-1}) from the v'J' level to the v"J" level, is

$$A_{v''J''}^{v'J'} = \frac{64\pi^4}{3hc^3} p_{v''J''}^{v'J'} S_{J'J''} (\nu_{v''J''}^{v'J'})^3/(2J'+1) \tag{5}$$

where ν is the frequency of the transition. $S_{J'J''}$ is the rotational line strength, here normalized such that $\Sigma_{J''} S_{J'J''} = 2J' + 1$. It is an angular momentum factor denoting that portion of all emission from the J' level which goes into the particular J', J" branch. The lifetime of the excited level, $\tau_{v'J'}$, is the reciprocal of the sum of all Einstein coefficients for that level:

$$\tau_{v'J'} = (\Sigma_{v''J''} A_{v''J''}^{v'J'})^{-1}. \tag{6}$$

For absorption from the v"J" level, one must consider the Einstein B-coefficient

$$B_{v'J'}^{v''J''} = \frac{1}{4\pi} \frac{2J'+1}{2J''+1} \frac{c^2}{2h\nu^3} A_{v''J''}^{v'J'} = \frac{8\pi^3}{3h^2c} p_{v''J''}^{v'J'} S_{J'J''}/(2J''+1) . \tag{7}$$

A comment on the units of B is in order. They are $cm^2 erg^{-1} sec^{-1}$. An incident spectral power density per unit frequency interval in units of erg $cm^{-2} sec^{-1}$ Hz^{-1}, when multiplied by B, yields the rate of absorption per second (i.e., the number of absorptions per second per molecule).

The linear form of the transition moment used in the calculations of I and II, was

$$R_e(r) = c_\ell(1-\rho r) \tag{8}$$

where c_ℓ is a constant. In terms of q and $\bar{r}$, the transition probability for some (v',v'') band was then

$$P_{v'v''} = c_\ell^2 \; q_{v'v''} \; (1-\rho\bar{r}_{v'v''})^2. \tag{9}$$

The exponential form also examined in I and II, was (with c_e some constant)

$$R_e(r) = c_e \exp(-\alpha r). \tag{10}$$

The hyperbolic form used in III, was forced to two asymptotes. At large r,

$$R_e(r) \rightarrow R_e^\ell = 0; \tag{11}$$

and at small r,

$$R_e(r) \quad R_e^s = (1-\rho r). \tag{12}$$

This furnished the overall hyperbolic form

$$R_e(r) = c_h[(1-\rho r) + [(1-\rho r)^2 + a]^{1/2} \tag{13}$$

where c_h is a constant.

Since only relative values of the transition probabilities are calculated, the values of the constants c_ℓ, c_e, and c_h are unimportant. The parameters ρ, α, and a can be determined by obtaining a best fit to the results. For the linear moment, ρ was determined to be $0.75A^{-1}$

as first suggested by Shuler[4]; the details are discussed in I and II. The exponential moment calculations were carried out using values for α of 2.5Å^{-1}, following Learner[5], and 5.97^{-1} as an Anketell and Learner[6]. In III, the values $\rho = 0.756\text{Å}$ and $a = 0.00385$ were selected as constituting the best fit. The calculations producing the results given in the tables of this report were carried out with the hyperbolic movement and these parameters.

Table 1 gives the values of the spectroscopic constants for OH used in the programs for calculating the wavefunctions $\psi_{v'J''}$ and $\psi_{v''J''}$ in Eq (2). The calculations were carried out using the programs RKR and FCF furnished to us by Prof. R.N. Zare of Stanford University.

Tables 2, 3, and 4 list, for each band and for all rotational branches and levels, values of $p_{v''J''}^{v'J'}$ (Eq 2), $B_{v'J'}^{v''J''}$ (Eq 7) and $A_{v'J'}^{v''J''}$ (Eq 5), respectively.

The results given in the tables are on a relative basis. They may be placed on an absolute foundation using Eq (6) and German's value[7] of the radiative lifetime for the rotationless levels in v'=0 of 0.69 μsec. This value was obtained by a measurement of the LEF produced by a pulsed laser exciting single v',J' levels of $A^2\Sigma^+$. It is now in agreement with a reanalysis[8] of a similar experiment[9], and, in our opinion, this value constitutes the best one for this troublesome quantity.

On the other hand, temperature determinations from intensity measurements do not require absolute transition probabilities, only relative ones, and we have not made the conversion to absolute A and B coefficients in the tables.

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[4] *K. E. Shuler, "Kinetics of OH Radicals from Flame Emission Spectra. I. Vibrational Transition Probabilities, Intensities and Equilibrium in the $^2\Sigma^+ - {}^2\Pi$ Transition," J. Chem. Phys. 18, 1221-1226 (1950).*

[5] *R. C. M. Learner, "The Influence of Vibration-Rotation Interaction on Intensities in the Electronic Spectra of Diatomic Molecules. I. The Hydroxyl Radical," Proc. Roy. Soc. A269, 311-326 (1962).*

[6] *J. Anketell and R. C. M. Learner, "Vibration Rotation Interaction in OH and the Transition Moment," Proc. Roy. Soc. A301, 355-361 (1967).*

[7] *K. R. German, "Direct Measurement of the Radiative Lifetimes of the $A^2\Sigma^+$ (v=0) states of OH and OD," J. Chem. Phys. 62, 2584-2587 (1975).*

[8] *W. L. Dimpfl, private communication, 1976.*

[9] *J. H. Brophy, J. A. Silver and J. L. Kinsey, "Direct Measurement of the Radiative Lifetime of the $A^2\Sigma^+$ (v'=0, K'=1, J'=3/2) State of OH and OD," Chem. Phys. Lett. 28, 418-421 (1974).*

TABLE 1. SPECTROSCOPIC COEFFICIENTS USED IN RKR PROGRAM (cm^{-1})

Constant	$X^2\pi_i$	$A^2\Sigma^+$
D_o	35,410	18,840
T_o	0	32,402.1
ω_e	3,735.21	3,184.28
$\omega_e X_e$	82.81	97.84
B_e	18.871	17.369
α_e	0.714	0.8142
r_e (Å)	0.9707	1.0118

TABLE 2. VALUES OF THE VIBRATIONAL TRANSITION PROBABILITY, $P^{v'J'}_{v''J''}$, FOR ALL BANDS

	0 - 0 BAND			0 - 1 BAND		
J	P	Q	R	P	Q	R
.5	0	999	997	0	5	5
1.5	1000	997	993	5	5	6
2.5	997	993	987	5	5	6
3.5	994	988	980	4	5	6
4.5	989	981	972	4	5	6
5.5	982	973	962	4	5	6
6.5	974	963	950	4	5	7
7.5	965	952	937	3	5	7
8.5	954	939	923	3	5	7
9.5	941	925	907	3	5	7
10.5	927	910	890	3	5	7
11.5	912	893	872	3	4	7
12.5	895	875	852	2	4	7
13.5	877	855	831	2	4	7
14.5	857	834	809	2	4	7
15.5	837	812	785	2	4	7
16.5	815	789	761	2	4	7
17.5	791	764	735	1	4	7
18.5	767	738	708	1	4	7
19.5	741	712	680	1	3	7
20.5	714	684	651	1	3	7
21.5	686	655	622	1	3	7
22.5	658	625	591	1	3	7
23.5	628	595	560	0	3	6
24.5	598	564	529	0	2	6
25.5	566	532	496	0	2	6
26.5	535	500	464	0	2	5
27.5	502	468	431	0	2	5
28.5	470	435	398	0	2	5
29.5	437	402	366	0	1	4
30.5	403	369	333	0	1	4
31.5	370	336	301	0	1	3
32.5	337	303	269	0	1	3
33.5	305	271	238	0	0	2
34.5	272	240	207	0	0	2
35.5	241	209	178	0	0	2

The value of J listed is J". Differences for P between transitions to the $^2\Pi 1/2$ and $^2\Pi 3/2$ components are negligible here. All values are normalized to a value of 1000 for P(J=1.5) in the (0,0) band.

TABLE 2. VALUES OF THE VIBRATIONAL TRANSITION PROBABILITY, $P^{v''J''}_{v''J''}$, FOR ALL BANDS (CONTINUED)

	0 - 0 BAND			0 - 1 BAND		
J	P	Q	R	P	Q	R
.5	0	999	997	0	5	5
1.5	1000	997	993	5	5	6
2.5	997	993	987	5	5	6
3.5	994	988	980	4	5	6
4.5	989	981	972	4	5	6
5.5	982	973	962	4	5	6
6.5	974	963	950	4	5	7
7.5	965	952	937	3	5	7
8.5	954	939	923	3	5	7
9.5	941	925	907	3	5	7
10.5	927	910	890	3	5	7
11.5	912	893	872	3	4	7
12.5	895	875	852	2	4	7
13.5	877	855	831	2	4	7
14.5	857	834	809	2	4	7
15.5	837	812	785	2	4	7
16.5	815	789	761	2	4	7
17.5	791	764	735	1	4	7
18.5	767	738	708	1	4	7
19.5	741	712	680	1	3	7
20.5	714	684	651	1	3	7
21.5	686	655	622	1	3	7
22.5	658	625	591	1	3	7
23.5	628	595	560	0	3	6
24.5	598	564	529	0	2	6
25.5	566	532	496	0	2	6
26.5	535	500	464	0	2	5
27.5	502	468	431	0	2	5
28.5	470	435	398	0	2	5
29.5	437	402	366	0	1	4
30.5	403	369	333	0	1	4
31.5	370	336	301	0	1	3
32.5	337	303	269	0	1	3
33.5	305	271	238	0	0	2
34.5	272	240	207	0	0	2
35.5	241	209	178	0	0	2
36.5	210	179	149	0	0	1

TABLE 2. VALUES OF THE VIBRATIONAL TRANSITION PROBABILITY, $P^{V''J''}_{V''J''}$, FOR ALL BANDS (CONTINUED)

	1 - 0 BAND			1 - 1 BAND			1 - 2 BAND			1 - 3 BAND		
J	P	Q	R	P	Q	R	P	Q	R	P	Q	R
.5	0	253	254	0	603	599	0	7	8	0	2	2
1.5	252	254	257	604	600	593	7	8	8	2	2	2
2.5	251	254	258	603	596	587	7	7	8	2	2	2
3.5	250	254	259	601	592	580	6	7	9	2	2	2
4.5	249	254	260	598	587	572	6	7	9	2	2	2
5.5	248	254	261	594	580	563	6	7	9	2	2	2
6.5	247	254	262	589	572	552	5	7	9	2	2	2
7.5	246	254	263	582	563	541	5	7	9	2	2	2
8.5	245	254	264	574	552	528	4	6	9	2	2	2
9.5	244	254	264	565	541	514	4	6	9	2	2	2
10.5	243	254	265	554	528	499	4	6	9	2	2	2
11.5	242	253	266	543	514	483	3	6	9	2	2	2
12.5	241	253	266	530	499	466	3	5	9	2	2	2
13.5	240	253	267	516	483	448	2	5	9	2	2	2
14.5	239	253	267	501	466	430	2	5	8	2	2	2
15.5	238	252	267	484	448	410	2	4	8	2	2	2
16.5	236	252	267	467	430	390	1	4	8	2	2	2
17.5	235	251	266	449	410	369	1	4	8	2	2	2
18.5	234	250	265	430	390	348	1	4	7	2	2	2
19.5	233	249	264	410	369	326	1	3	7	2	2	2
20.5	231	247	263	389	347	304	0	3	7	2	2	2
21.5	230	246	261	368	325	282	0	3	6	2	2	2
22.5	228	244	258	346	303	259	0	2	6	2	2	2
23.5	225	241	255	324	280	237	0	2	6	2	2	2
24.5	223	238	251	301	258	215	0	2	5	2	2	2
25.5	220	235	247	278	235	193	0	2	5	2	2	2
26.5	217	231	242	255	213	171	0	2	5	2	2	2
27.5	213	226	235	232	191	150	0	1	4	1	2	1
28.5	209	220	228	209	169	130	0	1	4	1	1	1
29.5	204	213	219	187	148	111	0	1	4	1	1	1
30.5	198	205	209	165	128	93	0	1	3	1	1	1
31.5	191	196	197	144	108	76	0	1	3	1	1	1
32.5	183	186	183	124	90	60	0	1	3	1	1	0
33.5	173	173	167	104	73	46	0	1	3	0	0	0
34.5	162	159	149	85	57	33	0	1	2	0	0	0
35.5	149	142	129	68	50	22	0	1	2	0	0	0
36.5	133	123	106	52	30	14	0	1	2	0	0	0

TABLE 2. VALUES OF THE VIBRATIONAL TRANSITION PROBABILITY, $P^{v''J''}_{v''J'''}$, FOR ALL BANDS (CONTINUED)

	2 - 0 BAND			2 - 1 BAND			2 - 2 BAND		
J	P	Q	R	P	Q	R	P	Q	R
.5	0	42	43	0	395	396	0	302	298
1.5	42	42	43	394	395	397	303	299	293
2.5	41	42	44	393	395	398	303	297	288
3.5	41	43	45	391	394	398	303	294	283
4.5	41	43	45	390	393	397	302	291	277
5.5	41	43	46	388	392	397	300	286	270
6.5	40	43	47	386	391	396	297	281	263
7.5	40	44	48	384	389	395	293	275	255
8.5	40	44	49	381	388	393	289	268	246
9.5	40	45	50	379	385	392	284	261	236
10.5	40	45	51	376	383	389	277	253	226
11.5	41	46	52	373	380	387	270	244	210
12.5	41	47	53	370	377	383	262	234	205
13.5	41	47	55	366	373	379	254	224	193
14.5	41	48	56	362	369	375	244	213	181
15.5	42	49	57	358	365	369	234	202	169
16.5	42	50	59	353	360	363	224	190	157
17.5	43	51	61	347	354	356	212	178	144
18.5	44	53	62	342	347	348	200	165	131
19.5	45	54	64	335	339	339	188	153	119
20.5	46	55	66	328	331	329	175	140	106
21.5	47	57	68	320	321	317	162	127	94
22.5	48	58	70	311	311	304	149	114	82
23.5	49	60	72	301	299	290	135	101	70
24.5	50	62	74	290	285	274	122	88	59
25.5	52	63	76	278	271	256	108	76	49
26.5	53	65	77	264	254	237	95	65	39
27.5	54	66	79	249	236	216	82	54	30
28.5	56	68	80	232	217	194	70	43	23
29.5	57	69	80	214	196	171	58	34	16
30.5	59	70	80	195	174	147	47	26	11
31.5	60	70	80	175	151	123	37	18	6
32.5	61	70	78	153	128	100	28	12	3
33.5	61	69	75	131	105	77	20	8	1

TABLE 2. VALUES OF THE VIBRATIONAL TRANSITION PROBABILITY, $P_{V''J''}^{V'J'}$, FOR ALL BANDS (CONTINUED)

	2 - 3 BAND			2 - 4 BAND		
J	P	Q	R	P	Q	R
.5	0	8	8	0	5	5
1.5	8	8	9	5	5	5
2.5	7	8	9	5	5	5
3.5	7	8	9	5	5	5
4.5	7	8	9	5	5	5
5.5	6	8	9	5	5	5
6.5	6	7	9	5	5	5
7.5	5	7	9	5	5	5
8.5	5	7	9	4	4	4
9.5	4	6	9	4	4	4
10.5	4	6	9	4	4	4
11.5	3	5	8	4	4	4
12.5	3	5	8	4	4	4
13.5	2	5	8	4	4	4
14.5	2	4	8	3	4	3
15.5	2	4	7	3	3	3
16.5	1	4	7	3	3	3
17.5	1	3	7	3	3	3
18.5	1	3	7	3	3	3
19.5	1	3	6	2	3	2
20.5	0	3	6	2	2	2
21.5	0	3	6	2	2	2
22.5	0	2	6	2	2	2
23.5	0	2	5	2	2	1
24.5	0	2	5	1	1	1
25.5	0	2	5	1	1	1
26.5	0	2	5	1	1	1
27.5	0	2	5	1	1	1
28.5	0	2	4	1	1	0
29.5	0	2	4	0	0	0
30.5	0	2	4	0	0	0
31.5	0	2	3	0	0	0
32.5	0	2	3	0	0	0
33.5	0	2	2	0	0	0

TABLE 2. VALUES OF THE VIBRATIONAL TRANSITION PROBABILITY, $P_{v''J''}^{v''J''}$, FOR ALL BANDS (CONTINUED)

	3 - 0 BAND			3 - 1 BAND			3 - 2 BAND		
J	P	Q	R	P	Q	R	P	Q	R
.5	0	7	7	0	121	123	0	397	396
1.5	7	7	7	121	122	125	397	396	395
2.5	7	7	7	120	122	126	396	395	393
3.5	6	7	7	119	123	127	394	393	391
4.5	6	7	8	119	123	128	393	391	388
5.5	6	7	8	118	123	129	390	388	384
6.5	6	7	8	118	124	131	387	384	380
7.5	6	7	8	117	124	132	384	380	375
8.5	6	7	8	117	125	134	380	376	370
9.5	6	7	9	117	126	136	375	370	363
10.5	6	7	9	117	127	137	370	364	356
11.5	6	8	9	117	128	139	364	358	348
12.5	6	8	10	117	129	141	358	350	339
13.5	6	8	10	118	130	143	350	341	329
14.5	6	8	11	118	131	145	342	332	318
15.5	7	9	11	119	132	147	333	321	305
16.5	7	9	12	119	134	148	323	310	292
17.5	7	9	12	120	135	150	312	297	277
18.5	7	10	13	121	136	152	300	283	261
19.5	7	10	14	122	138	153	287	269	245
20.5	8	11	15	123	139	154	273	253	227
21.5	8	12	16	124	140	155	258	236	208
22.5	9	12	17	125	141	155	242	218	189
23.5	9	13	18	126	141	155	226	200	169
24.5	10	14	20	127	142	154	208	181	148
25.5	11	15	21	127	141	152	190	161	130
26.5	12	17	23	128	140	148	171	142	110
27.5	13	18	25	127	138	143	153	123	91
28.5	14	20	27	126	134	136	134	103	72
29.5	15	22	29	123	128	125	114	84	55
30.5	17	24	30	119	119	110	95	66	39

TABLE 2. VALUES OF THE VIBRATIONAL TRANSITION PROBABILITY, $P_{v''J''}^{v''J'''}$, FOR ALL BANDS (CONTINUED)

	3 - 3 BAND			3 - 4 BAND		
J	P	Q	R	P	Q	R
.5	0	115	112	0	10	10
1.5	116	113	109	10	10	11
2.5	117	112	106	9	10	11
3.5	117	111	104	9	10	11
4.5	117	109	100	8	9	11
5.5	116	107	96	8	9	11
6.5	116	104	92	7	9	11
7.5	114	102	88	7	8	11
8.5	113	98	84	6	8	10
9.5	110	95	79	6	8	10
10.5	108	91	74	5	7	10
11.5	105	87	69	5	7	10
12.5	101	82	64	4	6	9
13.5	97	77	58	4	6	9
14.5	93	72	53	3	6	9
15.5	88	67	47	3	5	8
16.5	82	61	42	3	5	8
17.5	77	55	36	2	5	8
18.5	71	49	31	2	5	7
19.5	65	44	26	2	4	7
20.5	59	38	21	2	4	7
21.5	52	32	17	2	4	6
22.5	46	27	13	1	4	6
23.5	40	22	9	1	3	6
24.5	34	17	6	1	3	5
25.5	28	13	4	1	3	5
26.5	23	10	2	1	3	4
27.5	18	6	1	1	3	4
28.5	13	4	0	1	2	3
29.5	9	2	0	1	2	2
30.5	6	1	0	1	2	2

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES

B = S + P 0 - 0 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	1000	0	565	1133	952	1133	417	665	278	565	79	1
2	132	899	467	396	630	1197	1165	360	409	429	596	83	2
3	118	871	607	289	444	1327	1280	285	281	524	636	72	3
4	94	859	683	216	327	1406	1369	223	204	586	668	59	4
5	74	852	728	164	248	1453	1429	176	153	626	691	48	5
6	58	845	756	127	191	1480	1468	141	118	652	705	39	6
7	46	836	771	100	151	1493	1490	114	94	668	714	32	7
8	37	826	779	80	122	1495	1500	94	75	676	717	26	8
9	30	816	781	65	99	1489	1500	78	62	679	716	22	9
10	25	803	778	54	83	1477	1493	66	51	677	711	18	10
11	21	790	772	45	69	1459	1480	56	43	672	704	16	11
12	18	774	763	38	59	1437	1462	48	36	663	694	13	12
13	15	758	752	32	50	1411	1439	42	31	653	683	11	13
14	13	741	740	28	44	1381	1412	37	27	640	669	10	14
15	11	723	725	24	38	1348	1382	32	23	625	654	9	15
16	10	703	708	21	34	1301	1349	28	20	608	637	8	16
17	9	683	691	18	30	1274	1313	25	18	590	619	6	17
18	8	661	672	16	26	1234	1275	22	16	571	600	6	18
19	7	639	651	14	24	1190	1234	20	14	550	579	5	19
20	6	615	630	12	22	1145	1190	18	12	528	557	5	20
21	6	591	607	11	20	1098	1145	17	11	505	535	4	21
22	5	566	584	10	18	1049	1098	15	10	482	511	4	22
23	5	540	559	9	16	999	1049	14	9	457	487	4	23
24	4	513	534	8	15	947	998	13	8	432	462	3	24
25	4	486	508	7	14	894	947	12	8	406	436	3	25
26	4	458	479	7	13	840	894	11	7	380	410	3	26
27	4	430	454	6	12	785	839	11	7	353	383	3	27
28	4	402	426	6	12	730	785	10	6	327	356	2	28
29	3	373	398	5	11	674	729	9	6	300	329	2	29
30	3	345	370	5	10	619	674	9	5	273	302	2	30
31	3	316	341	5	10	563	618	8	5	247	275	2	31
32	3	287	313	4	9	509	563	8	5	220	248	2	32

The value of N listed is N''. All values are normalized to a value of 1000 for $P_1(1)$ in the (0,0) band. Entries of zero mean values less than 0.5 with this normalization.

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S * P 0 - 1 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	5	0	3	6	5	6	2	3	1	3	0	1
2	0	4	2	2	3	6	6	2	2	2	3	0	2
3	0	4	2	1	2	7	6	1	1	3	3	0	3
4	0	4	3	1	1	7	7	1	0	4	4	0	4
5	0	3	3	1	1	8	7	0	0	4	4	0	5
6	0	3	3	0	1	8	7	0	0	4	4	0	6
7	0	3	3	0	0	8	8	0	0	5	5	0	7
8	0	3	3	0	0	8	8	0	0	5	5	0	8
9	0	2	2	0	0	8	8	0	0	5	5	0	9
10	0	2	2	0	0	8	8	0	0	5	5	0	10
11	0	2	2	0	0	8	7	0	0	5	5	0	11
12	0	2	2	0	0	8	7	0	0	5	5	0	12
13	0	2	2	0	0	7	7	0	0	6	5	0	13
14	0	2	2	0	0	7	7	0	0	6	6	0	14
15	0	1	1	0	0	7	7	0	0	6	6	0	15
16	0	1	1	0	0	7	7	0	0	6	6	0	16
17	0	1	1	0	0	7	7	0	0	6	6	0	17
18	0	1	1	0	0	6	6	0	0	6	6	0	18
19	0	1	1	0	0	6	6	0	0	6	6	0	19
20	0	1	1	0	0	6	6	0	0	5	5	0	20
21	0	1	1	0	0	6	6	0	0	5	5	0	21
22	0	0	0	0	0	5	5	0	0	5	5	0	22
23	0	0	0	0	0	5	5	0	0	5	5	0	23
24	0	0	0	0	0	4	5	0	0	5	5	0	24
25	0	0	0	0	0	4	4	0	0	5	5	0	25
26	0	0	0	0	0	4	4	0	0	4	4	0	26
27	0	0	0	0	0	3	4	0	0	4	4	0	27
28	0	0	0	0	0	3	3	0	0	4	4	0	28
29	0	0	0	0	0	3	3	0	0	3	4	0	29
30	0	0	0	0	0	2	2	0	0	3	3	0	30
31	0	0	0	0	0	2	2	0	0	3	3	0	31
32	0	0	0	0	0	1	2	0	0	2	2	0	32

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J'''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S + P 1 - 0 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	251	0	144	286	240	286	108	169	71	144	21	1
2	34	225	116	103	161	303	294	94	104	111	153	22	2
3	30	218	150	76	116	338	323	75	72	137	164	20	3
4	24	215	169	58	86	361	348	60	53	155	174	16	4
5	19	214	181	45	66	377	366	48	48	169	183	13	5
6	15	213	188	35	52	388	379	39	31	179	190	11	6
7	12	212	193	28	41	397	389	32	25	186	195	9	7
8	10	211	196	23	34	403	397	26	20	192	199	8	8
9	8	211	198	19	28	407	402	22	16	197	203	6	9
10	7	210	200	16	23	411	407	19	14	201	206	5	10
11	6	209	201	14	20	413	410	16	12	204	208	5	11
12	5	208	201	12	17	416	412	14	10	207	210	4	12
13	4	207	201	10	15	417	414	13	9	209	212	4	13
14	3	206	201	9	13	418	416	11	7	211	214	3	14
15	3	205	201	8	12	418	416	10	7	212	215	3	15
16	3	204	200	7	11	418	417	9	6	213	215	2	16
17	2	203	199	6	10	418	417	8	5	213	216	2	17
18	2	202	199	6	9	417	417	8	5	214	216	2	18
19	2	200	198	5	8	416	416	7	4	214	216	2	19
20	2	199	197	5	7	414	414	7	4	213	216	2	20
21	2	197	196	4	7	412	413	6	3	212	215	2	21
22	1	196	194	4	7	409	410	6	3	210	213	1	22
23	1	194	193	4	6	405	407	5	3	208	212	1	23
24	1	191	191	3	6	400	403	5	3	205	210	1	24
25	1	189	189	3	6	394	399	5	3	202	207	1	25
26	1	186	186	3	6	387	393	5	3	198	203	1	26
27	1	183	184	3	5	379	386	5	3	193	199	1	27
28	1	179	180	3	5	370	378	5	2	187	194	1	28

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S + P 1 - 1 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	601	0	339	683	567	683	255	405	164	339	48	1
2	82	541	279	239	384	713	698	222	252	252	355	51	2
3	74	524	364	175	273	789	765	177	174	307	377	44	3
4	60	518	410	131	203	835	816	139	127	342	394	36	4
5	47	513	438	99	154	861	851	109	96	364	406	29	5
6	37	509	455	77	119	875	872	87	74	377	412	24	6
7	30	503	464	60	94	879	883	71	59	383	414	19	7
8	24	496	469	48	76	876	885	58	47	385	413	16	8
9	19	488	469	39	61	868	881	48	39	383	409	13	9
10	16	479	466	32	51	855	872	40	32	378	403	11	10
11	13	469	461	26	42	839	859	34	27	371	395	9	11
12	11	458	454	22	36	819	842	29	22	362	385	7	12
13	9	446	445	18	30	796	822	25	19	351	374	6	13
14	8	432	435	15	26	771	799	21	16	339	361	5	14
15	7	418	423	13	22	744	774	18	14	326	348	5	15
16	6	403	410	11	19	714	746	16	12	311	333	4	16
17	5	387	397	9	17	683	717	14	10	296	318	3	17
18	4	370	382	8	15	651	685	12	9	280	302	3	18
19	4	353	366	7	13	616	652	11	8	263	285	2	19
20	3	335	349	6	11	581	618	9	7	246	268	2	20
21	3	316	331	5	10	545	583	8	6	229	250	2	21
22	3	297	313	4	9	508	546	7	5	211	232	1	22
23	2	278	295	4	8	470	509	6	5	193	214	1	23
24	2	258	275	3	7	433	472	6	4	175	196	1	24
25	2	238	256	3	6	395	434	5	4	158	177	1	25
26	2	219	237	2	6	357	396	5	3	140	159	1	26
27	2	199	217	2	5	320	358	4	3	123	142	1	27
28	1	179	197	2	4	284	321	4	2	107	125	0	28

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B_{v''J'''}^{v'J'}$ FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S * P 1 - 2 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	7	0	4	8	7	8	3	5	2	4	0	1
2	0	6	3	3	4	9	8	2	3	3	5	0	2
3	0	5	4	2	3	10	9	2	1	4	5	0	3
4	0	5	4	1	2	10	10	1	1	5	5	0	4
5	0	5	4	1	1	11	10	1	0	6	6	0	5
6	0	4	4	1	1	11	10	1	0	6	6	0	6
7	0	4	4	1	1	11	10	0	0	6	6	0	7
8	0	4	3	0	0	10	10	0	0	6	6	0	8
9	0	3	3	0	0	10	10	0	0	7	7	0	9
10	0	3	3	0	0	10	10	0	0	7	7	0	10
11	0	3	3	0	0	9	9	0	0	7	7	0	11
12	0	2	2	0	0	9	9	0	0	7	7	0	12
13	0	2	2	0	0	9	9	0	0	7	7	0	13
14	0	2	2	0	0	8	8	0	0	7	7	0	14
15	0	1	1	0	0	8	8	0	0	6	6	0	15
16	0	1	1	0	0	7	7	0	0	6	6	0	16
17	0	1	1	0	0	7	7	0	0	6	6	0	17
18	0	1	1	0	0	6	6	0	0	6	6	0	18
19	0	0	1	0	0	6	6	0	0	6	6	0	19
20	0	0	0	0	0	5	5	0	0	5	6	0	20
21	0	0	0	0	0	5	5	0	0	5	5	0	21
22	0	0	0	0	0	4	5	0	0	5	5	0	22
23	0	0	0	0	0	4	4	0	0	5	5	0	23
24	0	0	0	0	0	4	4	0	0	4	5	0	24
25	0	0	0	0	0	3	3	0	0	4	4	0	25
26	0	0	0	0	0	3	3	0	0	4	4	0	26
27	0	0	0	0	0	3	3	0	0	3	4	0	27
28	0	0	0	0	0	2	2	0	0	3	3	0	28

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S + P 2 - 0 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	41	0	24	47	40	47	18	28	12	24	3	1
2	5	37	19	17	27	50	48	16	17	18	25	4	2
3	5	36	24	13	19	57	54	13	12	23	28	3	3
4	4	35	27	10	14	61	58	10	8	27	30	3	4
5	3	35	29	8	11	64	61	8	6	29	32	2	5
6	2	35	30	6	9	66	64	6	5	32	33	2	6
7	2	35	31	5	7	68	66	5	4	34	35	1	7
8	1	35	32	4	6	70	68	4	3	35	36	1	8
9	1	35	32	3	5	72	70	4	2	37	37	1	9
10	1	35	33	3	4	73	71	3	2	38	38	1	10
11	1	35	33	2	3	75	73	3	2	40	40	1	11
12	0	35	33	2	3	77	74	2	1	41	41	0	12
13	0	35	34	2	2	78	76	2	1	43	42	0	13
14	0	36	34	1	2	80	78	2	1	44	43	0	14
15	0	36	35	1	2	82	79	2	1	46	45	0	15
16	0	37	35	1	2	84	81	1	1	47	46	0	16
17	0	37	36	1	1	86	83	1	1	49	48	0	17
18	0	38	36	1	1	88	85	1	0	50	49	0	18
19	0	38	37	1	1	90	87	1	0	52	51	0	19
20	0	39	38	1	1	93	90	1	0	54	52	0	20
21	0	40	38	1	1	95	92	1	0	55	54	0	21
22	0	41	39	1	1	98	95	1	0	57	56	0	22
23	0	0	0	1	0	101	97	0	0	0	0	0	23

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J'''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S + P 2 - 1 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	391	0	224	447	371	447	171	267	108	224	33	1
2	54	351	179	160	255	468	456	150	166	169	236	36	2
3	49	340	233	120	183	522	501	121	115	209	253	31	3
4	40	336	263	91	137	557	538	96	84	236	268	26	4
5	31	334	282	70	105	580	565	76	64	255	279	22	5
6	25	333	294	55	82	596	585	61	50	269	288	18	6
7	20	331	302	44	65	607	599	50	39	279	295	15	7
8	16	329	307	36	53	614	609	41	32	286	300	12	8
9	13	327	310	29	43	618	615	35	26	292	303	10	9
10	11	325	311	24	36	620	618	29	22	295	305	8	10
11	9	322	311	20	30	620	620	25	18	297	306	7	11
12	7	319	311	17	26	618	620	22	15	298	307	6	12
13	6	316	309	15	22	616	618	19	13	297	306	5	13
14	5	313	308	13	19	611	615	16	11	296	304	4	14
15	5	309	305	11	17	606	610	14	10	294	302	4	15
16	4	304	302	9	15	599	605	13	9	290	299	3	16
17	3	300	298	8	13	590	598	11	8	286	295	3	17
18	3	295	294	7	12	580	589	10	7	281	290	3	18
19	3	289	290	6	11	568	579	9	6	275	285	2	19
20	2	282	284	6	10	555	567	8	5	267	278	2	20
21	2	275	278	5	9	539	554	8	5	258	270	2	21
22	2	268	272	5	8	522	538	7	4	248	261	2	22
23	2	0	0	4	0	502	521	0	4	0	0	1	23

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B_{v''J'''}^{v'J'}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S + P 2 - 2 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	301	0	169	342	281	342	129	205	80	169	24	1
2	42	271	139	119	194	352	348	113	128	122	175	26	2
3	38	263	182	87	139	390	380	90	89	148	185	22	3
4	31	260	206	65	103	412	405	71	65	164	192	18	4
5	24	258	220	49	78	424	421	55	49	174	196	15	5
6	19	256	229	38	60	429	430	44	38	179	198	12	6
7	15	253	234	29	47	429	434	35	30	180	197	9	7
8	12	249	236	23	38	425	434	29	24	179	195	7	8
9	10	245	236	18	30	418	429	23	19	176	191	6	9
10	8	240	235	15	25	409	422	19	16	171	186	5	10
11	7	234	231	12	20	398	412	16	13	162	180	4	11
12	5	227	227	9	17	384	401	13	11	159	173	3	12
13	4	219	221	8	14	369	387	11	9	152	165	2	13
14	4	211	215	6	11	353	372	9	7	143	157	2	14
15	3	202	207	5	10	335	355	8	6	134	148	2	15
16	2	193	199	4	8	317	338	7	5	125	138	1	16
17	2	183	191	3	7	297	319	6	4	116	128	1	17
18	2	173	181	3	6	277	299	5	4	106	118	1	18
19	1	162	171	2	5	256	278	4	3	96	108	0	19
20	1	151	161	2	4	234	257	3	3	86	98	0	20
21	1	139	150	1	3	213	236	3	2	76	88	0	21
22	1	128	139	1	3	191	214	2	2	67	78	0	22
23	1	0	0	1	0	170	193	0	2	0	0	0	23

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B ≈ S ⁴ P 2 - 3 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	8	0	5	9	8	9	3	5	2	5	0	1
2	1	7	3	3	5	10	9	3	3	4	5	0	2
3	0	6	4	2	3	11	10	2	2	5	5	0	3
4	0	6	4	2	2	11	11	2	1	5	6	0	4
5	0	5	4	1	2	11	11	1	1	6	6	0	5
6	0	5	4	1	1	11	11	1	0	6	6	0	6
7	0	4	4	1	1	11	11	0	0	6	7	0	7
8	0	4	4	0	0	11	11	0	0	6	7	0	8
9	0	3	3	0	0	10	10	0	0	7	7	0	9
10	0	3	3	0	0	10	10	0	0	6	7	0	10
11	0	3	3	0	0	9	9	0	0	6	7	0	11
12	0	2	2	0	0	9	9	0	0	6	6	0	12
13	0	2	2	0	0	8	8	0	0	6	6	0	13
14	0	2	2	0	0	8	8	0	0	6	6	0	14
15	0	1	1	0	0	7	7	0	0	6	6	0	15
16	0	1	1	0	0	7	7	0	0	6	6	0	16
17	0	1	1	0	0	6	6	0	0	5	6	0	17
18	0	1	1	0	0	6	6	0	0	5	5	0	18
19	0	0	1	0	0	5	5	0	0	5	5	0	19
20	0	0	0	0	0	5	5	0	0	5	5	0	20
21	0	0	0	0	0	5	5	0	0	5	5	0	21
22	0	0	0	0	0	4	4	0	0	5	5	0	22
23	0	0	0	0	0	4	4	0	0	0	0	0	23

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S • P 2 - 4 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	5	0	3	6	5	6	2	3	1	3	0	1
2	0	4	2	2	3	6	6	2	2	2	3	0	2
3	0	4	3	1	2	7	6	1	1	2	3	0	3
4	0	4	3	1	1	7	7	1	1	3	3	0	4
5	0	4	3	0	1	7	7	1	0	3	3	0	5
6	0	4	4	0	1	7	7	0	0	3	3	0	6
7	0	4	4	0	0	7	7	0	0	3	3	0	7
8	0	4	4	0	0	7	7	0	0	3	3	0	8
9	0	4	4	0	0	7	7	0	0	3	3	0	9
10	0	4	3	0	0	7	7	0	0	3	3	0	10
11	0	3	3	0	0	7	7	0	0	3	3	0	11
12	0	3	3	0	0	7	7	0	0	3	3	0	12
13	0	3	3	0	0	6	7	0	0	3	3	0	13
14	0	3	3	0	0	6	6	0	0	3	3	0	14
15	0	3	3	0	0	6	6	0	0	2	3	0	15
16	0	3	3	0	0	6	6	0	0	2	3	0	16
17	0	2	3	0	0	5	6	0	0	2	2	0	17
18	0	2	2	0	0	5	5	0	0	2	2	0	18
19	0	2	2	0	0	5	5	0	0	2	2	0	19
20	0	2	2	0	0	4	5	0	0	2	2	0	20
21	0	2	2	0	0	4	4	0	0	2	2	0	21
22	0	2	2	0	0	4	4	0	0	1	2	0	22
23	0	0	0	0	0	3	4	0	0	0	0	0	23

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$ FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S + P 3 - 0 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	7	0	4	8	6	8	3	4	2	4	0	1
2	0	6	3	3	4	8	8	2	3	3	4	0	2
3	0	5	4	2	3	9	9	2	2	4	4	0	3
4	0	5	4	1	2	10	9	1	1	4	5	0	4
5	0	5	4	1	2	10	10	1	1	5	5	0	5
6	0	5	5	1	1	11	10	1	0	5	5	0	6
7	0	5	5	0	1	11	11	1	0	6	6	0	7
8	0	5	5	0	1	12	11	0	0	6	6	0	8
9	0	5	5	0	0	12	11	0	0	6	6	0	9
10	0	5	5	0	0	12	12	0	0	7	7	0	10
11	0	5	5	0	0	13	12	0	0	7	7	0	11
12	0	5	5	0	0	13	12	0	0	7	7	0	12
13	0	5	5	0	0	13	13	0	0	8	8	0	13
14	0	0	0	0	0	14	13	0	0	0	0	0	14
15	0	0	0	0	0	14	14	0	0	0	0	0	15

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$ FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S + P 3 - 1 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	119	0	69	137	114	137	54	82	33	69	10	1
2	9	107	54	50	79	144	139	47	51	53	73	11	2
3	15	103	70	38	58	161	153	39	36	65	79	10	3
4	12	101	79	29	44	172	165	31	26	75	84	9	4
5	10	101	84	23	34	181	174	25	20	82	89	7	5
6	8	101	88	19	27	188	182	21	16	88	93	6	6
7	6	101	91	15	22	193	188	17	13	93	96	5	7
8	5	101	92	12	18	197	192	14	10	97	99	4	8
9	4	101	94	10	15	201	196	12	8	100	102	4	9
10	3	101	95	9	13	204	200	10	7	103	105	3	10
11	3	101	96	8	11	207	203	9	6	106	107	3	11
12	2	101	96	7	10	210	206	8	5	109	109	2	12
13	2	101	97	6	8	213	209	7	4	111	112	2	13
14	2	0	0	5	0	216	212	0	4	0	0	2	14
15	2	0	0	5	0	219	215	0	3	0	0	2	15

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B_{v''J'''}^{v'J'}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S + P 3 - 2 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	392	0	224	450	368	450	174	271	106	224	34	1
2	32	352	179	161	258	464	454	153	170	165	234	37	2
3	52	340	232	121	189	515	497	125	120	202	249	33	3
4	43	336	262	92	143	548	532	100	88	228	262	27	4
5	34	334	281	72	110	569	557	80	68	245	271	23	5
6	27	332	293	56	87	582	575	65	53	256	278	19	6
7	22	329	301	45	69	589	586	53	42	263	282	15	7
8	18	326	305	36	56	592	592	44	34	267	284	13	8
9	15	323	307	30	46	591	594	37	28	269	284	11	9
10	12	319	307	25	39	587	592	31	23	268	283	9	10
11	10	314	305	21	33	580	588	26	20	266	280	8	11
12	9	308	302	17	28	571	581	23	17	262	276	6	12
13	7	302	298	15	24	560	572	20	14	256	270	5	13
14	6	0	0	13	0	546	560	0	12	0	0	5	14
15	6	0	0	11	0	531	547	0	11	0	0	4	15

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S + P 3 - 3 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	114	0	63	130	105	130	50	79	29	63	9	1
2	9	104	53	45	75	132	131	43	50	44	65	10	2
3	15	101	69	33	54	145	143	35	35	54	68	8	3
4	12	100	79	24	41	153	152	28	26	58	70	7	4
5	10	100	85	18	31	157	158	22	20	61	71	5	5
6	8	99	88	14	24	158	161	17	15	62	70	4	6
7	6	98	91	11	19	158	161	14	12	62	69	3	7
8	5	97	92	8	15	155	160	11	10	60	67	3	8
9	4	95	92	6	12	151	158	9	8	58	65	2	9
10	3	93	91	5	10	147	154	7	6	56	62	1	10
11	3	90	90	4	8	141	149	6	5	53	59	1	11
12	2	87	88	3	6	134	143	5	4	49	55	1	12
13	2	83	85	2	5	127	136	4	4	45	51	1	13
14	1	0	0	2	0	119	128	0	3	0	0	0	14
15	1	0	0	1	0	110	120	0	2	0	0	0	15

TABLE 3. VALUES OF THE EINSTEIN B-COEFFICIENTS $B^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

B = S * P 3 - 4 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	9	0	6	11	9	11	4	6	3	6	0	1
2	0	8	4	4	6	12	11	4	4	4	6	1	2
3	1	8	5	3	4	13	12	3	2	5	6	0	3
4	0	7	5	2	3	13	13	2	1	6	7	0	4
5	0	7	6	2	2	14	13	2	1	7	7	0	5
6	0	6	6	1	2	14	13	1	1	7	7	0	6
7	0	6	5	1	1	13	13	1	0	7	8	0	7
8	0	5	5	1	1	13	13	1	0	7	8	0	8
9	0	5	5	0	1	13	13	0	0	7	8	0	9
10	0	4	4	0	0	12	12	0	0	7	8	0	10
11	0	4	4	0	0	11	12	0	0	7	7	0	11
12	0	4	4	0	0	11	11	0	0	7	7	0	12
13	0	3	3	0	0	10	11	0	0	7	7	0	13
14	0	0	0	0	0	10	10	0	0	0	0	0	14
15	0	0	0	0	0	9	9	0	0	0	0	0	15

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES

A = S * P * NU ** 3 0 - 0 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	1000	0	140	559	477	561	210	667	93	140	26	1
2	130	671	461	131	310	599	578	182	307	162	199	31	2
3	86	575	447	107	218	663	634	144	187	212	239	29	3
4	61	529	446	85	160	701	678	113	127	247	269	25	4
5	44	501	444	67	120	724	708	89	91	272	290	21	5
6	33	481	440	53	93	736	726	71	68	290	305	17	6
7	25	464	434	43	73	740	735	58	53	302	316	14	7
8	20	449	427	35	58	739	739	47	42	309	322	12	8
9	16	435	420	29	47	734	737	40	34	314	326	10	9
10	13	421	410	24	39	726	731	33	27	315	327	9	10
11	10	408	401	20	33	715	722	28	23	315	327	7	11
12	9	395	390	17	27	701	711	24	19	313	324	6	12
13	7	382	380	14	23	686	697	21	16	309	320	5	13
14	6	369	368	12	20	668	682	18	14	304	315	5	14
15	5	355	357	10	17	650	664	16	12	297	309	4	15
16	4	342	344	9	15	623	645	14	10	290	301	4	16
17	4	328	332	8	13	607	624	12	9	281	293	3	17
18	3	314	319	7	12	585	603	11	8	272	284	3	18
19	3	300	305	6	10	561	580	10	7	261	274	2	19
20	2	285	292	5	9	536	556	9	6	251	263	2	20
21	2	271	278	5	8	510	531	8	5	239	252	2	21
22	2	256	264	4	7	484	505	7	5	227	240	2	22
23	2	242	250	4	7	457	479	7	4	215	228	2	23
24	2	227	236	3	6	430	452	6	4	202	215	1	24
25	1	212	222	3	6	402	425	6	3	189	202	1	25
26	1	198	207	3	5	375	398	5	3	176	189	1	26
27	1	183	193	2	5	347	370	5	3	163	176	1	27
28	1	169	179	2	4	319	342	4	3	149	162	1	28
29	1	155	165	2	4	292	315	4	2	136	149	1	29
30	1	141	151	2	4	265	288	4	2	123	135	1	30
31	1	127	137	2	4	238	261	4	2	110	122	1	31
32	1	114	124	1	3	213	234	3	2	97	109	1	32

The value of N listed is N". All values are normalized to a value of 1000 for $P_1(1)$ in the (0,0) band. Entries of zero mean values less than 0.5 with this normalization.

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A_{v''J'''}^{v'J'}$ FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 0 - 1 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	3	0	0	2	1	2	0	2	0	0	0	1
2	0	2	1	0	1	2	2	0	1	0	0	0	2
3	0	1	1	0	0	2	2	0	0	1	1	0	3
4	0	1	1	0	0	2	2	0	0	1	1	0	4
5	0	1	1	0	0	2	2	0	0	1	1	0	5
6	0	1	1	0	0	2	2	0	0	1	1	0	6
7	0	1	1	0	0	2	2	0	0	1	1	0	7
8	0	1	1	0	0	2	2	0	0	1	1	0	8
9	0	1	1	0	0	2	2	0	0	1	1	0	9
10	0	1	1	0	0	2	2	0	0	1	1	0	10
11	0	0	0	0	0	2	2	0	0	1	1	0	11
12	0	0	0	0	0	2	2	0	0	2	1	0	12
13	0	0	0	0	0	2	2	0	0	2	2	0	13
14	0	0	0	0	0	2	2	0	0	2	2	0	14
15	0	0	0	0	0	2	2	0	0	2	2	0	15
16	0	0	0	0	0	2	2	0	0	2	2	0	16
17	0	0	0	0	0	2	2	0	0	2	2	0	17
18	0	0	0	0	0	2	2	0	0	2	2	0	18
19	0	0	0	0	0	2	2	0	0	2	2	0	19
20	0	0	0	0	0	2	2	0	0	2	2	0	20
21	0	0	0	0	0	2	2	0	0	2	2	0	21
22	0	0	0	0	0	1	1	0	0	1	1	0	22
23	0	0	0	0	0	1	1	0	0	1	1	0	23
24	0	0	0	0	0	1	1	0	0	1	1	0	24
25	0	0	0	0	0	1	1	0	0	1	1	0	25
26	0	0	0	0	0	1	1	0	0	1	1	0	26
27	0	0	0	0	0	1	1	0	0	1	1	0	27
28	0	0	0	0	0	1	1	0	0	1	1	0	28
29	0	0	0	0	0	0	1	0	0	1	1	0	29
30	0	0	0	0	0	0	0	0	0	1	1	0	30
31	0	0	0	0	0	0	0	0	0	1	1	0	31
32	0	0	0	0	0	0	0	0	0	0	0	0	32

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$ FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 1 - 0 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	327	0	46	184	157	185	71	221	31	46	9	1
2	43	219	149	44	104	198	189	62	102	54	66	11	2
3	29	187	144	37	74	220	209	49	63	72	80	10	3
4	20	173	144	30	55	234	224	39	43	85	91	9	4
5	15	164	144	24	42	244	235	31	31	95	100	7	5
6	11	158	143	19	32	251	244	25	23	103	106	6	6
7	9	153	142	16	26	255	249	21	18	109	112	5	7
8	7	149	140	13	21	258	253	17	14	114	116	4	8
9	5	146	139	11	17	260	256	14	11	117	119	4	9
10	4	143	137	9	14	261	258	12	9	121	122	3	10
11	3	140	135	8	12	262	259	11	8	123	124	3	11
12	3	137	133	7	10	262	259	9	7	125	126	2	12
13	2	135	131	5	9	261	259	8	6	127	128	2	13
14	2	132	129	5	8	260	258	7	5	128	129	2	14
15	2	130	127	4	7	259	257	6	4	129	129	2	15
16	1	128	125	4	6	257	255	6	4	129	130	1	16
17	1	125	123	3	5	255	254	5	3	129	130	1	17
18	1	123	121	3	5	252	251	5	3	129	130	1	18
19	1	120	119	3	4	249	249	4	3	128	129	1	19
20	1	118	117	2	4	246	246	4	2	127	128	1	20
21	1	115	114	2	4	242	242	4	2	126	127	1	21
22	1	113	112	2	3	238	239	3	2	124	126	1	22
23	0	110	109	2	3	233	234	3	2	122	124	1	23
24	0	107	107	2	3	228	230	3	1	120	122	1	24
25	0	104	104	2	3	222	224	3	1	117	119	1	25
26	0	101	101	1	3	216	218	3	1	113	116	1	26
27	0	98	98	1	3	208	217	3	1	109	112	1	27
28	0	94	95	1	2	200	205	3	1	105	108	0	28

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A_{v''J''}^{v'J'}$ FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 1 - 1 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	570	0	79	319	269	320	122	385	52	80	15	1
2	76	382	261	74	179	338	328	106	179	90	112	18	2
3	51	328	254	61	127	373	359	84	110	117	134	17	3
4	36	302	253	49	94	394	383	66	75	136	150	15	4
5	26	286	253	39	71	406	399	52	54	150	161	12	5
6	20	274	251	31	55	411	408	42	40	158	168	10	6
7	15	264	248	24	43	412	412	34	31	164	173	8	7
8	12	255	243	20	34	410	412	28	25	166	175	7	8
9	9	246	238	16	28	405	409	23	20	167	176	6	9
10	8	238	233	13	23	397	404	19	16	166	175	5	10
11	6	229	226	11	19	388	396	16	13	164	173	4	11
12	5	221	220	9	16	378	387	14	11	161	169	3	12
13	4	212	212	7	13	365	376	12	9	157	165	3	13
14	3	203	205	6	11	352	364	10	8	152	160	2	14
15	3	194	197	5	9	338	351	9	6	146	155	2	15
16	2	185	188	4	8	323	336	7	5	139	148	2	16
17	2	175	180	4	7	307	321	6	5	133	141	1	17
18	2	166	171	3	6	290	305	6	4	125	134	1	18
19	1	156	162	3	5	273	288	5	3	118	127	1	19
20	1	146	152	2	4	256	271	4	3	110	119	1	20
21	1	136	143	2	4	238	254	4	2	101	110	1	21
22	1	127	133	1	3	220	236	3	2	93	102	0	22
23	1	117	124	1	3	202	218	3	2	85	94	0	23
24	0	107	114	1	2	184	200	2	2	76	85	0	24
25	0	98	105	1	2	166	182	2	1	68	77	0	25
26	0	88	95	1	2	149	165	2	1	60	68	0	26
27	0	79	86	1	2	132	147	1	1	53	60	0	27
28	0	70	77	0	1	116	131	1	1	45	53	0	28

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 1 - 2 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	5	0	0	2	2	2	1	3	0	0	0	1
2	0	3	2	0	1	3	2	1	1	0	1	0	2
3	0	2	2	0	1	3	3	0	0	1	1	0	3
4	0	2	1	0	0	3	3	0	0	1	1	0	4
5	0	2	1	0	0	3	3	0	0	1	1	0	5
6	0	1	1	0	0	3	3	0	0	1	1	0	6
7	0	1	1	0	0	3	3	0	0	2	2	0	7
8	0	1	1	0	0	3	3	0	0	2	2	0	8
9	0	1	1	0	0	3	3	0	0	2	2	0	9
10	0	1	1	0	0	3	3	0	0	2	2	0	10
11	0	1	1	0	0	3	3	0	0	2	2	0	11
12	0	0	0	0	0	3	3	0	0	2	2	0	12
13	0	0	0	0	0	2	2	0	0	2	2	0	13
14	0	0	0	0	0	2	2	0	0	2	2	0	14
15	0	0	0	0	0	2	2	0	0	2	2	0	15
16	0	0	0	0	0	2	2	0	0	2	2	0	16
17	0	0	0	0	0	2	2	0	0	2	2	0	17
18	0	0	0	0	0	2	2	0	0	2	2	0	18
19	0	0	0	0	0	2	2	0	0	2	2	0	19
20	0	0	0	0	0	1	1	0	0	1	1	0	20
21	0	0	0	0	0	1	1	0	0	1	1	0	21
22	0	0	0	0	0	1	1	0	0	1	1	0	22
23	0	0	0	0	0	1	1	0	0	1	1	0	23
24	0	0	0	0	0	1	1	0	0	1	1	0	24
25	0	0	0	0	0	1	1	0	0	1	1	0	25
26	0	0	0	0	0	1	1	0	0	1	1	0	26
27	0	0	0	0	0	0	0	0	0	1	1	0	27
28	0	0	0	0	0	0	0	0	0	1	1	0	28

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 2 - 0 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	37	0	5	21	17	21	8	25	3	5	1	1
2	5	24	16	5	12	22	21	7	11	6	7	1	2
3	3	21	16	4	8	25	23	5	7	8	9	1	3
4	2	19	16	3	6	27	25	4	4	10	10	1	4
5	1	18	16	2	5	28	27	3	3	11	12	1	5
6	1	17	16	2	3	29	28	3	2	12	12	0	6
7	1	17	15	2	3	30	29	2	2	13	13	0	7
8	0	17	15	1	2	31	30	2	1	14	14	0	8
9	0	16	15	1	2	31	30	1	1	15	15	0	9
10	0	16	15	1	1	32	31	1	1	16	15	0	10
11	0	16	15	1	1	32	31	1	0	16	16	0	11
12	0	16	15	0	1	33	32	1	0	17	17	0	12
13	0	16	15	0	1	34	32	1	0	18	17	0	13
14	0	16	15	0	1	34	33	0	0	18	18	0	14
15	0	16	15	0	0	35	34	0	0	19	18	0	15
16	0	16	15	0	0	35	34	0	0	20	19	0	16
17	0	16	15	0	0	36	35	0	0	20	20	0	17
18	0	16	15	0	0	37	35	0	0	21	20	0	18
19	0	16	15	0	0	37	36	0	0	21	21	0	19
20	0	16	15	0	0	38	37	0	0	22	21	0	20
21	0	16	15	0	0	39	37	0	0	23	22	0	21
22	0	16	15	0	0	39	38	0	0	23	23	0	22
23	0	0	0	0	0	40	39	0	0	0	0	0	23

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$ FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 2 - 1 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	477	0	67	269	226	270	105	326	44	68	13	1
2	65	319	216	64	153	285	275	92	152	78	96	16	2
3	44	273	210	54	110	318	302	74	94	102	115	15	3
4	31	252	210	44	82	338	324	59	64	121	131	13	4
5	23	240	210	35	62	351	340	47	46	134	142	11	5
6	17	231	209	28	48	360	351	38	35	145	151	10	6
7	13	224	207	23	38	365	359	31	27	152	158	8	7
8	10	217	205	19	31	368	363	25	21	158	163	7	8
9	8	212	202	15	25	369	366	21	17	162	166	6	9
10	7	207	199	13	21	368	366	18	14	165	169	5	10
11	5	202	196	11	17	367	365	15	12	167	171	4	11
12	4	197	192	9	15	363	363	13	10	168	171	3	12
13	4	192	189	8	12	360	360	11	8	168	171	3	13
14	3	188	185	7	11	355	356	10	7	167	171	2	14
15	2	183	181	6	9	349	351	8	6	166	169	2	15
16	2	178	176	5	8	342	345	7	5	164	168	2	16
17	2	173	172	4	7	335	338	7	4	161	165	1	17
18	1	167	167	4	6	326	331	6	4	157	162	1	18
19	1	162	162	3	5	317	322	5	3	153	158	1	19
20	1	156	157	3	5	306	312	5	3	148	153	1	20
21	1	150	151	2	4	294	302	4	2	142	148	1	21
22	1	143	146	2	4	282	290	4	2	136	142	1	22
23	1	0	0	2	0	268	277	0	2	0	0	1	23

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$ FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 2 - 2 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	269	0	37	151	125	151	58	184	24	37	7	1
2	37	181	122	35	85	157	154	51	86	41	52	8	2
3	25	155	119	29	61	174	168	40	53	53	62	8	3
4	18	143	120	23	45	183	179	32	36	62	69	7	4
5	13	136	120	18	34	188	186	25	26	67	73	5	5
6	10	130	119	14	26	190	191	20	20	70	76	4	6
7	7	125	118	11	20	190	191	16	15	72	78	4	7
8	6	121	116	9	16	187	190	13	12	73	78	3	8
9	4	116	113	7	13	184	188	10	9	72	77	2	9
10	3	112	110	5	10	179	184	8	7	71	76	2	10
11	3	107	107	4	8	173	179	7	6	67	74	1	11
12	2	103	103	3	7	166	173	6	5	66	71	1	12
13	2	98	99	3	5	159	166	5	4	63	68	1	13
14	1	93	95	2	4	151	159	4	3	60	65	1	14
15	1	88	91	2	4	143	151	3	3	56	61	0	15
16	1	83	86	1	3	134	143	3	2	52	57	0	16
17	1	78	81	1	2	125	134	2	2	48	53	0	17
18	0	72	76	1	2	116	125	2	1	44	49	0	18
19	0	67	71	1	2	106	115	1	1	40	45	0	19
20	0	62	66	0	1	96	106	1	1	36	40	0	20
21	0	56	60	0	1	87	96	1	1	31	36	0	21
22	0	51	55	0	1	77	86	1	0	27	32	0	22
23	0	0	0	0	0	68	77	0	0	0	0	0	23

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A_{v''J'''}^{v'J'}$ FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 2 - 3 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	7	0	1	4	3	4	1	5	0	1	0	1
2	0	4	3	1	2	4	4	1	2	1	1	0	2
3	0	3	2	0	1	5	4	1	1	1	1	0	3
4	0	3	2	0	1	5	4	0	0	2	2	0	4
5	0	2	2	0	0	5	5	0	0	2	2	0	5
6	0	2	2	0	0	5	5	0	0	2	2	0	6
7	0	2	2	0	0	5	5	0	0	2	2	0	7
8	0	2	2	0	0	4	4	0	0	2	2	0	8
9	0	1	1	0	0	4	4	0	0	2	2	0	9
10	0	1	1	0	0	4	4	0	0	2	2	0	10
11	0	1	1	0	0	4	4	0	0	2	2	0	11
12	0	1	1	0	0	3	4	0	0	2	2	0	12
13	0	1	1	0	0	3	3	0	0	2	2	0	13
14	0	0	0	0	0	3	3	0	0	2	2	0	14
15	0	0	0	0	0	3	3	0	0	2	2	0	15
16	0	0	0	0	0	3	3	0	0	2	2	0	16
17	0	0	0	0	0	2	2	0	0	2	2	0	17
18	0	0	0	0	0	2	2	0	0	2	2	0	18
19	0	0	0	0	0	2	2	0	0	2	2	0	19
20	0	0	0	0	0	2	2	0	0	2	2	0	20
21	0	0	0	0	0	2	2	0	0	2	2	0	21
22	0	0	0	0	0	1	1	0	0	2	2	0	22
23	0	0	0	0	0	1	1	0	0	0	0	0	23

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 2 - 4 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	4	0	0	2	2	2	1	3	0	0	0	1
2	0	3	2	0	1	2	2	0	1	0	0	0	2
3	0	2	2	0	1	3	3	0	0	1	1	0	3
4	0	2	2	0	0	3	3	0	0	1	1	0	4
5	0	2	2	0	0	3	3	0	0	1	1	0	5
6	0	2	2	0	0	3	3	0	0	1	1	0	6
7	0	2	2	0	0	3	3	0	0	1	1	0	7
8	0	2	1	0	0	3	3	0	0	1	1	0	8
9	0	1	1	0	0	3	3	0	0	1	1	0	9
10	0	1	1	0	0	3	3	0	0	1	1	0	10
11	0	1	1	0	0	3	3	0	0	1	1	0	11
12	0	1	1	0	0	3	3	0	0	1	1	0	12
13	0	1	1	0	0	3	3	0	0	1	1	0	13
14	0	1	1	0	0	2	2	0	0	1	1	0	14
15	0	1	1	0	0	2	2	0	0	1	1	0	15
16	0	1	1	0	0	2	2	0	0	1	1	0	16
17	0	1	1	0	0	2	2	0	0	1	1	0	17
18	0	1	1	0	0	2	2	0	0	1	1	0	18
19	0	1	1	0	0	2	2	0	0	0	1	0	19
20	0	0	1	0	0	1	2	0	0	0	0	0	20
21	0	0	0	0	0	1	1	0	0	0	0	0	21
22	0	0	0	0	0	1	1	0	0	0	0	0	22
23	0	0	0	0	0	1	1	0	0	0	0	0	23

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 3 - 0 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	5	0	0	3	2	3	1	4	0	0	0	1
2	0	3	2	0	1	3	3	1	1	1	1	0	2
3	0	3	2	0	1	4	3	0	1	1	1	0	3
4	0	3	2	0	1	4	4	0	0	1	1	0	4
5	0	2	2	0	0	4	4	0	0	1	1	0	5
6	0	2	2	0	0	4	4	0	0	2	2	0	6
7	0	2	2	0	0	4	4	0	0	2	2	0	7
8	0	2	2	0	0	5	4	0	0	2	2	0	8
9	0	2	2	0	0	5	4	0	0	2	2	0	9
10	0	2	2	0	0	5	5	0	0	2	2	0	10
11	0	2	2	0	0	5	5	0	0	2	2	0	11
12	0	2	2	0	0	5	5	0	0	3	2	0	12
13	0	2	2	0	0	5	5	0	0	3	3	0	13
14	0	0	0	0	0	5	5	0	0	0	0	0	14
15	0	0	0	0	0	5	5	0	0	0	0	0	15

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 3 - 1 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	100	0	14	57	48	57	22	69	9	14	3	1
2	8	67	45	14	32	60	58	20	32	16	20	3	2
3	9	57	43	12	24	67	63	16	20	22	25	3	3
4	7	52	43	9	18	72	68	13	14	26	28	3	4
5	5	50	43	8	14	75	72	10	10	30	31	2	5
6	4	48	43	6	11	78	75	8	7	32	33	2	6
7	3	47	43	5	9	80	77	7	6	35	35	2	7
8	2	46	42	4	7	81	79	6	4	37	37	1	8
9	2	45	42	4	6	82	80	5	4	38	38	1	9
10	1	44	42	3	5	84	81	4	3	40	40	1	10
11	1	43	41	3	4	84	82	4	2	41	41	1	11
12	1	43	41	2	3	85	83	3	2	42	42	1	12
13	1	42	41	2	3	86	84	3	2	43	43	1	13
14	0	0	0	2	0	86	85	0	1	0	0	0	14
15	0	0	0	1	0	87	85	0	1	0	0	0	15

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 3 - 2 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	445	0	63	252	209	253	100	308	40	63	13	1
2	36	298	201	60	144	263	255	88	145	71	88	16	2
3	43	255	194	51	105	292	279	72	90	92	106	15	3
4	31	235	194	41	79	310	299	57	62	108	119	13	4
5	23	223	194	33	61	321	312	46	46	120	128	11	5
6	18	214	194	27	47	327	321	37	34	128	135	9	6
7	14	207	192	22	38	330	326	30	27	133	140	8	7
8	11	201	189	18	30	330	328	25	21	137	143	6	8
9	9	195	186	15	25	328	328	21	17	139	145	5	9
10	7	189	183	12	21	324	326	17	14	139	145	5	10
11	6	183	178	10	17	318	321	15	12	139	144	4	11
12	5	177	174	9	15	312	316	13	10	137	143	3	12
13	4	170	169	7	12	303	309	11	8	134	140	3	13
14	3	0	0	6	0	293	301	0	7	0	0	2	14
15	3	0	0	5	0	284	291	0	6	0	0	2	15

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A_{v''J'''}^{v'J'}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 3 - 3 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	96	0	13	54	44	54	21	66	8	13	2	1
2	8	65	44	12	31	55	54	18	31	14	18	3	2
3	9	56	43	10	22	61	59	15	20	18	21	3	3
4	7	51	43	8	16	64	63	11	13	20	23	2	4
5	5	49	43	6	12	65	65	9	10	22	24	2	5
6	4	47	43	5	9	66	66	7	7	23	25	1	6
7	3	45	43	4	7	65	66	6	6	23	25	1	7
8	2	44	42	3	6	64	66	4	4	23	25	1	8
9	2	42	41	2	4	62	64	4	3	22	24	0	9
10	1	40	40	2	4	60	63	3	3	21	24	0	10
11	1	39	39	1	3	57	60	2	2	20	22	0	11
12	1	37	37	1	2	54	57	2	2	19	21	0	12
13	0	35	36	1	2	51	54	1	1	17	20	0	13
14	0	0	0	0	0	47	51	0	1	0	0	0	14
15	0	0	0	0	0	44	48	0	1	0	0	0	15

TABLE 4. VALUES OF THE EINSTEIN A-COEFFICIENTS $A^{v'J'}_{v''J''}$, FOR ALL BANDS AND BRANCHES (CONTINUED)

A = S * P * NU ** 3 3 - 4 BAND

N	O12	P1	P2	Q12	P12	Q1	Q2	R21	Q21	R1	R2	S21	N
1	0	8	0	1	4	4	4	1	5	0	1	0	1
2	0	5	3	1	2	5	4	1	2	1	1	0	2
3	0	4	3	1	1	5	5	1	1	1	2	0	3
4	0	3	3	0	1	5	5	1	1	2	2	0	4
5	0	3	3	0	1	5	5	0	0	2	2	0	5
6	0	3	2	0	0	5	5	0	0	2	2	0	6
7	0	2	2	0	0	5	5	0	0	2	2	0	7
8	0	2	2	0	0	5	5	0	0	2	3	0	8
9	0	2	2	0	0	5	5	0	0	3	3	0	9
10	0	2	2	0	0	5	5	0	0	3	3	0	10
11	0	1	1	0	0	4	4	0	0	2	3	0	11
12	0	1	1	0	0	4	4	0	0	2	3	0	12
13	0	1	1	0	0	4	4	0	0	2	2	0	13
14	0	0	0	0	0	4	4	0	0	0	0	0	14
15	0	0	0	0	0	3	3	0	0	0	0	0	15

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