Fourier Transform Emission Spectroscopy of the A' ${}^{1}\Pi - X^{1}\Sigma^{+}$ and $A^{1}\Pi - X^{1}\Sigma^{+}$ Systems of IrN

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The emission spectrum of IrN has been investigated in the 10 000–20 000 cm⁻¹ region at 0.02 cm⁻¹ resolution using a Fourier transform spectrometer. The bands were excited in an Ir hollow cathode lamp operated with a mixture of 2 Torr of Ne and a trace of N₂. Numerous bands have been classified into two transitions labeled as $A^1\Pi - X^1\Sigma^+$ and $A' {}^1\Pi - X^1\Sigma^+$ by analogy with the isoelectronic PtC molecule. Ten bands involving vibrational levels up to v = 4 in the ground and excited states have been identified in the $A^1\Pi - X^1\Sigma^+$ transition. This electronic transition has been previously observed by [A. J. Marr, M. E. Flores, and T. C. Steimle, J. Chem. Phys. 104, 8183–8196 (1996)]. To lower wavenumbers, five additional bands with *R* heads near 12 021, 12 816, 13 135, 14 136, and 15 125 cm⁻¹ have been assigned as the 0–1, 3–3, 0–0, 1–0, and 2–0 bands, respectively, of the new $A' {}^1\Pi - X^1\Sigma^+$ transition. A rotational analysis of these bands has been carried out and equilibrium constants for the ground and excited states have been extracted. The v = 2 and 3 vibrational levels of the $A' {}^1\Pi$ state interact with the v = 0 and 1 levels of the $A^1\Pi$ state and cause global perturbations in the bands. The ground state equilibrium constants for 193 IrN are: $\omega_e = 1126.176360(61) \text{ cm}^{-1}$, $\omega_e x_e = 6.289697(32) \text{ cm}^{-1}$, $B_e = 0.5001033(20) \text{ cm}^{-1}$, $\alpha_e = 0.0032006(20) \text{ cm}^{-1}$, and $r_e = 1.6068276(32)$ Å. @ 1999 Academic Press

INTRODUCTION

Bonding and electronic structure of transition metal-containing molecules have been of interest in several areas such as catalysis, ab initio calculations, and astrophysics. Transition metal atoms have relatively high abundances in many stars (1-3) and several transition metal hydrides and oxides have also been detected (1-10). There is a strong possibility that transition metal nitrides may also be found. So far, nitride molecules have not been observed in stellar atmospheres, in part due to lack of precise spectroscopic data required for a meaningful search in the complex stellar spectra. The experimental data are also required to test ab initio calculations. The electronic spectra of several transition metal nitrides have recently been analyzed at high resolution (11-22) and considerable progress has been made in theoretical studies (22-31). Still, there are only limited and fragmentary spectroscopic data available for a number of transition metal nitride molecules and much more work is necessary.

Among the Ir-containing molecules, the electronic spectra of IrO (32–35) and IrC (36–38) have been known for some time and IrN spectra have been recently observed by Marr *et al.* (21). Marr *et al.* (21) observed a ${}^{1}\Pi - {}^{1}\Sigma^{+}$ transition near 15 190 cm⁻¹ by laser excitation spectroscopy (21). Although there are no *ab initio* predictions available for the spectroscopic properties of IrN, this transition was assigned as the $A^{1}\Pi - X^{1}\Sigma^{+}$ transition by comparison with the results available for the isoelectronic PtC molecule (39–42). Marr *et al.* (21) have also resolved the hyperfine structure for the *R*(0) line in the 0–0

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and 1-0 bands and have measured the dipole moments by the Stark effect. For the isovalent RhN molecule, a ${}^{1}\Sigma{}^{-1}\Sigma$ transition has recently been observed near 22 400 cm⁻¹ by Balfour and coworkers (17), but no RhN bands are known in the red and near infrared regions. For PtC, a $B^1\Sigma^+$ state has been found near 32 700 cm^{-1} , and there are at least two low-lying electronic states $A'^{-1}\Pi$ and $A''^{-1}\Sigma^+$ observed below the $A^{-1}\Pi$ state (41). To search for the corresponding states of IrN, we have recorded the spectra in the $10\,000-20\,000$ cm⁻¹ region using a Fourier transform spectrometer. In this work, we have identified a new A' ${}^{1}\Pi - X^{1}\Sigma^{+}$ transition of IrN near 13 135 cm⁻¹, in addition to the bands belonging to the $A^{1}\Pi - X^{1}\Sigma^{+}$ transition observed previously (21). A number of new bands involving vibrational levels up to v = 4 in the ground and excited states of the $A^{1}\Pi - X^{1}\Sigma^{+}$ system have also been identified. The $A'' \Sigma^+$ state was not detected either because of weak intensity of the $A'' {}^{1}\Sigma^{+} - X^{1}\Sigma^{+}$ bands or because the A'' ${}^{1}\Sigma^{+}$ state lies below 10 000 cm⁻¹. A rotational analysis of a number of the $A'^{-1}\Pi - X^{1}\Sigma^{+}$ and $A^{1}\Pi - X^{1}\Sigma^{+}$ bands has been carried out and the results are reported in this paper.

EXPERIMENTAL

The IrN bands were produced in a hollow cathode lamp. The cathode was prepared by pressing a mixture of Ir and Cu metal powder (1:3 ratio) in a 10-mm diameter hole in a copper block. After tightly filling the hole, the block was bored through to give a 8-mm diameter hole in the center. This procedure provided a 1-mm thick layer of the Cu/Ir mixture on the inner wall of the cathode. The lamp was operated at 600 mA and 350 V current with a slow flow of a mixture of 2 Torr of Ne carrier





FIG. 1. A compressed portion of the spectrum showing the 0-1 band of the $A^{1}\Pi - X^{1}\Sigma^{+}$ system and the 1-0 band of the $A'^{1}\Pi - X^{1}\Sigma^{+}$ system of IrN.

gas and about 10 mTorr of N₂. Most of the IrN bands are badly overlapped with strong N₂ bands present in the same region. Only a few IrN bands are free from N₂ overlapping and can be picked out easily in our spectra. The carrier of the new bands was established by flowing a trace of O₂ instead of N₂ into the cathode. The new bands disappeared when N₂ was replaced by O₂ and reappeared when N₂ was added again, consistent with an IrN carrier.

The spectra were recorded with the 1-m Fourier transform spectrometer associated with the McMath-Pierce Solar Telescope of the National Solar Observatory at Kitt Peak. The spectrometer was equipped with a visible beam splitter and Si photodiode detectors. No filters were used to record the spectra in the $10\,000-20\,000$ cm⁻¹ region. In total, 36 scans were co-added in about 4.5 h of integration. In addition to the IrN bands, the observed spectra also contained Ir and Ne atomic lines in addition to very strong N2 molecular lines. The spectra were calibrated using the measurements of Ne atomic lines made by Palmer and Engleman (43). The absolute accuracy of the wavenumber scale is expected to be on the order of ± 0.002 cm^{-1} . The strong lines of IrN appear with a typical signal-tonoise ratio of 12:1; therefore the precision of measurements of strong and unblended IrN lines is expected to be better than ± 0.003 cm⁻¹. However, the uncertainty in the measurement of the IrN lines which are blended with N2 lines is larger and these lines were included with lower weights in our fits.

OBSERVATIONS

The spectra were measured using a program called PC-DECOMP developed by J. Brault at Kitt Peak. The peak positions were determined by fitting a Voigt lineshape function to each spectral feature and the branches were sorted using a color Loomis–Wood program running on a PC computer.

The IrN bands are located in the 10 000–18 500 cm⁻¹ region. All of the observed bands have been classified into two ${}^{1}\Pi {-}^{1}\Sigma^{+}$ transitions with the 0–0 bands near 15 190 and 13 135

cm⁻¹. These two transitions have been assigned as the $A^{1}\Pi - X^{1}\Sigma^{+}$ and $A'^{1}\Pi - X^{1}\Sigma^{+}$ transitions adopting the notation used for the isoelectronic PtC molecule. The $A^{1}\Pi - X^{1}\Sigma^{+}$ transition has also been previously observed by Marr *et al.* (21) by laser excitation spectroscopy. The $A'^{1}\Pi - X^{1}\Sigma^{+}$ transition has been observed for the first time.

A. The $A^{I}\Pi - X^{I}\Sigma^{+}$ Transition

The 0-0 band of this transition is located near 15 190 cm⁻¹ and is heavily overlapped by a strong N₂ band. In spite of this overlapping, IrN rotational lines were easily distinguished because of their narrow linewidths and the relatively small separation between consecutive rotational lines in a branch. Our color Loomis-Wood program was very helpful in identifying the weak lines in the overlapped bands. The characteristic isotopic pattern was also very helpful in identifying IrN lines. Ir has two naturally occurring isotopes ¹⁹¹Ir and ¹⁹³Ir, with abundances of 37.4 and 62.6%, respectively. The 191 IrN/ 193 IrN molecular lines, therefore, are expected to be observed with an approximate intensity ratio of 1:2. The 0-2, 0-1, 1-0, and 2-0 bands of the $A^{1}\Pi - X^{1}\Sigma^{+}$ transition, located near 12 970, 14 078, 16 074, and 16 959 cm^{-1} , respectively, were initially identified by the characteristic isotopic pattern of the lines. Of these bands, only 0-1, 1-0, and 2-0 are relatively free from overlapping by N₂. Once a rotational analysis of these bands was obtained, other vibrational bands with v = 3 and 4 in the ground and excited state were predicted using extrapolated molecular constants and were identified in spite of strong overlapping by N₂. In addition to the 0-0, 1-0, 3-0, and 4-0bands previously observed by Marr et al. (21), the 0-2, 0-1, 1-3, 2-0, 2-4, 3-1, and 4-1 bands were identified for the first time. A compressed part of the 0-1 band is presented in Fig. 1, while an expanded portion of the 1-0 band is provided in Fig. 2, with *P*- and *Q*-branch lines of the 191 IrN/ 193 IrN isotopomers marked.



FIG. 2. An expanded portion of the 1-0 band of the $A^1\Pi - X^1\Sigma^+$ system of IrN with the lines of the ¹⁹¹IrN and ¹⁹³IrN isotopomers marked.

B. The A' ${}^{I}\Pi - X^{I}\Sigma^{+}$ Transition

The 0–0 band of this transition is located near 13 135 cm⁻¹. Most of the bands of this transition are also heavily overlapped by N₂ bands, except for the weak 1–0 band (Fig. 1). In fact, the 1–0 band of this transition was the only one which could be identified initially. The other bands were found with the help of ground state combination differences obtained in the analysis of the $A^1\Pi - X^1\Sigma^+$ transition. Ultimately five bands, namely 0–1, 0–0, 1–0, 2–0, and 3–3, located near 12 027, 13 135, 14 140, 15 123, and 12 818 cm⁻¹, respectively, were identified and rotationally analyzed.

A search for the $A'' {}^{1}\Sigma^{+}-X^{1}\Sigma^{+}$ transition, which is expected to be near 1 μ m, was unsuccessful, probably due to its weak intensity and overlapping from strong N₂ bands. The $A'' {}^{1}\Sigma^{+}-X^{1}\Sigma^{+}$ transition could, however, lie just below the 9500 cm⁻¹ cutoff of the Si detectors. Improved spectra will be required for the identification of the $A'' {}^{1}\Sigma^{+}-X^{1}\Sigma^{+}$ bands.

RESULTS AND DISCUSSION

Each band consists of a single *R*, a single *P*, and a single *Q* branch for each isotopomer with no Λ doubling, as expected for a ${}^{1}\Pi - {}^{1}\Sigma^{+}$ transition. Although the first lines, *R*(0), *Q*(1), and *P*(2) were generally not identified because of overlapping by N₂ bands and by the returning *R* lines after the formation of the head, there is no doubt in the assignment since many bands are interconnected by common vibrational levels. Moreover, our observed line positions in the 0–0 and 1–0 bands of the $A^{1}\Pi - X^{1}\Sigma^{+}$ transition agree well with the lines observed by Marr *et al.* (*21*) in their laser excitation experiments. The *R* and *P* branches appear with similar intensity and the *Q* branch is the most intense branch. The lines of both isotopomers 191 IrN and 193 IrN were measured and analyzed. The observed line positions of the $A^{1}\Pi - X^{1}\Sigma^{+}$ transitions of the most abundant 193 IrN isotopomer are provided in Table 1.

A table of observed line positions of the minor isotopomer ¹⁹¹IrN has been deposited in the editorial office as supplement and can also be obtained from the authors upon request.² The molecular constants were determined by fitting the observed line positions with the customary energy level expressions for ${}^{1}\Sigma^{+}$ (Eq. [1]) and ${}^{1}\Pi$ (Eq. [2]) states:

$$F_{v}(J) = T_{v} + B_{v}J(J+1) - D_{v}[J(J+1)]^{2} + H_{v}[J(J+1)]^{3}, \quad [1]$$

$$F_{v}(J) = T_{v} + B_{v}J(J+1) - D_{v}[J(J+1)]^{2} + H_{v}[J(J+1)]^{3} \pm \frac{1}{2}\{qJ(J+1)\}. \quad [2]$$

In the final fit, the badly blended lines were given a reduced weighting and overlapped lines were excluded in order to improve the standard deviation of the fit. The bands of both transitions were initially fitted separately. In the final fit, however, the lines of both transitions were combined and a global fit was obtained to determine a single set of molecular constants for each vibrational level of ¹⁹¹IrN and ¹⁹³IrN. The molecular constants obtained for the $X^1\Sigma^+$, $A'^{-1}\Pi$, and $A^{1}\Pi$ states of ¹⁹¹IrN and ¹⁹³IrN are provided in Tables 2 and 3, respectively.

A careful inspection of the molecular constants of the $A^1\Pi$ state indicates that the vibrational intervals of $\Delta G_{1/2} = 882.19547(56)$ cm⁻¹, $\Delta G_{3/2} = 885.9101(10)$ cm⁻¹, $\Delta G_{5/2} = 866.8519(15)$ cm⁻¹, and $\Delta G_{7/2} = 843.5562(16)$ cm⁻¹ vary in an irregular manner. A similar problem was noted for the vibrational spacings in the $A'^{-1}\Pi$ state [$\Delta G_{1/2} = 1000.82076(75)$ cm⁻¹, $\Delta G_{3/2} =$ 987.57817(75) cm⁻¹, $\Delta G_{5/2} = 994.8464(13)$ cm⁻¹]. Although no localized rotational perturbations have been observed in the range of observed J values, a global interaction between v = 2 of the A'

² Supplementary data for this article may be found on the journal home page (http://www.academicpress.com/jms).

TABLE 1Observed Line Positions (in cm⁻¹) for the $A^1\Pi - X^1\Sigma^+$ and $A' \ ^1\Pi - X^1\Sigma^+$ Systems of 193 IrN

J	R(J)	O- C	P(J)	0-C	Q(J)	0-C	R(J)	0-С	P(J)	0-C	Q(J)	0-С
			$\mathbf{A}^{1}\Pi - \mathbf{X}^{1}\Sigma^{+},$	4 - 1					$\mathbf{A}^{1}\Pi - \mathbf{X}^{1}\Sigma^{+},$	3 - 1		
6					17549.2131	-6						
7					17548.4053	116						
8	17555.3270	52			17547.4538	-27						
9	17555.1320	-96			17546.3976	-46						
10	17554.8521	80			17545.2289	-16	16711.7256	29	16601 1601	122	16702.0497	131
11	17554.4279	-16	17522 0557	106	17543.9348	-68	16711.3939	58	16691.1621	132	16700.8281	12
12	17553 2403	-44	17520 6600	-100	17542.5515	-42	16710.3884	-20	10066.9555	106	16698 0625	36
14	17552 4854	40	17527 1535	-110	17539.3690	-22	16709.7152	-79	16684.2106	44	16696.5124	-2
15	17551.5918	-54	17524.5294	-23	17537.6150	21	16708.9482	3	16681.6728	9	16694.8537	-25
16	17550.6051	96			17535.7344	-28	16708.0561	-64	16679.0253	-24	16693.0859	-37
17	17549.4808	46	17518.9206	-26	17533.7428	-12	16707.0673	1			16691.2075	-56
18			17515.9366	-66	17531.6353	19	16705.9593	-27	14400 1014		16689.2205	-61
19	17546.8913	64	17512.8520	61	17529.4002	-50	16704.7373	-96	166/0.4246	-123	16687.1278	-25
20	17543.4210	84 66	17509.0200	-48	17527.0575	-10	16701 0774	-33	16664 1501	-136	16682 6001	-00-
21	17542 1215	-00	17502 8556	-20 51	17522 0176	30	16700.4403	-27	16660.8751	153	16680.1763	-63
23	17540.2876	-13	17499.2846	6	17519.3206	49	16698.7875	-16	100000000	100	16677.6432	-43
24			17495.6058	57	17516.4976	-12	16697.0288	32	16653.9129	-154	16674.9977	-52
25	17536.2859	28	17491.8057	70	17513.5680	39	16695.1486	-40	16650.2955	-34	16672.2422	-66
26	17534.1184	153	17487.8813	16	17510.5140	26	16693.1661	-42	16646.5568	-35	16669.3832	-21
27	17531.8062	14	17483.8458	26	17507.3405	-1	16691.0768	-18	16642.7127	0	16666.4136	9
28	17529.4002	120	17479.6924	33	17504.0560	42	16686 5660	-18	16634 6866	-21	16660 1308	-8
30	17520.8480	-4/	17475.4174	26	17300.0433	-12	16684 1522	-J 41	16630 5189	-45	16656 8405	8
31	17521.4189	-88	17466.5248	47	17493.4796	37	16681.6195	-1	16626.2371	29	16653.4343	36
32	17518.5354	-15	17461.8891	-56	17489.7157	18	16678.9844	22	16621.8390	-40	16649.9182	56
33	17515.5222	-52	17457.1563	50	17485.8343	8			16617.3513	81	16646.2879	20
34	17512.4005	13	17452.2891	-8	17481.8358	14			16612.7350	-1	16642.5556	54
35	17509.1532	14	17447.3108	4	17477.7195	28	16670.4246	87	16608.0251	65	16638.7133	73
36	17505.7850	-4	17442.2153	26	17473.4814	13	16667.3402	-26	16603.1955	17	16634.7636	106
3/	17408 6010	-100	17437.0039	-63	17469.1259	-14	16660 8691	-17	16598.2017	0 7	16626 5260	41 58
- 20 - 20	17498.0910	-40	17426 2074	-05	17460 0537	-14	16657 4670	-35	16588.0745	40	16622.2454	31
40	17491.1313	42	17420.6404	22	17455.3422	-26	16653.9643	22	16582.8138	6	16617.8557	7
41	17487.1584	-53	17414.9493	11	17450.5134	4	16650.3474	24	16577.4456	-22	16613.3632	40
42	17483.0882	77	17409.1459	65	17445.5570	-49	16646.6158	-33	16571.9739	-6	16608.7559	10
43	17478.8803	27	17403.2106	-13			16642.7851	7	16566.3950	19	16604.0434	12
44	17474.5641	95	17397.1615	-39	17435.2992	-19	16638.8402	-8	16560.7065	26	16599.2203	-6
45 46	17465 5462	-112	17390.99994	-5	17429.9884	-29	16630 6333	-73	16548 0055	-12	16580 2462	-28
40	17460 8573	-73	17378 3004	-101	17419 0092	-29	16626.3502	-73	16542.9818	-67	16584,1013	-47
48	17456.0527	-77	17371.7837	-44	17413.3442	17	16621.9704	-79	16536.8662	-12	16578.8440	-66
49	17451.1306	-49	17365.1298	-156	17407.5497	-29	16617.4851	-50	16530.6346	-37	16573.4788	-76
50	17446.0923	24	17358.3918	87	17401.6437	12	16612.8891	-35	16524.2945	-65	16568.0108	-28
51	17440.9276	42	17351.4940	-72	17395.6074	-45	16608.1937	79	16517.8539	-18	16562.4280	-38
52	17435.6407	50			17389.4593	-15	16603.3784	87	16511.3018	-3	16556.7416	4
53 54	17430.2400	151			17376 7009	14 24	10398.4475	30	10504.0443	41	10220.9210	95
55	1/424.0920	-41			17370 2828	54 1						
56	17413.2779	64			17363.6478	-2						
57	17407.3728	-34			17356.8940	21						
58					17350.0182	37						
			$\mathbf{A}^{1}\Pi - \mathbf{X}^{1}\Sigma^{+}$,	3 - 0					$A^1\Pi - X^1\Sigma^+$,	2 - 4		
	17925 4202				17017 5046				125((0(20	00	10572 1021	
ð	17825.4292	92 19			17816 4574	89 145			12500.0020	-82 2	12573.1921	20
10	17824 9618	25			17815 2818	86			12504.4500	2	12571 6436	-20 55
11	17824.5449	-90			17813.9959	91	12581.4212	-24	12560.9638	-16	12570.7475	42
12	17824.0304	-14			17812.5843	8			12559.1106	92	12569.7720	48
13	17823.3779	-151			17811.0608	-28	12581.1778	78	12557.1732	170	12568.7069	-27
14	17822.6370	-6			17809.4327	56	10000 0000		12555.1320	21	12567.5674	-32
15	17821.7785	128	17794.4918	22	17807.6759	20	12580.5909	4	12553.0277	53	12566.3502	0
16	17820.7772	-0 22	17791.7435	105	17805.8122	79 51	12580.1836	51	12550.8373	36	12565.0524	40
17 18	17818 4556	-32 46	17785 8030	-53	17801 7105	-51	12579.0000	-49	12546.2020	18 _94	12505.0020	-24 30
19	17817.1051	-83	17782.8157	123	17799.4916	-52	12578.4595	-58	12543.7824	20	12560.6622	84
-*												

Note: O-C are the observed minus calculated wavenumbers in units of 10^{-4} cm⁻¹.

TABLE 1—Continued

J	R(J)	0-C	P (J)	0-C	Q(J)	0-С	R(J)	0-C	P (J)	0-C	Q(J)	0-C
20	17815.6568	-28	17779.5836	-80	17797.1526	-90	12577.7114	-32	12541.2654	-16	12559.0276	16
21	17814.0915	20	17776.2561	-77	17794.7035	-68	12576.8864	-82	12538.6696	-26	12557.3166	-0
22	17812.3989	-44	17772.8173	-28	17792.1384	-45	12575.9924	-4	12535.9902	-61	12555.5262	5
23	17810.6080	70	17769.2609	2	17789.4546	-49			12533.2281	-111	12553.6526	-5
24	17808.6803	-24	17765.5783	-72	17786.6585	-15	10570 7040		12530.3946	-61	12551.6983	-7
25	17806.6543	58	17761.8064	117	17783.7380	-67	12572.7940	-32	12527.4757	-53	12549.0588	-45
20	1/804.4955	-29	17753 8566	-100	17777 5676	-21	12570.2601	-55 24	12521 3044	-35	12547.3472	12
27	17799 8548	40	17749.7287	-100	17774.3004	-36	12568.8641	-11	12521.5544	-55	12543.0669	6
29	17797.3487	-47	17745.4781	12	17770.9291	33	12567.3897	-12	12514.9891	-5	12540.7009	-30
30	17794.7447	43			17767.4347	26			12511.6635	0	12538.2607	8
31	17792.0123	5	17736.6260	-4	17763.8214	-14	12564.1962	-1	12508.2499	-61	12535.7294	-48
32	17789.1778	101	17732.0179	-107	17760.1015	32	12562.4727	-34			12533.1267	0
33	17786.2108	26	17727.3184	26	17756.2568	-16			12501.1815	-157	12530.4364	-10
34	17783.1338	6	17722.4924	44	17752.3148	117			12497.5307	-151	12527.6676	13
35	17779.9400	-27	17717.5369	-86	17748.2494	166	12556.8257	23	12493.8112	-20	10501 07/7	22
30	17776.6364	-/	17707 2268	108	17720 7510	/0	12554.7754	107	12490.0027	30	12521.8/0/	-22
31	17760 6812	16	17702 0407	108	17735 3362	40	12552.0559	-107	12480.1041	4	12515.0055	10
20	17766 0201	-78	17702.0407	114	17730 8014	16	12530.4312	-9	12402.1515	-10	12512 5811	-10
<u>40</u>	17762 2635	-75			17726 1451	-88	12545 7581	-25	12473 9383	-10	12512.5011	-29
41	17758.3760	-28	17685.4922	106	17721.4009	79	12543.3041	24	12469.7143	56	12505.9785	2
42	17754.3809	-4	17679.7331	-35	17716.5196	26	12540.7586	-20	12465.4139	73	12502.5531	4
43	17750.2672	-12	17673.8823	51	17711.5266	5			12461.0299	68	12499.0368	-85
44			17667.8960	-72	17706.4166	-36			12456.5589	6		
45	17741.6956	-12			17701.1968	-24	12532.6379	-64	12452.0167	45	12491.7870	22
46	17737.2417	38	17655.6149	29	17695.8596	-36	12529.7681	-64	12447.3892	44	12488.0337	20
47	17732.6606	-29			17690.4072	-49			12442.6736	-26		
48	17727.9723	-13			17684.8386	-72	12523.7902	19	12437.8781	-80	12480.2755	-48
49	17723.1733	53			17679.1645	1	12520.6783	63	12433.0234	84	12476.2891	73
50	17718.2475	8					12517.4744	10	12428.0641	15	12472.2056	40
51	17713.2085	-10			17667.4586	31	12514.1937	- 9	10417 0153	10	12468.0414	18
52	1//08.054/	-10			17655 2081	125	12510.8220	-75	12417.9153	10	12403.7985	20
55 54					17055.2981	155	12307.3920	15			12459.4750	22
55											12450.5735	-25
56											12400.0750	-10
57											12441.3528	4
58							12488.9304	-4			12436.6238	48
59											12431.8049	7
60												
61											12421.9197	-108
62											12416.8679	-39
		A	$\mathbf{A}^{1}\Pi - \mathbf{X}^{1}\Sigma^{+},$	2 - 0					$\mathbf{A}^{1}\Pi - \mathbf{X}^{1}\Sigma^{+},$	1 - 3		
6					16952.6021	6					12764.2963	41
7					16951.8518	19					12763.7320	-5
8	16958.9998	-10			16950.9909	1					12763.0875	-51
9	16958.9220	-23	16942.0240	14	16950.0253	10					12762.3757	29
10	16958.7352	-54	16940.0604	0	16948.9529	25			12752.6032	-1	12761.5703	-26
11	16958.4502	8	16937.9930	20	16947.7698	7			12750.8269	-5	12760.6961	30
12	16958.0526	20	16935.8109	-36	16946.4808	6			12748.9668	-49	12759.7373	40
13	16957.5482	40	16933.5326	20	16945.0845	6			12747.0381	19	12758.6939	5
14	16956.9354	50	16931.1372	-22	16943.5830	28			12745.0307	98	12757.5732	-3
13			16928.6454	43	16941.9692	4	12770.7313	-84	12742.9263	5	12756.3739	5
16	16955.3789	-11	1/000 2010	10	16940.2505	6	12770.3505	-69	12740.7506	-1	12755.0967	33
1/	16954.4440	12	16923.3212	-12			12769.9013	65	12/38.4928	-32	12753.7326	-7
10	16052 2462	1	16920.3033	12	16024 4476	2	12769.3529	8 42	12/30.101/	122	12/52.2929	-1
20	16952.2402	-0	16014 5358	20	16032 2086	-5	12768 0105	43	12755.7595	125	12/50.7719	-8
21	16940 6108	20	16011 2020	-59	16030 0302	_10	12708.0193	-00 52	12728 6756	_31	12747.1719	-4 1
22	16948 1406	-37	16908 1502	24	16927 6761	-10	12766 3841	52	0.0100	-51	12745 7324	25
23	16946.5596	-15	16904.7916	7	16925.2024	-24	12765.4292	-56			12743 8880	-20
24	16944.8688	-11	16901.3256	-9	16922.6223	-25	12764.4104	-1	12720.4744	-29	12741.9621	-68
25	16943.0670	-38	16897.7533	-14	16919.9372	2		•	12717.5862	24	12739.9700	24
26	16941.1630	-7	16894.0723	-32	16917.1387	-27			12714.6089	-16	12737.8893	32
27	16939.1469	-18		-	16914.2367	-13	12760.8538	-10			12735.7237	-6
28	16937.0264	7	16886.3900	-48	16911.2272	5	12759.5082	-5			12733.4777	-45
29	16934.7920	-24	16882.3904	-28	16908.1050	-26	12758.0753	-68	12705.2022	-88	12731.1588	-10
30	16932.4552	0	16878.2805	-36	16904.8796	-9	12756.5737	-12	12701.9255	74	12728.7546	-26
31	16929.9971	-107	16874.0687	12	16901.5452	-4	12754.9900	28	12698.5479	27	12726.2740	-1

TABLE 1—Continued

J	R(J)	0-C	P(J)	0-C	Q(J)	0-C	R(J)	0-C	P(J)	0-C	Q(J)	0-C
32	16927.4538	16	16869.7425	9	16898.1011	-15	12753.3228	40	12695.0918	-5	12723.7130	22
33	16924.7844	-39	16865.3095	-22	16894.5504	-14	12751.5718	20	12691.5600	5	12721.0680	11
34	16922.0156	-6	16860.7738	13	16890.8954	26	12749.7335	-66	12687.9458	-9	12718.3421	-6
35	16919.1382	24	16856.1227	-29	16887.1263	4	12747.8371	74	12684.2479	-61	12715.5401	20
36	16916.1465	-6	16851.3690	-21	16883.2543	34	12745.8386	1	12680.4782	-29	12712.6541	11
37	16913.0522	22	16846.5112	22	16879.2680	3	12743.7680	14	12676.6294	11	12709.6790	-84
38	16909.8437	-8	16841.5379	-14	16875.1763	-2	12741.6112	-26	10//0 /70/		12706.6413	1
39	16906.5307	2	16836.4620	0	168/0.9/9/	26	12739.3738	-03	12008.0784	-41	12703.5148	5
40	16903.1104	22	16831.2/0/	-2	16860.0093	-2	12/3/.0039	4	12004.3900	12	12/00.314/	68
41	16805 0344	-35	16820 5813	_25	16857 7335	36	12732 2025	03	12656 1569	-61	12693 6512	6
42	16892 1876	-35	16815 0804	-2J 47	16853 0999	21	12729.6279	-77	12651.8297	-01	12690.2066	52
44	16888.3379	44	16809.4605	6	16848.3584	10	12726.9880	-88	12647.4112	-48	12686.6716	3
45	16884.3741	56	16803.7373	10	16843.5124	35	12724.2732	-38	12642.9305	85	12683.0677	71
46	16880.2968	20	16797.9068	17	16838.5531	10	12721.4736	-23	12638.3448	-33	12679.3662	-27
47	16876.1173	47	16791.9659	-3	16833.4895	25	12718.6010	74	12633.6884	-54	12675.5946	-19
48	16871.8277	60	16785.9231	35	16828.3153	17	12715.6379	80	12628.9538	-52	12671.7472	39
49	16867.4248	26	16779.7655	3	16823.0345	25	12712.5843	-7	12624.1468	26	12667.8078	-12
50			16773.5040	8	16817.6452	31	12709.4723	136	12619.2442	-47	12663.7924	-15
51			16767.1368	33	16812.1465	24	12706.2496	-13	12614.2750	18	12659.7021	43
52	16853.5780	60	16760.6560	-1	16806.5381	4	12702.9725	108	12609.2143	-30	12655.5203	-3
53	16848.7375	-5	10/54.00/4	-37	16800.8244	14	12699.5944	30	12604.0792	-10	12051.2010	-/
54	16839 7434	-5	16740 5757	-5	16780.0676	_17	12602 6051	6	12396.6360	-30		
56	16833 5710	-134	16733 6697	-24	16783 0323	22	12688 9775	-112				
55	10055.5710	-154	16726.6535	-14	16776.8812	-15	12000.7775					
58	16822.9327	-64			16770.6237	-36	12681.5075	-44				
59	16817.4465	-72	16712.2935	-81	16764.2614	-23	12677.6525	18				
60	16811.8551	-48	16704.9570	-68	16757.7925	4	12673.7101	25				
61	16806.1534	-42	16697.5251	65	16751.2062	-63						
62	16800.3454	-16	16689.9673	12	16744.5256	6						
63	16794.4159	-121	16682.3065	1	16737.7292	-4						
64	16788.3936	-72										
65	16782.2696	41										
00 67	16760 6702	75										
68	16763 2172	61										
68 69	16763.2172	61 -22										
68 69 70	16763.2172 16756.6416 16749.9720	61 -22 32										
68 69 70	16763.2172 16763.2172 16756.6416 16749.9720	61 -22 32	Λ ¹ Π - Χ ¹ Σ ⁺ ,	1 - 0	. <u>.</u>				Α ¹ Π - Χ ¹ Σ ⁺ ,	0 - 2		
68 69 70	16763.2172 16756.6416 16749.9720	61 -22 32	$\mathbf{A}^{1}\Pi$ - $\mathbf{X}^{1}\Sigma^{+}$,	1 - 0	. <u> </u>				$\mathbf{A}^{1}\Pi - \mathbf{X}^{1}\Sigma^{+},$	0 - 2		
67 68 69 70 5 6	16763.2172 16756.6416 16749.9720	61 -22 32	$\mathbf{A}^{1}\Pi$ - $\mathbf{X}^{1}\Sigma^{+}$,	1 - 0	16066.8546	-33		4	Α'Π - Χ'Σ +,	0 - 2	12970.5308	
67 68 69 70 5 6 7	16763.2172 16756.6416 16749.9720	61 -22 32	$\mathbf{A}^{1}\Pi$ - $\mathbf{X}^{1}\Sigma^{+}$,	1 - 0	16066.8546 16066.1645	-33 27		A	Α'Π - Χ'Σ +,	0 - 2	12970.5308 12969.9731	94 -6
67 68 69 70 5 6 7 8	16763.2172 16756.6416 16749.9720	61 -22 32	Α¹Π - Χ ¹ Σ ⁺ , 16058.1918	1 - 0 26	16066.8546 16066.1645 16065.3648	-33 27 -14			Α'Π - Χ'Σ+, 12962.1000	0 - 2 -42	12970.5308 12969.9731 12969.3522	94 -6 44
67 68 69 70 5 6 7 8 9	16763.2172 16756.6416 16749.9720	61 -22 32	A ¹ Π - X ¹ Σ ⁺ , 16058.1918 16056.3979	1 - 0 26 3	16066.8546 16066.1645 16065.3648 16064.4732	-33 27 -14 22			Α'Π - Χ'Σ+, 12962.1000 12960.4968	0 - 2 -42 17	12970.5308 12969.9731 12969.3522 12968.6418	94 -6 44 -16
67 68 69 70 5 6 7 8 9 10	16763.2172 16756.6416 16749.9720	-11	A ¹ Π - X ¹ Σ ⁺ , 16058.1918 16056.3979 16054.5085	1 - 0 26 3 17	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758	-33 27 -14 22 -6		1	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968	0 - 2 -42 17	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583	94 -6 44 -16 -26
68 69 70 5 6 7 8 9 10 11	16763.2172 16756.6416 16749.9720	-111 -87	A ¹ Π - X ¹ Σ ⁺ , 16058.1918 16056.3979 16054.5085 16052.5165	1 - 0 26 3 17 -2	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826	-33 27 -14 22 -6 2			A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454	0 - 2 -42 17 29	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583	94 -6 44 -16 -26
67 68 69 70 5 6 7 8 9 10 11 12	16073.3523 16073.3523 16073.4523	-11 -87 -51	16058.1918 16056.3979 16054.5085 16052.5165 16050.4277	1 - 0 26 3 17 -2 5	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903	-33 27 -14 22 -6 2 15	12977.8316	-81	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003	0 - 2 -42 17 29 12	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618	94 -6 44 -16 -26 9
68 69 70 5 6 7 8 9 10 11 12 13	16073.3523 16073.3523 16073.3523 16073.1486 16072.4685	-11 -22 -11 -11 -87 -51 -22	A ¹ Π - X ¹ Σ ⁺ , 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16048.2366	1 - 0 26 3 17 -2 5 -18	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16059.8931	-33 27 -14 22 -6 2 15 -26	12977.8316 12977.7128	-81 -153	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781	0 - 2 -42 17 29 12 5	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447	94 -6 44 -16 -26 9 14
68 69 70 5 6 7 8 9 10 11 12 13 14	16073.3523 16073.3523 16073.3523 16073.1486 16072.8565 16072.4685 16071.9641	-11 -22 -11 -11 -87 -51 -22 -74	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16045.9609	1 - 0 26 3 17 -2 5 -18 105 24	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16059.8931 16058.5024	-33 27 -14 22 -6 2 15 -26 -6 -26	12977.8316 12977.7128	-81 -153	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12950.2035	0 - 2 -42 17 29 12 5 13 32	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491	94 -6 44 -16 -26 9 14 15 23
68 69 70 5 6 7 8 9 10 11 12 13 14 15 16	16073.3523 16073.3523 16073.3523 16073.1486 16072.8565 16072.4685 16071.9641 16071.3817	-11 -22 32 -11 -87 -51 22 -74 46	A ¹ Π - X ¹ Σ ⁺ , 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16045.9609 16043.5607 16041.0731	1 - 0 26 3 17 -2 5 -18 105 -24 -32	16066.8546 16065.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16059.8931 16058.5024 16057.0120	-33 27 -14 22 -6 2 15 -26 -6 12	12977.8316 12977.7128 12977.2739	-81 -153 41	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035	0 - 2 -42 17 29 12 5 13 33	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.2314	94 -6 44 -16 -26 9 14 15 23 4
68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17	16073.3523 16073.3523 16073.3523 16073.1486 16072.8565 16072.4685 16071.3817 16070.6820	-11 -22 32 -11 -87 -51 22 -74 46 -10	A ¹ Π - X ¹ Σ ⁺ , 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16043.5607 16043.5607 16043.84840	1 - 0 26 3 17 -2 5 -18 105 -24 -22 -64	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16059.8931 16058.5024 16057.0120 16055.4190 16053.7275	-33 27 -14 22 -6 2 15 -26 -6 12 0 0	12977.8316 12977.7128 12977.2739 12976.9223 12976.5002	-81 -153 41 -7 25	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035 12944.8096	-42 17 29 12 5 13 33	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905	94 -6 44 -16 -26 9 14 15 23 3 4
67 68 69 70 5 6 7 7 8 9 10 11 12 13 14 15 16 17 18	16073.3523 16073.3523 16073.3523 16073.1486 16073.1486 16072.8565 16072.4685 16071.9641 16071.3817 16070.6820 16068.9941	-11 -22 32 -11 -87 -51 22 -74 46 -10 12 -17	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16045.9609 16043.5607 16043.5607 16043.8480 16035.8185	1 - 0 26 3 17 -2 5 -18 105 -24 -32 -64 135	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16059.8931 16058.5024 16057.0120 16055.4190 16053.7275 16051.9375	-33 27 -14 22 -6 2 15 -26 -6 12 0 -28	12977.8316 12977.7128 12977.2739 12976.9223 12976.5002 12975.9936	-81 -153 41 -7 25	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013	-42 17 29 12 5 13 33 -6 32	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812	94 -6 44 -16 -26 9 14 15 23 4 4 4
68 69 70 5 6 7 7 8 9 10 11 12 13 14 15 16 17 18 19	16073.3523 16073.3523 16073.3523 16073.1486 16072.8565 16072.4685 16071.9641 16071.3817 16070.6820 16069.8904 16068.9941	-11 -22 32 -11 -87 -51 22 -74 46 -10 12 -17 -16	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16043.5607 16038.4840 16035.8185 16035.0271	1 - 0 26 3 17 -2 5 -18 105 -24 -32 -64 135 67	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16059.8931 16058.5024 16057.0120 16055.4190 16055.4190 16055.7275 16051.9375 16050.0470	-33 27 -14 22 -6 2 15 -26 -6 12 0 -2 8 9	12977.8316 12977.7128 12977.2739 12976.9223 12976.5002 12975.9936 12975.4122	-81 -153 41 -7 25 -2 6	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12940.1097	-42 17 29 12 5 13 33 -6 32 19	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812	94 -6 44 -16 -26 9 14 15 23 4 4 4 4
68 69 70 5 6 7 7 8 9 10 11 12 13 14 15 16 17 18 19 20	16073.3523 16073.3523 16073.3523 16073.1486 16072.8565 16072.4685 16071.9641 16070.6820 16069.8904 16068.9941 16068.9010	-11 -22 -32 -11 -87 -51 22 -74 46 -10 12 -17 -16 -3	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16043.5607 16043.5607 16038.4840 16035.8185 16030.0271 16030.1368	1 - 0 26 3 17 -2 5 -18 105 -24 -32 -64 1355 67 4	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16059.8931 16058.5024 16057.0120 16055.4190 16053.7275 16050.0470 16048.0565	-33 27 -14 22 -6 2 15 -26 -6 15 -26 -6 12 0 -2 8 9 6	12977.8316 12977.7128 12977.7128 12976.9223 12976.5002 12975.9936 12975.4122 12974.7489	-81 -153 41 -7 25 -2 6 -17	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12940.1097 12937.6434	0 - 2 -42 17 29 12 5 13 33 -6 32 9 41	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269	94 -6 44 -16 -26 9 14 15 23 4 4 4 -1
68 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	16073.3523 16756.6416 16749.9720 16756.6416 16749.9720 16073.3523 16073.1486 16072.8565 16071.9641 16071.3817 16070.6820 16069.8904 16068.9910 16066.9100 16065.9102	-111 -22 32 -11 -87 -51 22 -74 46 -10 12 -17 -16 3 -8	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16043.5607 16043.5607 16043.5607 16038.4840 16035.8185 16030.03.0271	26 3 17 -2 5 -18 105 -24 -32 -64 135 67 4 -54	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16058.5024 16057.0120 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190	-33 27 -14 22 -6 2 15 -26 -6 12 0 -2 8 9 6 -51	12977.8316 12977.7128 12977.2739 12976.9223 12976.5002 12975.4129 12974.7489 12974.0168	-81 -153 41 -7 25 -2 6 -17 57	A¹Π - X¹Σ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12940.1097 12937.6434 12935.0931	-42 17 29 12 5 13 33 -6 32 19 41 41	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269 12954.0830	94 -6 44 -16 -26 9 14 15 23 4 4 4 4 -1 6
68 68 69 70 5 6 7 8 9 10 11 12 13 13 14 15 16 17 18 19 20 21 22	16073.3523 16756.6416 16749.9720 16756.6416 16749.9720 16073.3523 16073.1486 16072.4685 16071.9641 16076.820 16069.8904 16068.0010 16066.9100 16066.9100	-11 -22 32 -11 -87 -51 22 -74 46 -10 12 -17 -16 3 -8 7	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16052.5165 16048.2366 16045.9609 16043.5607 16038.4840 16035.8185 16030.1368 16021.1476 16024.0572	26 3 17 -2 5 -18 105 -24 -32 -64 135 67 4 -54 -131	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16058.5024 16057.0120 16055.4190 16053.7275 16051.9375 16050.0470 16048.0565 16045.9609 16043.7776	-33 27 -14 22 -6 2 15 -26 -6 12 0 -2 8 9 6 -51 11	12977.8316 12977.7128 12977.7128 12976.9223 12976.5002 12975.9936 12975.4122 12974.7489 12974.0168 12973.1933	-81 -153 41 -7 25 -2 6 -17 57 3	A ¹ Π - X ¹ Σ ⁺ , 12962.1000 12960.4968 12957.0454 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12943.1097 12937.6434 12935.0931	0 - 2 -42 17 29 12 5 13 33 -6 32 19 41 4	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269 12954.0830	94 -6 44 -16 -26 9 14 15 23 3 4 4 4 4 -1 6
68 66 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 22 23	16073.3523 16756.6416 16749.9720 16756.6416 16749.9720 167749.9720 16073.3523 16073.1486 16072.8565 16072.4685 16072.4685 16071.9641 16076.8200 16066.9100 16066.9100 16066.9100 16066.9102 16064.4251 16064.4251	-111 -22 32 -11 -87 -51 22 -74 46 -10 12 -17 -16 3 -8 7 -20	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16045.9609 16035.8185 16033.0271 16030.1368 16027.1476 16020.884	26 3 17 -2 5 -18 105 -24 -32 -64 135 67 4 -54 -131 3	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16058.5024 16057.0120 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16051.9375 16050.0470 16048.0565 16045.9609 16043.7776 16041.4870	-33 27 -14 22 -6 2 15 -26 -6 12 0 -2 8 9 6 -51 11 -3	12977.8316 12977.7128 12977.7128 12976.9223 12976.5002 12975.9936 12975.4122 12974.7489 12974.0168 12973.1933 12972.2945	-81 -153 41 -7 25 -2 6 -17 57 3 -17	A ¹ Π - X ¹ Σ ⁺ , 12962.1000 12960.4968 12957.0454 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12940.1097 12937.6434 12935.0931	0 - 2 -42 17 29 12 5 13 33 -6 32 19 41 4	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269 12954.0830 12950.5565	94 -6 44 -16 -26 9 14 15 23 3 4 4 4 4 -1 6 -14
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68 66 69 70 5 6 7 8 9 10 11 12 13 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	16073.3523 16073.3523 16073.3523 16073.3523 16073.1486 16072.8565 16072.4685 16071.9641 16076.820 16069.8904 16068.9941 16068.0010 16066.9100 16066.9100 16065.7162 16063.0301 16056.4527 16058.2546 16055.4657	-11 -22 -32 -11 -87 -51 22 -74 -10 12 -74 -16 -3 -8 7 -20 -7 1 -8 25 -7 1 -8	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16043.266 16043.5607 16043.5607 16038.4840 16035.8185 16027.1476 16020.8885 16017.1552 16014.2264 16017.453 16007.1655	26 3 17 -2 5 -18 105 -24 -32 -64 135 67 4 -54 -131 3 -15 7 -1 -1 -1	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16059.8931 16058.5024 16057.0120 16055.4190 16055.4190 16055.4190 16055.4190 16045.9609 16045.9609 16043.7776 16041.4870 16036.6100 16034.0224 16031.3346	-33 27 -14 22 -6 2 15 -26 -6 12 0 -2 8 9 6 -51 11 -3 11 5 15 200	12977.8316 12977.7128 12977.2739 12976.9223 12975.9936 12975.4122 12974.0168 12973.1933 12972.2945 12971.3195 12970.2698 12969.1326	-81 -153 41 -7 25 -2 6 -17 57 3 -17 -12 32 -10	A ¹ Π - X ¹ Σ ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12940.1097 12937.6434 12926.9823 12924.1264 12921.1865 12918.1608	-42 17 29 12 5 13 33 -6 32 19 41 4 -16 19 -4 -104	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.5214 12958.7812 12958.7812 12955.7269 12954.0830 12955.7269 12954.0830 12954.0830 12954.0818 12944.6818 12942.5665	94 -6 44 -16 -26 9 14 15 23 4 4 4 -1 6 -14 -12 -10 -3 4 4
68 66 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 20	16073.3523 16073.3523 16073.3523 16073.486 16072.8565 16072.4685 16071.3817 16070.6820 16069.8904 16068.9941 16068.9941 16066.9100 16065.7162 16064.4251 16064.4251 16063.0301 16055.3546 16055.4567 16055.2572	-11 -22 -32 -11 -87 -51 22 -74 46 -10 12 -17 -16 -3 -8 7 -20 -7 1 -8 25 -9 -6	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16043.5607 16038.4840 16035.8125 16030.1368 16024.0572 16020.8884 16017.6052 16017.4753 16007.1655 16003.4857	26 3 17 -2 5 -18 105 -24 -32 -64 135 67 4 -54 -131 3 -15 7 -1 -1 -1 -1 -1	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16051.1903 16059.8931 16058.5024 16057.0120 16055.4190 16053.7275 16050.0470 16048.0565 16045.9609 16043.7776 16041.4870 16039.0993 16036.6100 16034.0224 16031.3346 16028.5456	-33 27 -14 22 -6 2 15 -26 6 -6 12 0 -2 8 9 6 -51 11 -3 11 5 15 20 111 8	12977.8316 12977.7128 12976.9223 12976.9223 12975.9936 12975.4122 12974.0168 12973.1933 12972.2945 12971.3195 12970.2698 12969.1326 12966.6288	-81 -153 41 -7 25 -2 6 -17 57 3 -17 -12 32 -10 -24	A ¹ Π - X ¹ Σ ⁺ , 12962.1000 12960.4968 12957.0454 12953.2781 12951.2792 12949.2035 12944.8096 12937.6434 12935.0931 12926.9823 12924.1264 12921.1865 12911.9001	0 - 2 -42 17 29 12 5 13 33 -6 32 19 41 4 -16 19 -4 -104 -47	12970.5308 12969.9731 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269 12954.0830 12955.5565 12948.6766 12946.7182 12944.6818 12942.5669 12940.3701 12938.0925	94 -6 44 -16 -26 9 14 15 23 4 4 4 -1 6 -14 -12 -10 -3 4 -200 -6
668 669 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	16073.3523 16753.2172 16756.6416 16749.9720 16756.6416 16749.9720 16073.3523 16073.1486 16072.8565 16071.3817 16070.6820 16068.9941 16068.9900 16065.9100 16065.9100 16065.9100 16065.9100 16065.9101 16055.916 16056.4657 16058.2546 16056.4657 16058.25781	-11 -22 32 -11 -87 -51 22 -74 46 -10 12 -17 -16 3 -8 7 -20 -7 1 -8 25 -9 -5	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16043.5607 16038.4840 16035.8185 16030.1368 16024.0572 16028.884 16017.6052 16010.7453 16003.4857 16003.4857 16997.7078 15995.8278	1 - 0 26 3 17 -2 5 -18 105 -24 -32 -64 1355 67 4 -54 -131 3 -155 7 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16059.8931 16058.5024 16057.0120 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16045.9609 16043.7776 16041.4870 16039.0993 16036.6100 16034.0224 16031.3346 16028.5456 16025.6573 16022 6700	-33 27 -14 22 -6 2 15 -26 -6 12 0 -2 8 9 6 -51 11 -3 11 11 5 15 20 11 8 4	12977.8316 12977.7128 12977.7128 12976.9223 12976.9022 12975.9936 12975.4122 12974.7489 12974.0168 12974.7489 12974.0168 12974.0168 12972.2945 12971.3195 12970.2698 12969.1326 12966.6288 12965.2574 12965.8107	-81 -153 41 -7 25 -2 6 -17 57 3 -17 -12 32 -10 -24 -43 -26	A ¹ Π - X ¹ Σ ⁺ , 12962.1000 12960.4968 12957.0454 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12940.1097 12935.0931 12926.9823 12924.1264 12921.1865 12911.9001	0 - 2 -42 17 29 12 5 13 33 -6 32 19 41 4 -16 19 -4 -104 -47	12970.5308 12969.9731 12969.9731 12969.3522 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269 12954.0830 12955.7269 12954.0830 12955.565 12948.6766 12944.67182 12944.6818 12942.5669 12940.3701 12938.0985 12935.7472	94 -6 44 -16 -26 9 14 15 23 4 4 4 -1 6 -14 -12 -10 -3 4 -20 -6 -2
668 669 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	16073.3523 16753.2172 16756.6416 16749.9720 16756.6416 16749.9720 16073.3523 16073.1486 16072.8565 16071.9641 16071.3817 16070.6820 16065.9100 16065.9100 16065.9100 16065.9101 16065.9102 16065.9102 16065.9102 16065.9102 16055.7162 16054.5701 16052.5781 16052.5781 16054.6577	-11 -22 32 -11 -87 -51 22 -74 -46 -10 12 -17 -16 3 -8 7 -20 -7 1 -8 25 -9 -6 5 8	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16043.5607 16041.0731 16038.4840 16035.8185 16030.1368 16027.1476 16024.0572 16020.8884 16017.6052 16014.2264 16007.1655 16003.4857 15995.7078 15991.8504	1 - 0 26 3 17 -2 5 -18 105 -24 -32 -64 1355 67 4 -54 -131 3 -155 7 1 1 1 1 1 1 1 1	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16058.5024 16057.0120 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16045.9609 16045.9609 16043.7776 16041.4870 16034.0224 16031.3346 16028.5456 16025.6573 16022.6700 16019.5812	-33 27 -14 22 -6 2 15 -26 -6 2 15 -26 -6 12 0 -2 8 9 6 -51 11 -3 11 15 15 20 11 8 4 4 6	12977.8316 12977.7128 12977.7128 12976.9223 12976.9021 12975.9936 12975.4122 12974.0168 12973.1933 12972.2945 12971.3195 12970.2698 12969.1326 12966.6288 12965.2574 12966.8107 12962.2890	-81 -153 41 -7 25 -2 6 -17 57 3 -17 -12 32 -10 -24 -43 -24 -43 -26 30	A ¹ Π - X ¹ Σ ⁺ , 12962.1000 12960.4968 12957.0454 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12937.6434 12935.0931 12926.9823 12924.1264 12921.1865 12911.9001 12905.3221	0 - 2 -42 17 29 12 5 13 33 -6 32 19 41 4 -16 19 -4 -104 -47 -32	12970.5308 12969.9731 12969.9731 12968.6418 12967.8583 12966.0618 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269 12954.0830 12955.565 12948.6766 12946.7182 12944.6818 12942.5669 12940.3701 12938.0985 12935.7472 12933.3162	94 -6 44 -16 -26 9 14 15 23 3 4 4 -1 6 -14 -12 -10 -3 4 -20 -6 -2 -9
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 30 31 32 24	16073.3523 16073.3523 16073.4523 16073.4523 16073.4523 16073.4523 16073.466 16072.8565 16071.9641 16071.3817 16070.6820 16065.9100 16065.9100 16065.9100 16065.9102 16065.9102 16065.9102 16055.7162 16056.4657 16056.4657 16052.5781 16052.5781 16054.82945 16048.2945	-11 -22 32 -11 -87 -51 22 -74 46 -10 12 -17 -16 3 -8 7 -20 -7 1 -8 25 -9 -6 -5 8 59	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16045.9609 16043.5607 16035.8185 16030.1368 16024.0572 16020.8884 16017.6052 16014.2264 16007.1655 16003.4857 15999.7078 15991.8504 15987.7618	26 3 17 -2 5 -18 105 -24 -32 -64 135 67 4 -54 -131 3 -15 7 -1 -1 -7 1 -1 -7 1 -1 -2 -13 -12 -12 -12 -12 -2 -18 -24 -32 -64 -32 -64 -135 -24 -54 -131 -12 -54 -131 -12 -54 -131 -12 -12 -54 -131 -12 -54 -131 -12 -54 -131 -12 -131 -12 -131 -12 -131 -12 -131 -12 -131 -12 -131 -12 -131 -12 -131 -12 -13 -12 -13 -12 -131 -12 -13 -12 -13 -12 -13 -13 -13 -13 -13 -13 -13 -13	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16058.5024 16057.0120 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16051.9375 16050.0470 16041.4870 16041.4870 16034.0224 16031.3346 16028.5456 16022.6773 16022.6770 16019.5812 16016.3935	-33 27 -14 22 -6 2 15 -26 -6 12 0 -2 8 9 6 -51 11 -3 11 5 15 20 11 8 14 6 6	12977.8316 12977.7128 12977.7128 12976.9223 12976.9223 12975.9936 12975.4122 12974.7489 12974.0168 12973.1933 12972.2945 12971.3195 12970.2698 12969.1326 12966.6288 12965.2574 12963.8107 12962.2890	-81 -153 41 -7 25 -2 6 -17 57 3 -17 -12 32 -10 -24 -43 -26 30	$A^{1}Π - X^{1}\Sigma^{+}$, 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12940.1097 12937.6434 12935.0931 12926.9823 12924.1264 12921.1865 12918.1608 12911.9001 12905.3221 12901.9147	0 - 2 -42 17 29 12 5 13 33 -6 32 19 41 4 -16 19 -4 -104 -47 -32 -34	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269 12954.0830 12955.565 12948.6766 12946.7182 12942.5669 12940.3701 12938.0985 12935.7472 12933.3162	94 -6 44 -16 -26 9 14 15 23 3 4 4 4 -1 6 -14 -12 -10 -3 4 4 -20 -6 -29 9 -10
67 66 69 70 5 6 70 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33	16073.3523 16756.2172 16756.6416 16749.9720 16756.6416 16749.9720 16073.3523 16073.1486 16072.8565 16071.9641 16071.3817 16070.6820 16068.9941 16068.9010 16065.7162 16064.4251 16064.4251 16055.4557 16054.5701 16052.5781 16050.4858 16046.0069 16043.6074	-11 -22 32 -11 -87 -51 22 -74 46 -10 12 -17 -16 3 -8 7 -20 -7 1 -8 25 -9 -6 -5 8 59 -6	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16050.4277 16048.2366 16045.9609 16043.5607 16035.8185 16030.1368 16024.0572 16020.8884 16017.6052 16014.2264 16017.1655 16003.4857 15999.7078 15995.8278 15991.8504 15987.7618 15983.5971	26 3 17 -2 5 -18 105 -24 -32 -64 135 67 4 -54 -131 3 -15 7 -1 -1 -1 -1 -13 -126 -5	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16058.5024 16057.0120 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16055.4190 16048.0565 16045.9609 16043.7776 16041.4870 16034.0224 16036.6100 16034.0224 16025.6573 16022.6700 16019.5812 16016.3935 16013.1061	-33 27 -14 22 -6 2 15 -26 -6 12 0 -2 8 9 6 -51 11 -3 11 5 5 15 20 11 8 14 6 6 11	12977.8316 12977.7128 12977.7128 12976.9223 12976.9223 12975.9936 12975.4122 12974.7489 12974.0168 12973.1933 12972.2945 12971.3195 12970.2698 12969.1326 12966.6288 12965.2574 12966.2890 12958.9928	-81 -153 41 -7 25 -2 6 -17 -12 32 -10 -24 -43 -26 30 -14	A ¹ Π - X ¹ Σ ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12940.1097 12940.1097 12937.6434 12926.9823 12924.1264 12921.1865 12918.1608 12911.9001 12905.3221 12905.3221 12901.9147 12898.4330	0 - 2 -42 17 29 12 5 13 33 -6 32 19 41 4 -16 19 41 -16 19 -4 -104 -47 -32 -34 5	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269 12954.0830 12955.7269 12954.0830 12955.565 12948.6766 12946.7182 12944.6818 12942.5669 12940.3701 12938.0985 12935.7472 12933.3162 12930.8070 12928.2182	94 -6 44 -16 -26 9 14 15 23 3 4 4 4 -1 6 -14 -12 -10 -3 4 4 -20 -6 -2 9 -9 9 -10 0 -20
67 66 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34	16073.3523 16756.6416 16749.9720 16756.6416 16749.9720 16756.6416 16749.9720 16073.3523 16073.1486 16072.4685 16071.9641 16071.3817 16070.6820 16068.9040 16068.9040 16068.9040 16066.9100 16065.7162 16064.4251 16053.7162 16054.5701 16052.5781 16050.4858 16054.6057 16054.5701 16052.5781 16050.4858 16046.0069 16043.6074	-11 -22 32 -11 -87 -51 22 -74 46 -10 12 -17 -16 3 -8 7 -20 -7 1 -8 25 -9 -6 -5 8 9 -6 28	16058.1918 16058.1918 16056.3979 16054.5085 16052.5165 16052.5165 16048.2366 16043.5607 16048.2366 16043.5607 16043.5607 16048.2366 16045.9609 16043.5607 16030.1368 16027.1476 16024.0572 16020.8884 16017.6052 16014.2264 16017.1655 16003.4857 15999.7078 15995.8278 15991.8504 15983.5971 15979.3210	26 3 17 -2 5 -18 105 -24 -32 -64 135 67 4 -131 3 -15 7 -1 -1 -1 -1 -16 -13 -126 -5 -2	16066.8546 16066.1645 16065.3648 16064.4732 16063.4758 16062.3826 16061.1903 16058.5024 16057.0120 16055.4190 16055.4190 16053.7275 16051.9375 16051.9375 16051.9375 16041.4870 16043.7776 16041.4870 16034.0224 16036.6100 16034.0224 16025.6573 16022.6770 16019.5812 16016.3935 16013.1061 16009.7185	-33 27 -14 22 -6 2 15 -26 -6 12 0 -2 8 9 6 -51 11 -3 11 5 5 50 11 8 14 6 6 11 12	12977.8316 12977.7128 12977.7128 12976.9223 12976.9223 12975.9936 12975.4122 12974.7489 12974.0168 12973.1933 12972.2945 12971.3195 12970.2698 12969.1326 12966.6288 12965.2574 12966.2890 12958.9928 12957.2262	-81 -153 41 -7 25 -2 6 -17 -12 32 -10 -24 -43 -26 30 -14 -36	A ¹ Π - X ¹ Σ ⁺ , 12962.1000 12960.4968 12957.0454 12955.2003 12953.2781 12951.2792 12949.2035 12944.8096 12942.5013 12940.1097 12937.6434 12926.9823 12924.1264 12921.1865 12918.1608 12911.9001 12905.3221 12905.3221 12898.4330 12894.8678	0 - 2 -42 17 29 12 5 13 33 -6 32 19 41 4 -16 19 4 -16 19 -4 -104 -47 -32 -34 5 -7	12970.5308 12969.9731 12969.3522 12968.6418 12967.8583 12965.0447 12963.9491 12962.7757 12961.5214 12960.1905 12958.7812 12955.7269 12954.0830 12955.7269 12954.0830 12955.565 12948.6766 12946.7182 12944.6818 12942.5669 12940.3701 12938.0985 12935.7472 12933.3162 12933.3162 12930.8070 12928.2182	94 -6 44 -16 -26 9 14 15 23 3 4 4 4 -1 6 -14 -12 -10 -3 4 4 -20 -6 -2 9 -9 9 -10 0 -20 -11

TABLE 1—Continued

J	R(J)	0-C	P(J)	0-C	Q(J)	0-C	R(J)	0-C	P(J)	0-С	Q(J)	0-C
									10000 50.14		10010 0500	
36	16035.8185	-84	15970.4697	2	16002.6431	17	12953.4610	-25	12887.5046	-9	12919.9782	-56
37	16033.0271	-54	15965.8946	4	15998.9546	14	12951.4002	-13	11070 0207	1	12917.0782	-24
38	16030.1368	-/	15961.2318	120	15995.1008	10	12949.3010	08	120/9.020/	1	12914.0972	-12
39 40	16027.1422	112	15950.4445	-2	15087 2802	15	12947.2295	-78	12871 8354	-24	12907 8963	-8
40 //1	16024.0372	-35	15931.5092	-0	15983 1986	-0	12942.6584	-21	12867.7254	7	12904.6798	18
42	16017.5543	24	15941.5211	-5	15979.0135	42	120000				12901.3778	-19
43	16014.1518	-20	15936.3487	10	15974.7211	16	12937.7812	-23	12859.2638	13	12898.0018	-5
44	16010.6586	38	15931.0741	3	15970.3293	-0	12935.2344	89	12854.9112	-23	12894.5411	-45
45	16007.0580	29	15925.6983	-18	15965.8391	5			12850.4855	-3	12891.0129	31
46	16003.3518	-25	15920.2283	18	15961.2318	-156	12929.8753	43	12845.9775	-18	12887.3943	-4
47	15999.5508	-19	15914.6539	11	15956.5562	6	12927.0668	-72	12841.3945	3		_
48			15908.9792	1	15951.7643	10	12924.1946	-28	12836.7288	-15	12879.9263	-3
49	15991.6462	0	15903.2035	-19	15946.8716	14	12921.2394	-15	12831.9863	-12	12876.0736	2
50	15987.5413	1	15897.3318	3	15941.8795	30			12827.1630	-29	128/2.1418	10
51	15983.3372	21	15891.3004	-20	15930.//83	-37	12011 0001	85	12822.2038	.26	12864 0354	-1
52	15074 6207	10	15885.2822	-11	15931.3802	-4	12911.9001	36	12017.2034	-20	12850 8664	-10
55	15974.0207	-15	15872 8315	-26	15020.2920	22	12900.0100	50	12807 0890	-12	12855.6138	-11
55	15970.1072	-15	15866 4500	-20	15915 3962	11	12901 8204	-10	12801.8752	15	12851.2860	18
56	15960 7822	-16	15859 9852	16	15909.7957	-1	12898.3089	47	12796.5805	24	12846.8763	25
57	15955.9634	-55	15853.4062	-16	15904.0941	-14	12894.7091	24	12791.2082	47	12842.3844	8
58	15951.0451	-74	15846.7320	6	15898.2946	6			12785.7499	4	12837.8198	62
59	15946.0354	12	15839.9517	-29	15892.3900	-14	12887.2677	-26	12780.2230	67	12833.1626	-9
60	15940.9094	-48	15833.0778	6	15886.3871	-3	12883.4340	27	12774.6022	-18	12828.4335	-0
61	15935.6937	16	15826.0979	-12	15880.2800	-21	12879.5181	65	12768.9126	5	12823.6219	-15
62	15930.3731	49	15819.0251	47	15874.0735	-19	12875.5128	15	12763.1437	27	12818.7345	13
63	15924.9408	-14	15811.8437	27	15867.7673	2	12871.4387	85	12757.2883	-22	12813.7642	13
64	15919.4088	-52	15804.5538	-69	15861.3523	-51	12867.2658	-25	12751.3661	58	12808.7118	-5
65	15913.7876	38			15854.8446	-14	12863.0275	20	12745.3543	35	12803.5794	-19
66	15908.0495	-16			15848.2377	47	10054 0000	64	12739.2680	05	12/98.3/16	15
67	15902.2173	11			15841.5158	-24	12854.2903	-04	12/33.0924	-3	12/93.0820	42
68	15896.2690	-98			15834.0904	-52	12049.0099	-0	12/20.6396	-43	12782 2530	47
09 70	15890.2515	-75			15820 7634	-29	12840 5921	-28			12702.2337	8
71	15877 8525	14			15813 6470	68	12835 8609	-40			12771.0946	-115
72	15871 5012	-18			15015.0470	00	12831.0491	-44			12771.0910	110
73	15865.0580	58					12826.1587	-18			12759.6335	-20
74	15858.4991	7									12753.7835	45
75											12747.8371	-43
			$1\Pi - \mathbf{V}^{1} \mathbf{\Sigma}^{+}$	0.1					$A^{1}\Pi = X^{1}\Sigma^{+}$	0 - 0		
	-		<u>, , , , , , , , , , , , , , , , , , , </u>	0 - 1						0 - 0		
4					14072.3155	31					15185.8444	54
5					14071.8883	-4					15185.3836	5
6					14071.3801	-1					15184.8361	1
7			14064.4451	-34	14070.7863	-8			15177.8608	16	15184.1996	19
8			14062.8632	-24	14070.1108	16			15176.2269	22	15183.4705	23
9			14061.1996	16	14069.3485	21		•	15174.4978	-14	15182.6477	2
10			14059.4477	18	14068.5004	15	15191.7049	20			15181./334	-1
11	14079 2202	10	14057.0115	22	14007.3074	0	15191.0002	10	15168 7600	-63	15170 6380	0
12	14078.3303	19	14053.0879	15	14000.3304	9	15191.4108	-12	15166 6881	-05	15178 4501	.22
14	14077 8529	14	14051 5904	-15	14064 2621	13	10101.1000	12	15100.0001	10	19170.1901	
15	14077 4852	-5	14049.4131	-28	14062.9908	15	15190.3044	9	15162.2297	-40	15175.8064	-6
16	14077.0347	-2	14047.1563	2	14061.6339	11	15189.7508	12	15159.8731	23	15174.3464	-11
17	14076.5014	22	14044.8118	1	14060.1917	2	15189.1043	1	15157.4176	9	15172.7967	2
18	14075.8778	-6	14042.3842	16	14058.6666	14	15188.3674	-0	15154.8745	29	15171.1527	-16
19	14075.1733	6	14039.8691	3	14057.0545	3	15187.5385	-7			15169.4188	-19
20	14074.3832	14	14037.2712	7	14055.3568	-13	15186.6188	-5	15149.5009	-71	15167.5949	-8
21	14073.5057	-1	14034.5872	-2	14053.5776	5	15185.6055	-24	15146.6878	-17	15165.6778	-14
22	14072.5455	8	14031.8202	6	14051.7121	11	15184.5076	26	15143.7867	68	15163.6695	-18
23	14071.4984	-0	14028.9664	-8	14049.7630	29	15183.3101	-2	15140.7813	22	15161.5700	-20
24	14070.3661	-8	14026.0298	-2	14047.7258	18	15182.0217	-24	15137.0905	33 70	15159.3784	-27
20	14009.1487	-15	14023.0074	-8 ∡	14043.0030	0 4	15170 1740	-21	15134.5118	/ð 05	15157.0909	-19
20 27	1400/.84/0	-0	14019.9012	-4	14043.3972	4	15177 6116	-22	15127 2712	75 77	15157 7509	
22	14064 0868	-9	14013 4315	-26	14038 7296	5	15175 9583	-31	15124.4091	18	10102.2090	-1
20	14063 4277	-24	14010.0726	-6	14036.2676	ő	15174.2134	-28	15120.8615	23	15147.0570	35
30	14061.7851	-15	14006.6274	-1	14033.7219	12	15172.3765	-25			15144.3175	44
31	14060.0573	-3	14003.0977	8	14031.0890	2	15170.4454	-44	15113.4908	17	15141.4844	34
32	14058.2418	-13	13999.4792	-24	14028.3715	-0			15109.6670	-1	15138.5621	50
33	14056.3423	-7	13995.7803	-10	14025.5686	-4	15166.3090	-65	15105.7513	-25	15135.5477	62

TABLE 1—Continued

J	R(J)	0-C	P(J)	0-С	Q(J)	0-C	R(J)	0-C	P(J)	0-C	Q(J)	0-C
	14054 2552	20	12001-0051	10	14022 6812	1	15164 1078		15101 7451	20	15132 4402	67
34	14054.3553	-20	13991.9951	-10	14022.0812	1	15104.1078	-24	15101.7451	-39	15132.4402	02
30	14052.2851	-9	13988.1232	-0	14019.7082	4	15150 4228	4	15002 4597	-40	15129.2352	15
30	14050.1279	-10	12080 1300	-22	14010.0494	6	15156 0388	-24	15093.4387	-04	15122 5630	28
30	14047.0034	-36	13976 0046	-12	14010 2759	3	15150.9500	-24	15084 8069	-85	15119.0886	34
30	14043 1426	-30	13071 7054	-3	14006 9603	-1			15080.3408	-124	15115.5214	35
40	14040 6450	25	13967 5002	-4	14003 5582	-16	15148 9428	14	15075.7910	-84	15111.8589	2
41	14038 0527	-35	13963 1191	-12	14000 0738	2	15146.0879	-20	15071.1460	-81	15108.1070	-3
42	14035 3827	-10	13958 6530	-19	13996.5024	8	15143.1489	30	15066.4112	-58		•
43	14032.6246	-6	13954.1043	0	13992.8444	3	15140.1163	70			15100.3259	-21
44	14029.7804	-3	13949.4679	-7	13989.1013	6	15136.9870	71	15056.6665	-14	15096.2967	-33
45	14026.8479	-19	13944.7479	3	13985.2716	1	15133.7627	48	15051.6565	8		
46	14023.8327	-1	13939.9421	8	13981.3564	-2	15130.4449	17	15046.5533	17	15087.9630	-39
47	14020.7276	-18	13935.0508	12	13977.3567	10	15127.0372	17	15041.3566	9	15083.6563	-56
48	14017.5403	6	13930.0720	-6	13973.2700	11	15123.5357	7	15036.0715	35	15079.2598	-44
49	14014.2672	36	13925.0103	-0	13969.0972	10	15119.9462	46	15030.6869	-13	15074.7685	-56
50	14010.9044	35	13919.8637	12	13964.8372	-2	15116.2554	4	15025.2180	14	15070.1920	6
51	14007.4518	0	13914.6306	14	13960.4937	12	15112.4844	91	15019.6524	-4	15065.5183	22
52	14003.9170	11	13909.3128	23	13956.0623	8	15108.6017	-8	15013.9978	8	15060.7484	3
53	14000.2932	-2	13903.9059	-1	13951.5448	6	15104.6369	5			15055.8899	27
54	13996.5882	40	13898.4190	30	13946.9424	17	15100.5766	-4	15002.4092	3	15050.9340	5
55	13992.7897	16	13892.8420	16	13942.2508	-1	15096.4218	-24	14996.4814	48	15045.8874	4
56	13988.9068	17	13887.1804	14	13937.4748	1			14990.4608	89	15040.7497	21
57	13984.9342	-10	13881.4329	10	13932.6127	6	15087.8323	-59	14984.3405	56	15035.5190	38
58	13980.8750	-32	13875.6033	43	13927.6635	4	15083.3980	-68	14978.1272	16	15030.1863	-33
59	13976.7377	36	13869.6803	1	13922.6276	3	15078.8694	-83			15024.7687	-22
60	13972.5073	45	13863.6795	40	13917.5047	-4	15074.2531	-36	14965.4375	80	15019.2607	17
61	13968.1863	20	13857.5864	15	13912.2967	6	15069.5443	23	14958.9400	-25	15013.6516	-22
62	13963.7774	-11			13906.9988	-16	15064.7355	22	14952.3662	32	15007.9550	-3
63	13959.2840	-13			13901.6163	-16	15059.8293	-13	14945.0894	-15	15002.1654	21
64	13954.7001	-44					15054.8358	20	14938.9232	-21	14990.2780	2
65	13950.0337	-25							14932.0710	33	14990.2989	1
00	13945.2707	-30							14923.1227	52	14904.2275	14
47	12040 4200	22							14019 0720	0	14079 0542	54
67 68	13940.4399	33							14918.0730	-9	14978.0543	-54 51
67 68 60	13940.4399	33							14918.0730	-9	14978.0543 14971.8046	-54 51
67 68 69 70	13940.4399	33							14918.0730	-9	14978.0543 14971.8046 14965.4375 14958.9878	-54 51 -80 -97
67 68 69 70	13940.4399	33	/11 115+				<u></u>		14918.0730	-9	14978.0543 14971.8046 14965.4375 14958.9878	-54 51 -80 -97
67 68 69 70	13940.4399	33 	^{′1} Π - Χ ¹ Σ ⁺ ,	2 - 0				A	14918.0730 ^{′1} Π - Χ ¹ Σ ⁺ ,	-9 1 - 0	14978.0543 14971.8046 14965.4375 14958.9878	-54 51 -80 -97
67 68 69 70 5	13940.4399	33 A	$^{\prime 1}\Pi$ - X ¹ Σ ⁺ ,	2 - 0			14140.3438	A 61	14918.0730	-9 <u>1 - 0</u>	14978.0543 14971.8046 14965.4375 14958.9878	-54 51 -80 -97
67 68 69 70 5 6	13940.4399	33 A	^{′1} Π - Χ ¹ Σ ⁺ ,	2 - 0	15121.8214	16	14140.3438 14140.7075	A 61 -61	14918.0730	-9 1 - 0	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550	-54 51 -80 -97 7
67 68 69 70 5 6 7	13940.4399	33 A	^{′1} Π - Χ ¹ Σ ⁺ ,	2 - 0	15121.8214 15121.1588	16 -20	14140.3438 14140.7075 14141.0106	A 61 -61 98	14918.0730 ^{/1} Π - Χ ¹ Σ ⁺ ,	-9 1 - 0	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339	-54 51 -80 -97 7 10
67 68 69 70 5 6 7 8	13940.4399	33 A	^{′1} Π - Χ ¹ Σ ⁺ ,	2 - 0	15121.8214 15121.1588 15120.4098	16 -20 22	14140.3438 14140.7075 14141.0106 14141.2065	A 61 -61 98 73	14918.0730	-9 <u>1 - 0</u>	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237	-54 51 -80 -97 7 10 10
67 68 69 70 5 6 7 8 9	13940.4399	33 A 86	^{'1} Π - Χ'Σ+, 15111.4396	2 - 0	15121.8214 15121.1588 15120.4098 15119.5620	16 -20 22 17	14140.3438 14140.7075 14141.0106 14141.2065	A 61 -61 98 73	14918.0730 ^{/1} Π - Χ ¹ Σ ⁺ ,	-9 <u>1 - 0</u>	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280	-54 51 -80 -97 7 10 10 43
67 68 69 70 5 6 7 8 9 10	13940.4399	33 A 86 	^{/1} Π - Χ ¹ Σ ⁺ , 15111.4396 15109.5963	2 - 0	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217	16 -20 22 17 28	14140.3438 14140.7075 14141.0106 14141.2065	A 61 -61 98 73	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701	-9 <u>1 - 0</u>	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368	-54 51 -80 -97 7 10 10 43 9
67 68 69 70 5 6 7 8 9 10 11	13940.4399 15128.6008 15128.4241	33 A 86 22	^{'1} Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514	6 4 -75	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849	16 -20 22 17 28 17	14140.3438 14140.7075 14141.0106 14141.2065 14141.2630	A 61 -61 98 73 12	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118 3091	-9 <u>1 - 0</u> -33 -54	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3395	-54 51 -80 -97 7 10 10 43 9 1
67 68 69 70 5 6 7 8 9 10 11 12 13	13940.4399 15128.6008 15128.4241 15128.1955	33 A 86 22 1 30	¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15103.6208	2 - 0 6 4 -75 -17 23	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849	16 -20 22 17 28 17	14140.3438 14140.7075 14141.0106 14141.2065 14141.2630 14141.1043 14140.8663	A 61 -61 98 73 12 -8 67	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459	-9 1 - 0 -33 -54 -55 -59	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947	-54 51 -80 -97 7 10 10 43 9 1 6 8
67 68 69 70 5 6 7 8 9 10 11 12 13 14	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718	33 A 86 22 1 -30 -29	$^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 15111.4396 15109.5963 15107.6514 15105.6262 15103.5008	6 4 -75 -17 -23	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849	16 -20 22 17 28 17	14140.3438 14140.7075 14141.0106 14141.2065 14141.2630 14141.1043 14140.8663 14140.5237	A 61 -61 98 73 12 -8 67 -16	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14116.3459	-9 1 - 0 -33 -54 -55 29 18	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410	-54 51 -80 -97 7 10 10 43 9 1 6 8 8 24
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572	33 A 86 22 1 -30 -21	$^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 15111.4396 15109.5963 15107.6514 15105.6262 15103.5008 15098.9662	6 4 -75 -17 -23	15121.8214 15121.1588 15120.4098 15119.5620 15118.5217 15117.5849 15113.9089	16 -20 22 17 28 17 -28	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982	A 61 -61 98 73 12 -8 67 -16 -41	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14119.586	-9 -33 -54 -55 29 18 23	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950	-54 51 -80 -97 7 10 10 43 9 1 6 8 8 -24
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.9490 15126.3420	33 A 86 22 1 -30 -29 -21 -60	¹¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15105.6262 15103.5008 15098.9662 15098.9662	6 4 -75 -17 -23 -53 -13	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089	16 -20 22 17 28 17 -28 20	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.9853	A 61 -61 98 73 12 -8 67 -16 -41 -52	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 1411.957 1411.957	-9 -33 -54 -55 29 18 23 67	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14125.5654	-54 51 -80 -97 7 10 10 43 9 1 6 8 8 -24 -6 -1
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.9490 15125.6551	33 A 86 22 1 -30 -29 -21 -60 44	¹¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15103.5008 15098.9662 15096.5636 15094.0747	2 - 0 6 4 -75 -17 -23 -53 -13 102	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953	16 -20 22 17 28 17 -28 20 22	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14139.5853 14138 9908	A 61 -61 98 73 12 -8 67 -16 -41 -52 10	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14111.9586 14109.6370 14107.2169	-9 -33 -54 -55 29 18 23 67 13	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14122.2947 14128.1410 14126.8950 14125.5654 14122.5654	-54 51 -80 -97 7 10 10 43 9 1 6 8 -24 -6 -1 -17
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.9490 15126.3420 15125.6551 15124.8567	33 A 86 22 1 -30 -29 -21 -60 44 -26	¹ 1 Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15103.5008 15098.9662 15098.9662 15096.5636 15094.0747 15091.4676	2 - 0 6 4 -75 -17 -23 -53 -13 102 -25	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992	16 -20 22 17 28 17 -28 20 22 6	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14139.5853 14138.9908 14138.2981	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 0 -22	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14111.9586 14109.6370 14107.2169 14104.7145	-9 -33 -54 -55 29 18 23 67 13 20	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14125.5654 14124.1456 14122.0351	-54 51 -80 -97 7 10 10 43 9 9 1 6 8 -24 -6 -1 -1 -17 -2
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	13940.4399 15128.6008 15128.4241 15128.1955 15127.4572 15126.9490 15126.3420 15125.6551 15123.9738	33 A 86 22 1 -30 -29 -21 -60 44 -26 2	¹ 1Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15103.5008 15098.9662 15096.5636 15094.0747 15091.4676 15088.7780	6 4 -75 -17 -23 -53 -13 102 -25 -38	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992	16 -20 22 17 28 17 -28 20 22 6	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14139.5853 14138.9908 14138.2981 14137.5222	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14111.9586 14109.6370 14104.7145 14102.1128	-9 -33 -54 -55 29 18 23 67 13 20 -80	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14125.5654 14124.1456 14122.6351 14121.0389	-54 51 -80 -97 -97 -7 10 10 43 9 1 6 8 -24 -6 -1 -17 -27 27
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.9490 15126.3420 15125.6551 15123.9738 15122.9952	33 A 86 22 1 -30 -29 -21 -60 44 -26 44 -26 2 16	¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15103.5008 15098.9662 15096.5636 15094.0747 15091.4676 15088.7780 15085.9900	6 4 -75 -17 -23 -53 -13 102 -25 -38	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.9953 15107.6992 15104.0227	16 -20 22 17 28 17 -28 20 22 6 -47	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.2065 14140.8663 14140.5237 14140.0982 14139.5853 14138.9908 14138.2981 14137.5222 14136.6518	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22 2 -32	$^{14918.0730}$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}1122.2556$ $^{1}4120.3701$ $^{1}4118.3981$ $^{1}4116.3459$ $^{1}4114.1957$ $^{1}4111.9586$ $^{1}4109.6370$ $^{1}4107.2169$ $^{1}4104.7145$ $^{1}4102.1128$ $^{1}409.4488$	-9 -33 -54 -55 29 18 23 67 13 20 -80 79	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14122.6351 14122.6351 14121.0389 14119.3554	-54 51 -80 -97 7 10 10 10 43 9 1 6 8 8 -24 -6 -1 -17 -2 27 7 9
67 68 69 70 5 6 7 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	13940.4399 15128.6008 15128.4241 15128.1955 15127.4572 15126.9490 15126.3420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 16 -12	¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15098.9662 15098.9662 15098.9662 15094.0747 15091.4676 15088.7780 15085.9900 15083.1193	6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493	16 -20 22 17 28 17 -28 20 22 6 -47 -13	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.203 14140.8663 14140.5237 14140.0982 14139.5853 14138.9908 14138.2981 14137.5222 14136.6518 14135.6957	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22 2 2 -32 -34	$^{14918.0730}$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - 300000000000000000000000000000000000$	-9 -33 -54 -55 29 18 23 67 13 20 -80 79 -22	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14125.5654 14122.6551 14122.6551 14121.0389 14119.3554	-54 51 -80 -97 7 10 10 10 10 10 10 10 6 8 8 -24 -6 -1 -17 -2 277 9 6
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	13940.4399 15128.6008 15128.4241 15128.1955 15127.4572 15126.9490 15126.3420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184 15120.7616	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 10 44 -12 104	¹ 1 Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15098.9662 15098.9662 15094.0747 15091.4676 15088.7780 15088.7780 15085.9900 15083.1193 15080.1557	6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15099.9789	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14139.5853 14138.2981 14137.5222 14136.6518 14135.6957 14134.6552	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22 2 -32 -34 9	$^{14918.0730}$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}II - X^{1}Z^{+},$ $^{1}II - X^{1}Z^{+},$ ^{1}II	-9 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14122.5654 14122.6554 14122.6551 14121.0389 14119.3554 14117.5785 14115.7144	-54 51 -80 -97 -97 10 10 10 43 9 1 6 8 8 -24 -6 -1 -17 -2 277 9 6 6 41
67 68 69 70 5 6 7 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.3420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 16 -12 104 21	¹ 1 Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15098.9662 15096.5636 15094.0747 15091.4676 15088.7780 15088.7780 15083.1193 15080.1557	6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15099.9789 15097.8175	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8 28	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14139.5853 14138.9908 14138.2981 14137.5222 14136.6518 14135.6957 14134.6552 14133.5234	A 61 -61 98 73 73 12 -8 67 -16 -41 -52 2 2 -32 -32 -32 -34 9 26	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14116.3459 14114.1957 14119.5370 14107.2169 14104.7145 14102.1128 14099.4488 14096.6702 14093.8147 14090.8694	-9 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8 -8 -8	14978.0543 14971.8046 14965.4375 14958.9878 14958.9878 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14122.2947 14128.1410 14126.8950 14122.5654 14122.6351 14121.0389 14117.5785 14117.5785 14115.7144 14113.7654	-54 51 -80 -97 -97 10 10 43 9 9 1 6 8 8 -24 -6 -1 -1 7 -2 277 9 6 4 41 9 9
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 12 22 23 24	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.3420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907 15118.1391	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 16 -12 104 21 72	¹ 11 - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15098.9662 15098.9662 15096.5636 15094.0747 15091.4676 15088.7780 15085.9900 15083.1193 15080.1557 15073.9385	6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15 51	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15099.9789 15097.8175	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8 28	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14138.9908 14138.2981 14137.5222 14136.6518 14135.6957 14134.6552 14133.5234 14132.2974	A 61 -61 98 73 73 12 -8 67 -16 -41 -52 2 -32 -32 -34 9 26 -11	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14111.9586 14109.6370 14107.2169 14104.7145 14102.1128 14099.4488 14096.6702 14093.8147 14090.8694 14087.8383	-9 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8 -8 -8 18	14978.0543 14971.8046 14965.4375 14958.9878 14958.9878 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14122.2471 14128.410 14126.8950 14125.5654 14122.6351 14121.0389 14119.3554 14117.5785 14115.7144 14113.7654	-54 51 -80 -97 -97 -7 10 10 43 9 9 1 6 6 8 8 -24 -6 -1 -17 -2 277 9 6 6 41 1 9 -13
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.3420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907 15118.1391 15116.6792	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 16 -12 104 21 72 -16	¹¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15103.5008 15098.9662 15098.9662 15098.9662 15094.0747 15091.4676 15088.7780 15083.1193 15080.1557 15073.9385 15070.6844	6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15 51 21	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15099.9789 15097.8175 15093.2042	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8 28 18	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14139.5853 14138.2981 14137.5222 14136.6518 14135.6957 14133.5234 14132.2974 14130.9851	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22 2 -32 -32 -34 9 26 -11 -22	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14111.9586 14109.6370 14107.2169 14104.7145 14102.1128 14099.4488 14099.4488 14090.8694 14093.8147 14090.8694 14084.7130	-9 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8 -8 18 -15	14978.0543 14971.8046 14965.4375 14958.9878 14958.9878 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14125.5654 14124.1456 14122.6351 14121.0389 14119.3554 14117.5785 14115.7144 14117.7210 14109.5890 14107.3755	-54 51 -80 -97 7 10 10 10 43 9 1 1 6 8 8 -24 -6 -1 -17 -22 7 9 6 6 41 41 9 9 -13 37
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26	13940.4399 15128.6008 15128.4241 15128.1955 15127.4572 15126.9490 15126.3420 15125.6551 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907 15118.1391 15116.6792 15115.1378	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 16 -12 104 21 72 -16 22	¹ II - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15103.5008 15098.9662 15096.5636 15094.0747 15091.4676 15088.7780 15085.9900 15083.1193 15080.1557 15073.9385 15070.6844 15067.3399	2 - 0 6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15 51 21 24	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15099.9789 15097.8175 15093.2042 15090.7584	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8 28 18 32	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14139.5853 14138.2981 14137.5222 14136.6518 14135.6957 14134.6552 14133.5234 14132.2974 14130.9851 14129.5875	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22 2 -32 -32 -34 9 26 (-11 -22 1	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14111.9586 14109.6370 14104.7145 14102.1128 14099.4488 14099.4488 14099.4488 14090.8694 14087.8383 14081.5046	-9 -33 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8 -8 -8 18 -15 5	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14125.5654 14122.6351 14121.0389 14119.3554 14117.5785 14115.7144 14113.7654 14117.210 14109.5890	-54 51 -80 -97 7 100 43 9 1 1 6 8 8 -24 -6 -1 -17 -22 77 9 6 41 9 9 -13 37 7 -21
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	13940.4399 15128.6008 15128.4241 15128.1955 15127.4572 15126.3420 15125.6551 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907 15118.1391 15116.6792 15115.1378 15113.4908	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 16 -12 104 21 72 -16 22 -16 -25 3	¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15098.9662 15098.9662 15094.0747 15091.4676 15088.7780 15085.9900 15083.1193 15080.1557 15073.9385 15070.6844 15067.3399 15063.8942	6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15 51 21 24 -47	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15099.9789 15097.8175 15093.2042 15090.7584 15088.2150	16 -20 22 17 28 17 -28 17 -28 20 22 6 -47 -13 -8 28 18 32 11	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.2065 14141.2037 14140.8663 14140.5237 14140.0982 14139.5853 14138.9908 14137.5222 14136.6518 14135.6957 14134.6552 14133.5234 14132.2974 14130.9851 14129.5875 14128.0936	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22 2 -32 -34 9 26 -11 -22 1 -50	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14111.9586 14109.6370 14107.2169 14104.7145 14102.1128 14090.4488 14090.4488 14090.4488 14090.4488 14090.8694 14087.8383 14081.5046	-9 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8 -8 18 -8 -55 5	14978.0543 14971.8046 14965.4375 14958.9878 14134.3550 14133.0237 14132.2280 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14125.5654 14122.6351 14121.0389 14119.3554 14117.5785 14115.7144 14113.7654 14117.210 14109.5890 14107.3755 14105.0625 14102.0625 14102.0625	-54 51 -80 -97 7 10 10 43 9 1 1 6 8 8 -24 -6 -1 -17 -2 27 7 9 6 41 9 9 6 41 9 -33 37 -21 -10
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 6 27 28	13940.4399 15128.6008 15128.4241 15128.1955 15127.4572 15126.9490 15126.3420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907 15118.1391 15116.6792 15115.1378 15113.4908	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 104 21 72 -16 -12 104 21 72 -16 -29 -21 -30 -22 -21 -30 -22 -21 -30 -22 -21 -30 -22 -21 -30 -22 -21 -30 -22 -21 -30 -22 -21 -30 -22 -21 -30 -22 -21 -30 -22 -21 -30 -22 -21 -30 -22 -30 -22 -30 -22 -21 -30 -22 -30 -22 -30 -22 -30 -22 -30 -22 -30 -22 -30 -22 -30 -22 -32 -32 -32 -32 -32 -32 -32	¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15098.9662 15098.9662 15094.0747 15091.4676 15088.7780 15085.9900 15083.1193 15080.1557 15073.9385 15070.6844 15067.3399 15063.8942 15060.3665	6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15 51 21 24 -47 -2	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15099.789 15097.8175 15093.2042 15098.2150 15085.5775	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8 28 18 32 11 -10	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.2065 14141.2030 14141.1043 14140.8663 14140.5237 14140.0982 14139.5853 14138.9908 14138.2981 14135.6957 14134.6552 14133.5234 14132.2974 14130.9851 14129.5875 14128.0936 14126.5219	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22 2 -32 -34 9 26 -11 -22 1 -50 9	$^{14918.0730}$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ 1	-9 -33 -54 -55 29 18 23 67 13 20 -8 -8 -8 18 -15 5	14978.0543 14971.8046 14965.4375 14958.9878 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14122.6351 14122.6351 14122.6351 14121.0389 14119.3554 14117.5785 14115.7144 14117.5785 14115.7144 14117.5785 14105.8025 14102.6677 14100.1859	-54 51 -80 -97 -97 10 10 10 43 9 1 6 8 8 -24 -6 -1 -17 -2 277 9 6 41 9 9 -13 37 -21 -10 16
67 68 69 70 5 6 7 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.9490 15126.63420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907 15118.1391 15116.6792 15115.1378 15113.4908 15111.7646 15109.9317	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 16 -12 104 21 72 -16 22 -10 42 -20 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -20 -22 -21 -22 -21 -22 -21 -22 -21 -22 -21 -22 -21 -22 -21 -22 -21 -22 -21 -22 -21 -22 -22	¹¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15096.5636 15094.0747 15091.4676 15088.7780 15085.9900 15083.1193 15080.1557 15073.9385 15070.6844 15067.3399 15063.8942 15060.3665 15056.7408	6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15 51 21 24 -47 -2 2	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15097.8175 15093.2042 15093.2042 15093.2042 15093.2042 15088.2150	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8 28 18 32 211 -10 9	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.2065 14141.2063 14140.8663 14140.5237 14140.0982 14139.5853 14138.9908 14138.2981 14137.5222 14136.6518 14135.6957 14134.6552 14133.5234 14132.2974 14130.9851 14129.5875 14128.0936 14126.5219 14124.8558	A 61 -61 98 73 73 12 -8 67 -16 -41 -52 2 -32 -32 -32 -32 -32 -32 -32 -32 -32	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14114.1957 14109.6370 14107.2169 14104.7145 14090.4488 14090.4488 14090.8694 14090.8694 14097.8383 14081.5046 14071.3359	-9 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8 -8 18 -15 5 -71	14978.0543 14971.8046 14965.4375 14958.9878 14958.9878 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14132.2281 14122.8950 14122.6351 14122.6351 14122.6351 14121.0389 14117.5785 14115.7144 14113.7654 14117.3755 14107.3755 14102.6677 14100.1859 14097.6125	-54 51 -80 -97 -97 10 10 43 9 9 1 6 8 8 -24 -6 -11 -17 -2 277 9 6 6 41 9 -13 377 -21 0 16 14
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.3420 15126.3420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907 15118.1391 15116.6792 15115.1378 15113.4908 15111.7646 15109.9317 15108.0144	33 A 86 22 1 -30 -29 -21 -60 24 -26 2 16 -12 -16 22 -16 22 -28 22 -28 22 -28 22	¹¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15096.5636 15098.9662 15096.5636 15094.0747 15091.4676 15083.7780 15083.7780 15083.1193 15080.1557 15073.9385 15070.6844 15067.3399 15063.8942 15063.8942 15053.0147	6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15 51 21 24 -47 -2 2 -62	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15097.8175 15093.2042 15097.8175 15093.2042 15090.7584 15088.2150 15088.5175 15082.8499 15080.0259	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8 28 18 32 11 -10 9 4	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14139.5853 14138.9908 14138.2981 14137.5222 14136.6518 14135.2974 14130.9851 14128.0936 14128.0936 14126.5219 14124.8558 14123.1033	A 61 -61 -98 73 73 12 -8 67 -16 -41 -52 2 -32 -32 -34 9 26 -11 -22 1 -22 1 -34 9 26 -11 -22 1 -34 9 9 13 40	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14114.1957 14114.1957 14109.6370 14107.2169 14104.7145 14109.4488 14096.6702 14093.8147 14090.8694 14087.8383 14084.7130 14081.5046 14071.3359 14067.7817	-9 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8 -8 18 -15 5 -71 22	14978.0543 14971.8046 14965.4375 14958.9878 14958.9878 14133.7339 14133.0237 14132.2280 14133.7339 14133.0237 14132.2280 14133.0359 14122.2471 14128.1410 14126.8950 14125.5654 14122.6351 14122.0389 14119.3554 14117.5785 14115.7144 14113.7654 14117.5785 14105.0625 14105.0625 14097.6125 14094.9494	-54 51 -80 -97 -7 10 10 43 9 9 1 6 8 8 -24 -6 -1 -17 -2 227 9 6 6 41 -13 377 -21 -100 10 10 -13 -13 -13 -13 -13 -21 -14 -14 -14 -14 -14 -14 -14 -14 -14 -1
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.3420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907 15115.1378 15115.1378 15113.4908 15111.7646 15109.9317 15108.0144 15105.9990	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 104 -12 -16 21 72 -16 22 -33 22 -28 22 33	¹¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15096.5636 15094.0747 15091.4676 15088.7780 15085.9900 15083.1193 15080.1557 15073.9385 15073.9385 15073.9385 15073.6844 15063.8942 15063.8942 15063.655 15055.7408 15053.0147 15049.2083	2 - 0 6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15 51 21 24 -47 -2 2 -62 8 2 -62 8 -2 -62 -8 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15099.9789 15097.8175 15093.2042 15090.7584 15085.5775 15082.8499 15080.0259 15087.1072	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8 28 18 32 11 -10 9 4 4 -6	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14138.2981 14137.5222 14136.6518 14135.6957 14134.6552 14133.5234 14132.2974 14130.9851 14129.5875 14128.0936 14126.5219 14124.8558 14123.1033 14121.2541	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22 2 -32 -34 9 26 -11 -22 1 -50 9 13 40 -12	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14111.9586 14109.6370 14107.2169 14104.7145 14109.4488 14099.4488 14099.4488 14090.8694 14093.8147 14090.8694 14087.8383 14084.7130 14081.5046 14071.3359 14064.7817 14064.1239	-9 -33 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8 -8 -8 -8 -8 -8 -5 -71 22 -37 -7	14978.0543 14971.8046 14965.4375 14958.9878 14958.9878 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14122.2401 14126.8950 14125.5654 14122.6351 14122.6351 14121.0389 14119.3554 14117.5785 14115.7144 14113.7654 14117.5785 14105.0625 14105.0625 14102.6677 14100.1859 14097.6125 14094.9494 14092.1987	-54 51 -80 -97 -97 -10 10 43 9 9 1 6 6 8 8 -24 -6 -1 -17 -2 227 9 6 6 41 1 -13 37 -21 -10 16 16 4 1 -13 -13 -13 -13 -13 -14 -14 -14 -14 -14 -14 -14 -14 -14 -14
67 68 69 70 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 20	13940.4399 15128.6008 15128.4241 15128.1955 15127.8718 15127.4572 15126.3420 15125.6551 15124.8567 15123.9738 15122.9952 15121.9184 15120.7616 15119.4907 15118.1391 15116.6792 15115.1378 15113.4908 15111.7646 15109.9317 15108.0144 15105.9990 15103.8876	33 A 86 22 1 -30 -29 -21 -60 44 -26 2 16 -12 104 21 72 -16 22 -53 22 -33 26 -28 22 -33 26 -28 -29 -21 -50 -29 -10 -10 -29 -21 -60 -29 -21 -60 -29 -21 -60 -29 -21 -60 -29 -21 -60 -29 -21 -60 -26 -22 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -26 -27 -10 -27 -21 -60 -12 -10 -12 -10 -16 -27 -28 -27 -16 -27 -28 -27 -16 -27 -28 -27 -28 -27 -16 -22 -28 -28 -27 -16 -22 -28 -28 -28 -27 -28 -27 -26 -27 -27 -26 -27 -27 -26 -27 -27 -26 -27 -27 -27 -26 -27 -27 -28 -28 -28 -28 -28 -28 -28 -28	¹¹ Π - X ¹ Σ ⁺ , 15111.4396 15109.5963 15107.6514 15105.6262 15103.5008 15098.9662 15096.5636 15094.0747 15091.4676 15088.7780 15085.9900 15083.1193 15080.1557 15073.9385 15073.9385 15073.9385 15073.6844 15063.8942 15063.8942 15063.8942 15063.665 15055.7408 15053.0147 15049.2083 15045.3028	2 - 0 6 4 -75 -17 -23 -53 -13 102 -25 -38 -98 -46 15 51 21 24 -47 -2 2 -62 8 24 -62 -8 -62 -8 -62 -62 -62 -62 -62 -62 -62 -62	15121.8214 15121.1588 15120.4098 15119.5620 15118.6217 15117.5849 15113.9089 15110.9954 15109.3953 15107.6992 15104.0227 15102.0493 15099.789 15097.8175 15093.2042 15090.7584 15083.2150 15085.5775 15082.8499 15087.1072 15077.1072	16 -20 22 17 28 17 -28 20 22 6 -47 -13 -8 28 18 32 11 -10 9 9 4 -6 6	14140.3438 14140.7075 14141.0106 14141.2065 14141.2065 14141.2065 14141.1043 14140.8663 14140.5237 14140.0982 14130.5853 14138.2981 14137.5222 14136.6518 14135.6957 14134.6557 14134.6557 14134.6557 14132.2974 14130.9851 14129.5875 14128.0936 14126.5219 14124.8558 14123.1033 14121.2541	A 61 -61 98 73 12 -8 67 -16 -41 -52 10 -22 2 -32 -34 9 26 -11 -22 1 -50 9 13 40 -12	14918.0730 $^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 14122.2556 14120.3701 14118.3981 14116.3459 14114.1957 14111.9586 14109.6370 14107.2169 14104.7145 14109.4488 14090.8694 14090.8694 14090.8694 14090.8694 14081.5046 14071.3359 14067.7817 14064.1239 14060.3900	-9 -33 -54 -55 29 18 23 67 13 20 -80 79 -22 -8 -8 18 -15 5 -71 22 -37 25 -37	14978.0543 14971.8046 14965.4375 14958.9878 14958.9878 14958.9878 14133.7339 14133.0237 14132.2280 14131.3368 14130.3595 14129.2947 14128.1410 14126.8950 14125.5654 14122.6351 14122.6351 14121.0389 14119.3554 14117.5785 14115.7144 14117.710 14109.5890 14107.3755 14105.0625 14102.6677 14100.1859 14097.6125 14097.6125 14099.4949 14092.1987	-54 51 -80 -97 7 10 10 43 9 9 1 6 8 8 -24 -6 -1 -17 -227 9 6 6 41 -17 -227 9 9 -13 37 -21 -100 16 144 -11 -4 14-4 -11 -100 -100 -100 -100

TABLE 1—Continued

J	R(J)	0-C	P(J)	0-C	Q(J)	0-C	R(J)	0-C	P(J)	0-C	Q(J)	0-C
24			15037 2031	.21	15067 7912	3	14115,1898	-7	14052.6420	-8	14083.4164	-3
35	15096.9886	14	15033.0127	-45	15064.4974	3	14112.9920	7	14048.6331	-51	14080.3163	42
36	1007017000				15061.1107	13	14110.7022	-12	14044.5490	36	14077.1188	-1
37	15091.9190	16	15024.3606	1	15057.6293	17	14108.3239	-26	14040.3655	10	14073.8366	-6
38	15089.2382	-28	15019.8876	-41	15054.0538	20	14105.8601	-9	14036.0961	5	14070.4602	-69
39	15086.4802	98	15015.3282	-11	15050.3843	23	14103.3063	-4	14031.7358	-27	14067.0131	47
40	15083.5979	-76	15010.6708	-27	15046.6164	-18	14100.6684	48	14027.2906	-28	14063.4724	111
41	15080.6509	45	15005.9271	30	15042.7616	11	14097.9383	66	14022.7536	-67	14056 1004	11
42	15077.5920	-9	15001.0825	13	15038.8094	8	14095.1153	42	14018.1380	-5 14	14050.1004	-11
43	15074.4431	-21	14990.1455	-13	15034.7047	10 52	14092.1967	-30	14013.4313	24	14032.2851	-5
44	15067 8625	_45	14991.1151	-22	15026 3975	78	14086 1172	-45	14003.7453	-28	14044.4018	32
45	15064 4371	-45	14980 7726	-22	15020.5575	-1	14082.9319	-93	13998.7736	-17	14040.3218	10
40	15060 9120	4	14975.4638	-10	15017.6388	-18	14079.6905	136	13993.7095	-50	14036.1545	-2
48	15057.2914	-10	14970.0648	37	15013.1269	17	14076.3215	-24	13988.5711	52	14031.9018	15
49			14964.5644	2	15008.5140	-18	14072.8831	9	13983.3214	-82	14027.5586	11
50	15049.7606	-108	14958.9878	138	15003.8123	-3	14069.3485	-33	13978.0047	-7	14023.1271	8
51			14953.2871	-32	14999.0176	22	14065.7327	-0			14018.6058	-10
52	15041.8727	-4			14994.1268	25	14062.0205	-45			14013.9987	-5
53	15037.7745	-81	14941.6419	-12	14989.1386	-9	14058.2418	132	13961.5050	-14	14009.3069	37
54			14935.6788	-8			14054.3553	118	12050 0710		14004.5201	11
55	15029.3173	-14	14929.6139	-88	14072 (104	22	14050.3735	30	13950.0710	23	13999.0412	-33
56	15020 4802	26	14923.4080	-4/	149/3.0194	-22	14040.3000	-15	12029 2841	21	13994.0903	43
5/	15020.4803	20	14917.2284	-11	14908.2390	-17	14042.1303	-28	13032 2505	-46	13084 4060	-33
28 50	15015.9208	20 79	14910.0040	-01	14057 2555	-38	14037.9145	-28	15952.2505	-40	13979 2771	10
39 60	15006 5100	17	14504.4504	-70	14951 6180	-58	14029 1758	36	13010 0448	31	13973 9571	-49
61	15001.5109	75			14945 8798	-22	11029.1750	50	13913.6593	55	13968.5608	1
62	14996 7321	65			14940.0490	-37						
63	14991.6910	-13			14934.1365	68						
64					14928.1132	3						
65												
66	14976.0237	-35										
67	14970.6197	28										
68	14965.1155	30										
68	14965.1155	30 	$^{1}\Pi$ - X $^{1}\Sigma^{+}$,	0 - 1				A	′ ¹ Π - Χ ¹ Σ ⁺ ,	0 - 0		
68 4	14965.1155	30 	$^{1}\Pi$ - X ¹ Σ ⁺ ,	0 - 1	12021.0384	7		A	^{′1} Π - Χ ¹ Σ ⁺ ,	0 - 0		
68 4 5	14965.1155	30 	$^{\prime 1}\Pi - \mathbf{X}^{1}\Sigma^{+},$	0 - 1	12021.0384 12020.6565	7 34		A	$^{\prime 1}\Pi - \mathbf{X}^{1}\Sigma^{+},$	0 - 0		
68 4 5 6	14965.1155	30 	$T^{1}\Pi - \mathbf{X}^{1}\Sigma^{+},$	0 - 1	12021.0384 12020.6565 12020.1961	7 34 45		A	^{′1} Π - Χ ¹ Σ ⁺ ,	0 - 0		
68 4 5 6 7	14965.1155	30 	¹¹ Π - Χ ¹ Σ ⁺ ,	0 - 1	12021.0384 12020.6565 12020.1961 12019.6520	7 34 45 -12		A	^ν ¹ Π - Χ ¹ Σ ⁺ ,	0-0	13133.0658	20
68 4 5 6 7 8	14965.1155	30 <u>A</u> '	¹ Π - X ¹ Σ ⁺ ,	0 - 1	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358	7 34 45 -12 -20		A	¹¹ Π - X ¹ Σ ⁺ , 13125.0920	0 - 0	13133.0658 13132.3983	20 14
68 4 5 6 7 8 9	14965.1155	30 <u>A</u> '	¹ Π - X ¹ Σ ⁺ , 12010.1307	0 - 1	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406	7 34 45 -12 -20 -50		A	$^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 13125.0920 13123.4302	0 - 0 14 24	13133.0658 13132.3983	20 14
68 4 5 6 7 8 9 10	14965.1155	30 <u>A</u> '	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480	0 - 1 40 30	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750	7 34 45 -12 -20 -50 -14	12140 8681	A	$^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 13125.0920 13123.4302 13121.6781	0 - 0 14 24 -35 20	13133.0658 13132.3983 13130.8140	20 14 9
68 4 5 6 7 8 9 10 11 12	14965.1155	30 <u>A</u> '	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802	0 - 1 40 30 -64	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092	7 34 45 -12 -20 -50 -14 14	13140.8681	A 50 70	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414	0 - 0 14 24 -35 20	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012	20 14 9 4 52
68 4 5 6 7 8 9 10 11 12 13	14965.1155 12027.6921	30 <u>A</u> '	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339	0 - 1 40 30 -64 26	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065	7 34 45 -12 -20 -50 -14 14 16 -13	13140.8681 13140.7838	A 50 70	$^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414	0 - 0 14 24 -35 20 15	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109	20 14 9 4 52 -16
68 4 5 6 7 8 9 10 11 12 13 14	14965.1155 12027.6921 12027.6038 12027.4371	30 <u>A'</u> 38 14 -24	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498	0 - 1 40 30 -64 26 -57 -14	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306	7 34 45 -12 -20 -50 -14 14 16 -13 -6	13140.8681 13140.7838 13140.3633	A 50 70 93	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625	0 - 0 14 24 -35 20 15 -31	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448	20 14 9 4 52 -16 -9
68 4 5 6 7 8 9 10 11 12 13 14 15	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046	30 A' 38 14 -24 48	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873	0 - 1 40 30 -64 26 -57 -14 13	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15	13140.8681 13140.7838 13140.3633 13140.0258	A 50 70 93 82	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625	0 - 0 14 24 -35 20 15 -31	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926	20 14 9 4 52 -16 -9 -28
68 4 5 6 7 8 9 10 11 12 13 14 15 16	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.8807	30 A' 38 14 -24 48 -24	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294	0 - 1 40 30 -64 26 -57 -14 13 -148	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19	13140.8681 13140.7838 13140.3633 13140.0258 13139.6035	A 50 70 93 82 57	^{/1} Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522	0 - 0 14 24 -35 20 15 -31 -66	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13126.6448 13125.3926 13124.0616	20 14 9 4 52 -16 -9 -28 -4
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.8807 12026.4962	30 A' 38 14 -24 48 -24 67	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205	40 30 -64 26 -57 -14 13 -148 -53	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0	13140.8681 13140.7838 13140.3633 13140.0258 13139.6035	A 50 70 93 82 57	^{/1} Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272	0 - 0 14 24 -35 20 15 -31 -66 -37	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13126.6448 13125.3926 13124.0616 13122.6508	20 14 9 4 52 -16 -9 -28 -4 55
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.8807 12026.4962 12026.0219	30 A' 38 14 -24 48 -24 67 29	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321	40 30 -64 26 -57 -14 13 -148 -53 13	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569	7 34 45 -12 -50 -14 14 16 -13 -6 -15 19 -0 8	13140.8681 13140.7838 13140.3633 13140.0258 13139.6035 13138.5116	A 50 70 93 82 57 35	$^{'1}\Pi - X^{1}\Sigma^{+},$ 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173	0 - 0 14 24 -35 20 15 -31 -66 -37 -25	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438	20 14 9 4 52 -16 -9 -28 -4 55 -14
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.8807 12026.4962 12026.0219 12025.4686	30 A' 38 14 -24 48 -24 48 -24 67 29 -29	$^{11}\Pi - X^{1}\Sigma^{+},$ 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321	0 - 1 40 30 -64 26 -57 -14 13 -148 -53 13	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0 8 9	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424	A 50 70 93 82 57 35 44	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616	20 14 9 4 52 -16 -9 -28 -4 55 -14 -3
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.0219 12025.4686 12024.8443	30 A' 38 14 -24 48 -24 48 -24 -29 -29 -29 -29	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321 11987.4130	0 - 1 40 30 -64 26 -57 -14 13 -148 -53 13 19	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0 8 9 -6	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858	A 50 70 93 82 57 35 44 10	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179 13099.6442	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931	20 14 9 4 52 -16 -9 -28 -4 55 -14 -3 -22
68 4 5 6 7 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.0219 12025.4686 12024.8443 12024.8443	30 A' 38 14 -24 48 -24 67 29 -29 -29 -29 -44	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321 11987.4130 11984.8864	0 - 1 40 30 -64 26 -57 -14 13 -148 -53 13 19 0	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0455	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0 8 8 9 -6 53	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510	50 70 93 82 57 35 44 10 29	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13109.4522 13109.4522 13109.2179 13099.6442	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13129.5616 13117.8931 13116.1428	20 14 9 4 52 -16 -9 -28 -4 55 -14 -3 -22 -26
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 21 22	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4862 12026.4862 12022.4686 12024.8443 12024.1416 12023.3661	30 A' 38 14 -24 48 -24 67 29 -29 -29 -29 -44 -17	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321 11987.4130 11984.8864 11982.2840	0 - 1 40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -11	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0 8 9 -0 8 9 -6 53 1	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310	50 70 93 82 57 35 44 10 29 29	$^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13109.4522 13109.4522 13109.2179 13099.6442 13094.2422	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096	20 14 9 4 52 -16 6 -9 -28 -4 55 -14 -3 3 -22 -26 -26 -26 -26
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 4	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4862 12026.4862 12022.4686 12024.8443 12024.1416 12023.3661	30 A' 38 14 -24 48 -24 67 29 -29 -29 -29 -44 -17	¹¹ $\Pi - X^1\Sigma^+$, ^{12010.1307} ^{12008.4480} ^{12006.6802} ^{12004.8540} ^{12002.9339} ^{12000.9498} ^{11998.8873} ^{11996.7294} ^{11994.5205} ^{11992.2321} ^{11987.4130} ^{11984.8864} ^{11979.6046} ^{11979.6046}	0 - 1 40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -11 -27 4	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310	A 50 70 93 82 57 35 44 10 29 29	¹¹ II - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179 13099.6442 13094.2422 13094.2422	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13112.3934	20 14 9 4 52 -16 6 -9 9 -28 -4 55 -14 4 -3 22 -26 -26 -26 -25
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4862 12026.4962 12025.4686 12024.8443 12024.1416 12023.3661 12021.5819	30 A' 38 14 -24 48 -24 67 29 -29 -29 -29 -44 -17 12	¹¹ $\Pi - X^1\Sigma^+$, ^{12010.1307} ^{12008.4480} ^{12006.6802} ^{12004.8540} ^{12002.9339} ^{12000.9498} ^{11998.8873} ^{11996.7294} ^{11994.5205} ^{11992.2321} ^{11987.4130} ^{11984.8864} ^{11982.2840} ^{11979.6046} ^{11976.8536}	0 - 1 40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -11 -27 4	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12004.0485 12002.3521 12000.5835	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0 8 9 -0 8 9 -6 53 1 -5	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381	A 50 70 93 82 57 35 44 10 29 29 3	¹¹ II - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179 13099.6442 13094.2422 13088.4962 13085.5044	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 140	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13112.3934	20 14 9 4 52 -16 -9 9 -28 -4 55 -14 -3 22 -26 -26 -25
68 4 5 6 7 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.4962 12026.4962 12025.4686 12024.8443 12024.8443 12024.8443 12024.8443 12024.8443 12024.8443 12024.8443 12022.5706	30 A' 38 14 -24 48 -24 67 29 -29 -29 -29 -29 -29 -29 -29 -29 -29	12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321 11987.4130 11984.8864 11982.2840 11979.6046 11976.8536	0 - 1 40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -111 -27 4 -55	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521 12000.5835	7 34 45 -12 -20 -50 -14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5 34	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140	A 50 70 93 82 57 35 44 10 29 29 3 3	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13119.8543 13117.9414 13113.8625 13109.4522 13109.4522 13109.4522 13109.4522 13109.6442 13099.6442 13094.2422 13088.4962 13085.5044	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13112.3934	20 14 9 4 52 -16 -9 -28 -4 55 -14 -3 -22 -26 -25 -26 -25 -25 -26 -25
68 4 5 6 7 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.0219 12025.4686 12024.8443 12024.1416 12023.3661 12021.5819 12020.5706 12019.4886 12019.4886	30 A' 38 14 -24 48 -24 48 -29 -29 -29 -29 -29 -29 -29 -29 -29 -29	12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321 11987.4130 11984.8864 11972.6046 11976.8536 11971.1149 11968.1333	0 - 1 40 30 -64 26 -57 -14 13 -14 13 -14 19 0 -11 -27 4 -5 14	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521 12000.5835 11996.8211 11994.8210	7 34 45 -12 -20 -50 -14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5 34 16 17	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808	A 50 70 93 82 57 35 44 10 29 29 3 3 -2 34	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179 13099.6442 13094.2422 13088.4962 13085.5044 13085.5044 13072.2852	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -140 -32 -5	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13112.3934 13108.3090 13106.1446 13103.8924	20 14 9 4 52 -16 -9 -28 -4 55 -14 -3 -22 -26 -25 -25 -46 -29 -29 -60
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 17 18 19 20 21 22 23 24 25 26 27 28	12027.6921 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.0219 12025.4686 12024.443 12024.1416 12023.3661 12021.5819 12020.5706 12019.4886 12019.4886 12019.4886	30 A' 38 14 -24 48 -24 48 -29 -29 -29 -29 -29 -29 -29 -29 -29 -29	¹¹ Π - X ¹ Σ ⁺ , 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321 11987.4130 11984.8864 11992.2321 11987.4130 11984.8536 11971.1149 11968.1333 11965.0706	40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -11 -27 4 -5 14 -14	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521 12000.5835 11996.8211 11994.8210 11992.7462 11990.5928	7 34 45 -12 -20 -50 -14 16 -13 -6 -15 19 -0 8 9 -6 53 1 1-5 34 16 17 -0	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808 13129.4808	A 50 70 93 82 57 35 44 10 29 29 3 3 -2 34 7	$^{\prime 1}\Pi - X^{1}\Sigma^{+},$ 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179 13099.6442 13094.2422 13088.4962 13085.5044 13082.4403 13079.2852	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32 -5	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13112.3934 13108.3090 13106.1446 13103.8924 13101.5643	20 14 9 4 52 -16 -9 -28 -4 55 -14 -3 -22 -26 -25 -46 -29 -60 -60 -17
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 17 18 19 20 21 22 23 24 25 26 27 28 29	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.0219 12025.4686 12024.4443 12024.1416 12023.3661 12021.5819 12020.5706 12019.4886 12019.4886 12017.0856 12015.7664	30 A' 38 14 -24 48 -24 48 -24 -29 -29 -29 -29 -29 -29 -29 -29 -29 -29	¹¹ $\Pi - X^1\Sigma^+$, ^{12010.1307} ^{12008.4480} ^{12006.6802} ^{12004.8540} ^{12002.9339} ^{12000.9498} ^{11998.8873} ^{11994.5205} ^{11992.2321} ^{11987.4130} ^{11984.8864} ^{11984.8864} ^{11984.8864} ^{11976.8536} ^{11971.1149} ^{11968.1333} ^{11965.0706} ^{11961.9338}	40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -11 -27 4 -5 14 -14 -19	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12005.5528 11996.8211	7 34 45 -12 -20 -50 -14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5 34 16 17 -0 28	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808 13128.0578 13126.5540	A 50 70 93 82 57 35 44 10 29 29 3 3 -2 34 7 5	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179 13099.6442 13094.2422 13088.4962 13088.4962 13085.5044 13085.5044 13082.4403 13079.2852 13072.7309	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32 -5 92	13133.0658 13132.3983 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13112.3934 13108.3090 13106.1446 13103.8924 13101.5643 13099.1438	20 14 9 4 52 -16 -9 -28 -4 55 -26 -26 -26 -25 -25 -46 -29 -60 -17 -67
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.0219 12025.4686 12024.8443 12024.1416 12023.3661 12021.5819 12020.5706 12019.4886 12019.4886 12017.0856 12017.0856 12015.7664 12014.3716	30 A' 38 14 -24 48 -24 48 -24 -29 -29 -29 -29 -29 -44 -17 12 -13 25 172 172 17 -11 -27	¹¹ $\Pi - X^1\Sigma^+$, ^{12010.1307} ^{12008.4480} ^{12006.6802} ^{12004.8540} ^{12002.9339} ^{12000.9498} ^{11998.8873} ^{11994.5205} ^{11994.5205} ^{11992.2321} ^{11987.4130} ^{11984.8864} ^{11976.8536} ^{11971.1149} ^{11968.1333} ^{11965.0706} ^{11961.9338} ^{11958.7296}	40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -11 -27 4 -5 14 -5 14 -19 64	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12002.3521 12004.0485 12005.5528 11996.8211 11994.8210	7 34 45 -12 -20 -50 -14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5 34 16 17 -0 28 16	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808 13128.0578 13126.5540 13124.9665	A 50 70 93 82 57 35 44 10 29 29 3 -2 34 7 5 -1	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179 13094.2422 13094.2422 13094.2422 13088.4962 13088.4962 13085.5044 13082.4403 13079.2852 13072.7309 13069.3198	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32 -5 92 42	13133.0658 13132.3983 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.438 13119.5616 1317.8931 13116.1428 13114.3096 13105.643 13099.1438 13096.6439	20 14 9 4 52 -16 -9 -28 -4 55 -14 -3 -22 -26 -26 -25 -25 -25 -46 -29 -60 -17 -67 -79
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.4962 12025.4686 12024.8443 12024.1416 12023.3661 12021.5819 12020.5706 12019.4886 12019.4886 12019.4886 12015.7664 12014.3716 12012.9049	30 A' 38 14 -24 48 -24 48 -24 -29 -29 -29 -29 -29 -29 -29 -29 -29 -29	¹¹ $\Pi - X^1\Sigma^+$, ^{12010.1307} ^{12008.4480} ^{12006.6802} ^{12004.8540} ^{12000.9498} ^{1998.8873} ^{1999.2321} ^{1994.5205} ^{11994.5205} ^{11994.5205} ^{11994.5205} ^{11994.5205} ^{11994.5205} ^{11995.4333} ^{1965.0706} ^{11961.9338} ^{11955.4357}	40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -11 -27 4 -5 14 -14 -19 64 14	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12007.1962 12005.6571 12004.0485 12007.2521 12000.5835 11996.8211 11994.8210 11992.7462 11990.5928 11988.3673 11986.0611 11983.6775	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5 34 16 17 -0 8 8 16 -3	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808 13126.5540 13124.9665 13123.2978	A 50 70 93 82 57 35 44 10 29 29 3 -2 34 7 5 -1 14	¹¹ Π - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179 13099.6442 13094.2422 13088.4962 13088.4962 13085.5044 13082.4403 13079.2852 13072.7309 13069.3198	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32 -5 92 42	13133.0658 13132.3983 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13112.3934 13108.3090 13106.1446 13103.8924 13109.1438 13099.1438 13099.6439 13094.0680	20 14 9 4 52 -16 -9 -28 -4 55 -14 -55 -14 -3 -22 -26 -25 -25 -25 -26 -25 -26 -25 -26 -29 -60 -17 -67 -9 -79 -79 -79 -79 -721
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.4962 12025.4686 12024.8443 12024.8443 12024.1416 12023.3661 12021.5819 12020.5706 12019.4886 12017.0856 12017.0856 12015.7664 12012.9049 12011.3492	30 A' 38 14 -24 48 -24 48 -24 67 29 -29 -29 -29 -29 -29 -29 -29 -29 -29	$^{11}\Pi - X^{1}\Sigma^{+},$ 12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11994.5205 11992.2321 11987.4130 11984.8864 11976.8536 11976.8536 11971.1149 11968.1333 11965.0706 11961.9338 11955.4357 11952.0707	40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -11 -27 4 -5 14 -14 -19 64 14 15	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521 12000.5835 11996.8211 11994.8210 11992.7462 11990.5928 11988.3673 11988.66715 11981.2224	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5 34 16 17 -0 28 16 -3 28	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808 13126.5540 13124.9665 13123.2978 13121.5423	A 50 70 93 82 57 35 44 10 29 29 3 -2 34 7 5 -1 14 -5	$^{\prime 1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{-},$ $^{1}\Pi - X^{1}\Sigma^{-}$	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32 -5 92 42 18	13133.0658 13132.3983 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13112.3934 13108.3090 13106.1446 13103.8924 13109.6439 13099.6439 13094.0680	20 14 9 4 52 -16 -9 -28 -4 55 -14 -3 -22 -26 -26 -25 -25 -25 -46 -29 -60 -17 -67 -79 -21
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.4962 12026.4962 12025.4686 12024.8443 12024.8443 12024.1416 12023.3661 12021.5819 12020.5706 12019.4886 12017.0856 12017.0856 12017.0856 12017.0856 12017.0856 12017.0856 12017.0856 12017.0856 12017.0949 12013.3492 12009.7326	30 A ' A	$^{11}\Pi - X^{1}\Sigma^{+},$ $^{12}\Omega^{10}.1307$ $^{12}\Omega^{08}.4480$ $^{12}\Omega^{06}.6802$ $^{12}\Omega^{04}.8540$ $^{12}\Omega^{02}.9339$ $^{12}\Omega^{00}.9498$ $^{19}98.8873$ $^{19}94.5205$ $^{11}992.2321$ $^{11}987.4130$ $^{19}84.8864$ $^{19}82.2840$ $^{19}79.6046$ $^{19}76.8536$ $^{19}71.1149$ $^{19}68.1333$ $^{19}65.0706$ $^{19}61.9338$ $^{19}58.7296$ $^{19}52.4357$ $^{19}52.0707$ $^{19}48.6228$	40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -111 -27 4 -5 14 -14 -14 -19 64 14 15 -49	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521 12000.5835 11996.8211 11994.8210 11992.7462 11990.5928 11988.3673 11988.3673 11981.2224	7 34 45 -12 -20 -50 -14 14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5 34 16 17 -0 28 16 -3 28	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808 13128.0578 13126.5540 13124.9665 13123.2978 13121.5423 13119.7034	50 70 93 82 57 35 44 10 29 29 3 -2 34 7 5 -1 14 -5 -26	¹¹ II - X ¹ Σ ⁺ , 13125.0920 13123.4302 13121.6781 13119.8543 13117.9414 13113.8625 13109.4522 13109.4522 13109.4522 13109.4522 13109.4522 13109.4522 13099.6442 13099.6442 13088.4962 13088.4962 13069.5044 13085.5044 13085.5044 13085.5044 13069.2555 13058.6028 13058.6028	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32 -5 92 42 18 25	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13112.3934 13108.3090 13106.1446 13103.8924 13109.1438 13096.6439 13094.0680	20 14 9 4 52 -16 -9 -9 -28 -4 55 -14 -3 3 -22 -26 -26 -25 -26 -25 -26 -25 -26 -25 -46 -29 -60 -17 -67 -7-9 -21 -44 -29 -21 -21 -21 -21 -21 -21 -21 -21 -21 -21
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 4	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.8807 12026.4962 12026.4962 12025.4686 12024.8443 12024.8443 12024.8443 12024.8443 12024.5819 12020.5706 12019.4886 12019.4866 12019.4866 12019.4866 12019.4866 12019.4866 12009.4866	30 A A A A A A A A	12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321 11987.4130 11984.8864 11976.8536 11971.1149 11968.1333 11965.0706 11958.7296 11955.4357 11952.0707 11948.6228 11945.1136	40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -11 -27 4 -5 14 -14 -19 64 15 -49 34	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12015.8092 12015.8092 12014.8065 12013.7306 12012.5762 12010.401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521 12000.5835 11996.8211 11994.8210 11992.7462 11990.5928 11988.3673 11988.0671 11988.6715 11981.2224	7 34 45 -12 -20 -50 -14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5 34 16 17 -0 28 16 -3 28 16 -3 28	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808 13126.5540 13124.9665 13123.2978 13121.5423 13119.7034	A 50 70 93 82 57 35 44 10 29 29 3 -2 34 7 5 -1 1 14 -5 -26	$^{'1}\Pi - X^{1}\Sigma^{+},$ $^{13}125.0920$ $^{13}123.4302$ $^{13}123.4302$ $^{13}121.6781$ $^{13}119.8543$ $^{13}117.9414$ $^{13}113.8625$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}109.4522$ $^{13}1309.6442$ $^{13}009.2852$ $^{13}079.2852$ $^{13}079.2852$ $^{13}079.2852$ $^{13}079.2852$ $^{13}069.3198$ $^{13}062.2565$ $^{13}058.6028$ $^{13}054.8622$	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32 -5 92 42 18 25 -9 -9	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13124.0616 13122.6508 13121.1438 13119.5616 13123.0516 13117.8931 13116.1428 13114.3096 13112.3934 13108.3090 13106.1446 13103.8924 13108.3099 13109.1438 13099.1438 13099.1438 13099.40680 13088.6528 13088.6528	20 14 9 4 52 -16 -9 -9 -28 -4 55 -14 -3 -22 -26 -26 -25 -25 -26 -29 -60 -17 -67 -79 -21 -44 -137 -79
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 33 34 35	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.0219 12026.4962 12026.0219 12025.4686 12024.8443 12024.1416 12021.5819 12020.5706 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.4886 12019.5866 12009.586 12009.5866 12009.5	30 A' 38 14 -24 48 -24 48 -29 -29 -29 -29 -29 -29 -29 -29	12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321 11987.4130 11984.8864 11971.1149 11968.1333 11965.0706 11971.8338 11955.4357 11955.4357 11952.0707 11948.6228 11941.5239	40 30 -64 26 -57 -14 13 -148 -53 13 -11 -27 4 -5 14 -11 -27 4 -5 14 -14 -19 64 14 15 -49 34 76	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12011.3492 12010.0401 12008.6569 12007.1962 12005.6571 12004.0485 12002.3521 12000.5835 11996.8211 11994.8210 11992.7462 11990.5928 11988.3673 11986.0611 11983.6775 11981.2224	7 34 45 -12 -20 -50 -14 16 -13 -6 -15 19 -0 8 9 -6 53 1 -5 34 16 17 -0 28 16 -3 28 16 -3 28	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808 13128.0578 13126.5540 13124.9665 13123.2978 13121.5423 13119.7034	A 50 70 93 82 57 35 44 10 29 29 3 -2 34 7 5 -1 14 -5 -26 -30	$^{(1)}\Pi - X^{1}\Sigma^{+},$ 13125.0920 13123.4302 13123.4302 13121.6781 13119.8543 13119.8543 13117.9414 13113.8625 13109.4522 13107.1272 13104.7173 13102.2179 13099.6442 13094.2422 13088.4962 13079.2852 13079.2852 13079.2852 13079.2852 13072.7309 13069.3198 13062.2565 13058.6028 13054.8622 13051.0440 13051.0440 13051.0440 13052.1265 13058.6028 13054.8622 13051.0440 13054.8622 13054.8622 130551.0440 13054.8622 13054.8622 130551.0440 13054.8622 13054.86	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32 -5 92 42 18 25 -9 8 20 20 20 20 20 20 20 20 20 20	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13122.6508 13121.1438 13114.3096 13108.3090 13106.1446 13103.8924 13105.6439 13094.0680 13088.6528 13085.8124 13085.8124	20 14 9 4 55 -16 -9 -28 -46 -29 -26 -25 -14 -26 -25 -26 -25 -26 -25 -26 -25 -26 -27 -26 -27 -26 -27 -26 -27 -21 -44 -17 -79 -21 -21 -21 -21 -21 -21 -21 -21 -21 -21
68 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36	14965.1155 12027.6921 12027.6038 12027.4371 12027.2046 12026.8807 12026.4962 12026.0219 12025.4686 12024.8443 12024.1416 12023.3661 12021.5819 12020.5706 12019.4886 12019.4886 12019.4886 12019.4886 12015.7664 12015.7664 12015.7664 12012.9049 12011.3492 12009.7326 12008.0367 12008.0367 12008.2536 12004.3988	30 A ' 38 14 -24 48 -24 48 -29 -29 -29 -29 -29 -29 -29 -29	12010.1307 12008.4480 12006.6802 12004.8540 12002.9339 12000.9498 11998.8873 11996.7294 11994.5205 11992.2321 11987.4130 11984.8864 11979.6046 11976.8536 11971.1149 11968.1333 11965.0706 11961.9338 11955.4357 11952.0707 11948.6228 11955.1136 11941.5239 11937.8524	40 30 -64 26 -57 -14 13 -148 -53 13 19 0 -111 -27 4 -5 14 -14 -19 64 14 15 -49 34 76 60 60 60 60 60 60 60 60 60 6	12021.0384 12020.6565 12020.1961 12019.6520 12019.0358 12018.3406 12017.5750 12016.7319 12015.8092 12014.8065 12013.7306 12012.5762 12001.3492 12000.6569 12007.1962 12005.6571 12004.0485 12002.3521 12000.5835 11996.8211 11994.82100 11992.7462 11990.5928 11988.3673 11988.3673 11981.2224	$\begin{array}{c} 7\\ 34\\ 45\\ -12\\ -20\\ -50\\ -14\\ 14\\ 16\\ -13\\ -6\\ -15\\ 19\\ -0\\ 8\\ 9\\ -6\\ 53\\ 1\\ -5\\ 34\\ 16\\ -3\\ 28\\ 16\\ -3\\ 28\\ 11\\ 20\\ 16\\ 2\end{array}$	13140.8681 13140.7838 13140.7838 13140.0258 13139.6035 13138.5116 13137.8424 13137.0858 13136.2510 13135.3310 13133.2381 13130.8140 13129.4808 13128.0578 13126.5540 13124.9665 13123.2978 13121.5423 13119.7034 13115.7792 13113.6930	A 50 70 93 82 57 35 44 10 29 29 3 -2 34 7 5 -1 14 -5 -26 -30 -24 19	$^{\prime 1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{+},$ $^{1}\Pi - X^{1}\Sigma^{-},$ $^{1}\Pi - X^{1}\Sigma^{-}$	0 - 0 14 24 -35 20 15 -31 -66 -37 -25 -78 -44 -32 -140 -140 -32 -5 92 42 18 25 -9 8 -20 8 -20 -25 -29 8 -20 -25 -29 -25 -29 -25 -29 -25 -29 -25 -29 -25 -29 -25 -29 -25 -25 -25 -25 -25 -25 -25 -25	13133.0658 13132.3983 13130.8140 13129.8967 13128.9012 13127.8109 13126.6448 13125.3926 13124.0616 13122.6508 13121.1438 13119.5616 13117.8931 13116.1428 13114.3096 13108.3090 13106.1446 13103.8924 13101.5643 13099.1438 13094.0680 13088.6528 13085.8124 13085.8124 13085.8124	20 14 9 4 52 -16 -9 -28 -4 55 -14 -3 -22 -26 -26 -25 -25 -14 -29 -60 -25 -25 -17 -67 -79 -21 -44 -137 -77 -21

TABLE 1—Continued

J	R(J)	0-C	P(J)	0-C	Q(J)	0-C	R(J)	O-C	P(J)	0-C	Q(J)	0-0
38	12000.4629	6	11930.2792	12	11964.8523	-94	13109.2720	0	13039.0870	-7	13073.6707	-6
39	11998.3800	22	11926.3806	8	11961.8667	-9	13106.9308	-45	13034.9348	-24	13070.4289	38
40	11996.2184	19	11922.4062	7	11958.7980	10	13104.5129	-25	13030.6990	-53	13067.0974	- 10
41	11993.9769	-15	11918.3548	-4	11955.6513	13	13102.0102	-20	13026.3905	16	13063.6873	35
42	11991.6646	9	11914.2292	4	11952.4280	15	13099.4190	-68	13021.9878	-31	13060.1919	3:
43	11989.2686	-36	11910.0298	31	11949.1308	41	13096.7538	-24	13017.5130	24	13056.6122	1:
44	11986.8061	20	11905.7504	19	11945.7526	21	13093.9939	-95	13012.9445	-33	13052.9504	(
45	11984.2624	31	11901.3944	-1	11942.3038	58	13091.1628	-46	13008.3064	38	13049.2056	-
46	11981.6356	-22	11896.9792	145	11938.7710	19	13088.2515	33	13003.5748	-3	13045.3819	2:
47	11978.9391	-6	11892.4419	-172			13085.2385	-73			13041.4722	22
48	11976.1648	-2	11887.8796	19	11931.4834	8	13082.1691	89	12993.8814	84		
49	11973.3145	8	11883.2221	16	11927.7233	-17	13078.9923	7	12988.8916	-69	13033.4013	-10
49					11923.8939	28	13075.7413	14	12983.8396	-22	13029.2433	-18
51	11967.3707	-106	11873.6862	69	11919.9768	-43	13072.4085	36			13025.0074	2
52	11964.2989	-14	11868.7968	15	11915.9980	30	13068.9908	38			13020.6829	14
53	11961.1426	-3	11863.8378	21	11911.9327	-0	13065.4914	55				
54	11957.8946	-142	11858.8017	12	11907.7913	-31	13061.8997	-20			13011.7825	-4
55	11954.5935	-50	11853.6932	33	11903.5812	11	13058.2395	49			13007.2132	-3
56	11951.2272	156	11848.5061	23	11899.2907	10	13054.4909	65			13002.5641	1:
57	11947.7536	53	11843.2319	-104	11894.9216	-16	13050.6474	-38			12997.8185	-78
58	11944.2055	-30	11837.9117	63			13046.7274	-76			12993.0069	-
59	11940.5974	50			11885.9567	-60	13042.7362	2			12988.1092	30
60	11936.8843	-157			11881.3615	-71	13038.6471	-68				
61	11933.1259	-53			11876.6966	-21						
62	11929.2823	-38			11871.9476	-53						
63	11925.3602	-47										
64	11921.3717	44			11862.2479	138						
65	11917.2855	-81			11857.2626	15						
66	11913.1463	26			11852.2208	84						
67	11908.9235	59										
68	11904.6084	-70										
69	11900.2364	-6										
70	11895.7986	159										
71	11891.2521	-2										
72	11886.6552	93										
73	11881.9522	-114										
			N (D) O	~	0/17		1 D (1)				0 0/1	

J	R(J)	0-C	P(J)	0-C	Q(J)	0-C	J	R(J)	0-C	P(J)	0-C	Q(J)	O- C
						Λ΄ ¹ Π -	$X^{1}\Sigma^{+}$,	3 - 3					
5					12814.4615	-14	35	12797.3213	-9	12733.7593	-25	12765.0430	50
6					12813.9872	65	36	12795.3311	75	12729.9758	-54	12762.1424	-29
7			12807.1385	-20	12813.4178	-3	37	12793.2415	-30	12726.1204	-4	12759.1716	-6
8	12820.8525	1	12805.6045	32	12812.7702	-48	38	12791.0818	-30	12722.1837	32	12756.1153	-36
9	12821.0242	-25	12803.9900	82	12812.0450	-67	39	12788.8426	-18			12752.9849	-3
10	12821.1248	43	12802.2815	-7	12811.2518	39	40	12786.5242	6	12714.0619	15	12749.7707	-5
11			12800.4956	-67	12810.3628	-10	41	12784.1148	-73	12709.8812	6	12746.4775	4
12	12821.0692	21	12798.6408	-16	12809.4038	45	42	12781.6424	24	12705.6256	45	12743.1036	10
13	12820.9211	12	12796.7054	31	12808.3517	-27	43	12779.0777	4	12701.2802	-15	12739.6473	-4
14	12820.6939	18	12794.6846	27	12807.2282	-10	44	12776.4334	-7	12696.8632	5	12736.1131	4
15	12820.3884	44	12792.5760	-55	12806.0231	-5	45	12773.7076	-25	12692.3644	6	12732.4958	-16
16	12819.9952	-3			12804.7362	-14	46	12770.9111	55			12728.8046	29
17	12819.5214	-51	12788.1441	38	12803.3702	-10	47	12768.0195	-10	12683.1261	-8		
18	12818.9741	-29	12785.7980	-14	12801.9251	5	48	12765.0430	-118	12678.3972	83	12721.1681	-16
19	12818.3480	8			12800.3979	3	49	12762.0072	-12	12673.5700	-11	12717.2351	17
20	12817.6382	14	12780.8762	-14	12798.7896	-6	50			12668.6784	47	12713.2157	-11
21	12816.8450	-10	12778.2970	4	12797.1029	5	51	12755.6765	28	12663.6963	-4	12709.1237	38
22	12815.9738	-10			12795.3311	-32	52	12752.3834	-20	12658.6345	-54	12704.9455	26
23	12815.0244	13			12793.4867	9	53	12749.0276	112	12653.4937	-99	12700.6859	4
24	12813.9872	-36	12770.0749	17	12791.5579	9	54	12745.5667	-1			12696.3457	-23
25	12812.8796	15	12767.1697	-24	12789.5476	-3	55			12642.9896	-24	12691.9287	-15
26	12811.6856	7	12764.1917	8	12787.4577	-6	56			12637.6256	88	12687.4286	-37
27	12810.4107	-4	12761.1307	10	12785.2877	-8	57			12632.1624	2	12682.8575	33
28	12809.0604	35	12757.9852	-33	12783.0415	31	58			12626.6304	25	12678.1914	-44
29	12807.6212	-9	12754.7676	2	12780.7110	31	59			12621.0146	5	12673.4592	20
30	12806.1069	1	12751.4630	-32	12778.2970	0	60			12615.3224	17	12668.6353	-32
31	12804.5148	39	12748.0861	9	12775.8067	9	61					12663.7403	6
32	12802.8363	17	12744.6232	-10	12773.2314	-30	62					12658.7589	-17
33	12801.0766	-11	12741.0846	12	12770.5841	15	63					12653.7028	15
34	12799.2362	-41			12767.8512	8							

TABLE 2Molecular Constants (in cm⁻¹) for ¹⁹¹IrN

State	Constants ^a	v=0	v=1	v=2	v=3	v = 4
	T,	0.0	1113.98156(81)	2215.3583(12)	3304.1190(15)	4380.2571(13)
$X^{1}\Sigma^{+}$	B _v	0.4988514(43)	0.4956274(43)	0.4923794(44)	0.4891109(49)	0.4858132(47)
	$10^7 \times D_v$	3.961(11)	3.996(11)	4.0310(11)	4.081(13)	4.105(12)
	T,	13135.40589(82)	14136.5799(10)	15124.4725(10)	16119.5057(18)	
A′¹∏	B	0.4571612(44)	0.4544486(46)	0.4517702(45)	0.4489159(50)	
	$10^7 \times D_v$	3.756(11)	3.799(12)	3.891(11)	4.030(14)	
	$10^{\rm s} imes q_{\rm v}$	3.703(43)	4.108(58)	4.307(52)	4.679(52)	
	T,	15186.80941(78)	16069.46012(85)	16955. 53366(73)	17822.5985(25)	18666.4009(17)
	B	0.4532484(42)	0.4491175(43)	0.4451380(47)	0.4403810(76)	0.4370676(49)
А¹П	$10^7 \times D_v$	4.435(10)	4.397(11)	4.487(18)	2.587(47)	5.093(13)
	$10^{11} \times H_{v}$			0.345(30)	-1.125(100)	
	$10^5 \times q_v$	3.847(20)	4.581(32)	5.092(35)	5.838(48)	6.418(64)

^a Numbers in parentheses are one standard deviation in the last two digits.

¹ Π state and v = 0 of $A^1\Pi$ state and between v = 3 of the $A'^{\ 1}\Pi$ state and v = 1 of $A^1\Pi$ state is evident when the term values (T_v) of different vibrational levels are plotted (Fig. 3). Because of this interaction, the vibrational spacing $\Delta G_{5/2} = 994.8464(13) \text{ cm}^{-1}$ in the $A'^{\ 1}\Pi$ state is larger than the spacing between the lower vibrational levels. For the same reason, the vibrational spacing $\Delta G_{1/2} = 882.19547(56) \text{ cm}^{-1}$ in the $A^1\Pi$ state is smaller than $\Delta G_{3/2} = 885.9101(10) \text{ cm}^{-1}$. The constants of Tables 2 and 3 indicate that the Λ -doubling constant q in the $A'^{\ 1}\Pi$ and $A^1\Pi$ states increases rapidly with increasing vibrational quantum number v. These observations are in contrast with those for the isoelectronic PtC molecule, where no perturbations were observed in the $A^1\Pi$ and $A'^{\ 1}\Pi$ states (41).

The molecular constants of the $X^1\Sigma^+$, $A'^{-1}\Pi$, and $A^1\Pi$ states have been used to evaluate equilibrium molecular constants of both isotopomers (Table 4). The ground state vibrational intervals of 1113.59102(40), 1100.99516(71),

1088.3883(12), and 1075.7706(16) cm⁻¹ between the v'' = 0, 1, 2, 3, and 4 vibrational levels of the most abundant ¹⁹³IrN vary in a regular manner as expected for an isolated electronic state. These intervals provide the equilibrium vibrational constants of $\omega_e = 1126.176360(61) \text{ cm}^{-1}$, $\omega_e x_e = 6.289697(32)$ cm⁻¹ for the ground state of ¹⁹³IrN. The vibrational constants for the excited states A' ¹ Π and $A^{1}\Pi$ have also been determined from the experimental data of Table 3. However, the excited state vibrational constants are less accurate because of the global interactions between the A' ¹ Π and $A^{1}\Pi$ states. The values of $\omega_e = 1014.0636(74) \text{ cm}^{-1}$ and $\omega_e x_e = 6.6214(28)$ cm⁻¹ for the A' ¹ Π state and $\omega_e = 936.7389(53) \text{ cm}^{-1}$ and $\omega_e x_e = 11.64785(76) \text{ cm}^{-1}$ for the $A^{1}\Pi$ state have been obtained by giving a reduced weighting to the term values of the perturbed levels.

The rotational constants for the vibrational levels of the ground state also vary in a very regular manner and pro-

State	Constants ^a	v=0	v=1	v=2	v=3	v=4
	T,	0.0	1113.59102(40)	2214.58618(59)	3302.9745(10)	4378.7451(12)
$X^{1}\Sigma^{+}$	$\mathbf{B}_{\mathbf{v}}$	0.4984997(25)	0.4952786(25)	0.4920322(26)	0.4887636(29)	0.4854762(30)
	$10^7 \times D_v$	3.9608(47)	3.9969(50)	4.0280(50)	4.0610(65)	4.1066(69)
	T,	13135.39792(53)	14136.21868(53)	15123.79685(53)	16118.6432(12)	
Α′¹Π	B,	0.4568363(25)	0.4541299(26)	0.4514485(25)	0.4485981(30)	
	$10^7 \times D_v$	3.7516(49)	3.8030(51)	3.8786(48)	4.0157(69)	
	$10^5 \times q_v$	3.707(25)	4.077(27)	4.492(26)	4.637(31)	
	T,	15186.75075(32)	16068.94622(46)	16954.85635(92)	17821.7082(12)	18665.2644(10)
	B,	0.4529317(25)	0.4488022(25)	0.4448414(31)	0.4400080(44)	0.4367518(30)
A ¹ Π	$10^7 \times D_v$	4.4405(48)	4.3949(46)	4.592(11)	2.048(30)	5.0808(68)
	$10^{11} \times H_{v}$			0.534(14)	-2.152(69)	
	$10^5 \times q_v$	3.8502(94)	4.619(17)	5.023(30)	5.822(43)	6.470(50)

 TABLE 3

 Molecular Constants (in cm⁻¹) for ¹⁹³IrN

^a Numbers in parentheses are one standard deviation in the last two digits.



A′¹∏

FIG. 3. A schematic energy level diagram of the vibrational levels of the $A' \ ^{1}\Pi$ and $A^{1}\Pi$ states of IrN showing the interaction of the v = 2 and 3 vibrational levels of the $A' \ ^{1}\Pi$ state with the v = 0 and 1 vibrational levels of the $A^{1}\Pi$ state.

vide the equilibrium constants of $B''_e = 0.5001033(20) \text{ cm}^{-1}$ and $\alpha''_e = 0.0032006(20) \text{ cm}^{-1}$ for the most abundant ¹⁹³IrN molecule. The rotational constants for the interacting vibrational levels of the $A'^{-1}\Pi$ and $A^{1}\Pi$ states are also modified slightly by perturbations and were reduced in weighting for the determination of the equilibrium rotational constants. The values of $B_e = 0.458227(59) \text{ cm}^{-1}$, $\alpha_e = 0.002735(27)$ cm⁻¹ for the $A'^{-1}\Pi$ state and $B_e = 0.45494(20) \text{ cm}^{-1}$, $\alpha_e =$ 0.004077(76) cm⁻¹ for the $A^1\Pi$ state of ¹⁹³IrN were obtained using the data of Table 3. The equilibrium vibrational and rotational constants for the minor isotopomer ¹⁹¹IrN have also been evaluated in a similar manner. The equilibrium rotational constants have been used to evaluate the equilibrium bond lengths of 1.6068276(32) Å, 1.67864(11), Å and 1.68466(37) Å for the $X^1\Sigma^+$, $A'^{-1}\Pi$, and $A^{1}\Pi$ states of ¹⁹³IrN. Corresponding values of 1.6062648(33) Å, 1.67805(11), Å and 1.68412(37) Å have been obtained for the minor isotopomer ¹⁹¹IrN. The ground state bond length of 1.6068276(32) Å can be compared with 1.683 Å for IrC (*38*) and 1.772 for IrO (*35*). The bond length of the isoelectronic PtC molecule is 1.677 Å (*41*).

The ground state of IrN arises from the leading electron configuration $1\sigma^2 2\sigma^2 1\pi^4 3\sigma^2 1\delta^4$, whereas the excited states $A'^{1}\Pi$ and $A^{1}\Pi$ arise from the configurations $1\sigma^2 2\sigma^2 1\pi^4 3\sigma^1 1\delta^4 2\pi^1$ and $1\sigma^2 2\sigma^2 1\pi^4 3\sigma^2 1\delta^3 2\pi^1$. Here 3σ and 1δ are mainly the bonding and nonbonding orbitals, respectively, and 2π is an antibonding orbital. The $A'^{1}\Pi - X^{1}\Sigma^{+}$ transition thus involves promotion of an electron from bonding 3σ molecular orbital to the antibonding 2π orbital, whereas the $A^{1}\Pi - X^{1}\Sigma^{+}$ transition arises from the promotion of an electron in the nonbonding 1δ orbital to the antibonding 2π orbital. Two low-lying ${}^{3}\Pi$ states also arise from these configurations but so far have not been observed experimentally.

The equilibrium molecular constants for the unperturbed ground state of ¹⁹³IrN and ¹⁹¹IrN have been used in the isotopic relations (44) to check for consistency. The equilibrium constants $\omega_e = 1126.176360(61) \text{ cm}^{-1}$ and $B_e = 0.5001033(20) \text{ cm}^{-1}$ for ¹⁹³IrN provide the calculated values of $\omega_e = 1126.5746 \text{ cm}^{-1}$ and $B_e = 0.500459 \text{ cm}^{-1}$ for ¹⁹¹IrN, to be compared with the corresponding observedvalues of $\omega_e = 1126.5775(16) \text{ cm}^{-1}$ and $B_e = 0.5004538(21) \text{ cm}^{-1}$. There is excellent agreement between the calculated and observed values. For the excited states, however, the agreement is only moderate because of the presence of perturbations.

A very rough, semiquantitative estimate of the dissociation energy of this molecule can be made using the Morse relationship

 TABLE 4

 Equilibrium Constants (in cm⁻¹) for ¹⁹¹IrN and ¹⁹³IrN

		¹⁹¹ IrN			¹⁹³ IrN	
Constants	$\mathbf{X}^{1}\Sigma^{+}$	Α' ¹ Π	A ¹ II	Χ ¹ Σ ⁺	Α ′ ¹ Π	A ¹ II
ω _e	1126.5775(16)	1014.4554(94)	936.1344(43)	1126.176360(61)	1014.0636(74)	936.7389(53)
ω _e x _e	6.29532(88)	6.6407(33)	11.51159(66)	6.289697(32)	6.6214(28)	11.64785(76)
$10^3 \times \omega_e y_e$	-1.61(13)			-1.8288(47)		
B _e	0.5004538(21)	0.458552(59)	0.45525(20)	0.5001033(20)	0.458227(59)	0.45494(20)
$10^3 imes lpha_e$	3.1995(20)	2.738(27)	4.075(76)	3.2006(20)	2.735(27)	4.077(76)
$10^5 \times \gamma_e$	-1.196(40)			-1.113(39)		
r _e (Å)	1.6062648(33)	1.67805(11)	1.68412(37)	1.6068276(32)	1.67864(11)	1.68466(37)

^a Numbers in parentheses are one standard deviation in the last two digits.

$$D_{\rm e} = \omega_{\rm e}^2 / 4 \omega_{\rm e} x_{\rm e}.$$

The vibrational constants of the unperturbed ground state provide a value of $D_e = 50\ 400\ \text{cm}^{-1}$ (6.25 eV) for IrN. There is no other estimate of the dissociation energy of IrN, but this value can be compared with the $D_e = 6.28\ \text{eV}$ for PtC obtained from mass spectroscopy (36). The short IrN bond length relative to IrO and the high dissociation energy are consistent with a strong formal triple bond.

Very recently (after this paper was written), we have recorded the spectrum of IrN between the 3000 to 10 000 cm⁻¹ region and have identified a new $A^3\Pi - X^1\Sigma^+$ transition of IrN near 8840 cm⁻¹ (45). Our assignment is also supported by *ab initio* calculations (45). These observations indicate that the ${}^1\Sigma^+ - X^1\Sigma^+$ transition of IrN (analogous to the $A'' {}^1\Sigma^+ - X^1\Sigma^+$ transition of PtC) is, in fact, the $A^3\Pi_0 - X^1\Sigma^+$ subband of the $A^3\Pi - X^1\Sigma^+$ transition.

CONCLUSION

The emission spectrum of IrN has been investigated in the region extending from the near infrared to visible using a Fourier transform spectrometer. The bands observed in the 10000- $20\,000 \text{ cm}^{-1}$ region have been assigned to two electronic transitions, $A^1\Pi - X^1\Sigma^+$ and $A' \ ^1\Pi - X^1\Sigma^+$, adopting the notation for the isoelectronic PtC molecule (39–42). The $A^{1}\Pi - X^{1}\Sigma^{+}$ system was previously observed by Marr et al. (21), but a number of additional bands of this transition were identified. The A' ${}^{1}\Pi - X^{1}\Sigma^{+}$ system has been observed for the first time. A rotational analysis of a large number of bands has been obtained and molecular constants have been determined for vibrational levels up to v = 4in the $X^1\Sigma^+$ state, v = 4 in the $A^1\Pi$ state, and v = 3 in the $A'^{-1}\Pi$ state. The present observations indicate that the v = 0 and 1 vibrational levels of the $A^{1}\Pi$ state interact with the v = 2 and 3 vibrational levels of the $A'^{1}\Pi$ state causing global perturbations. No theoretical work is available for IrN and some ab initio predictions for the low-lying states would be welcome.

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