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Further Analysis of the $\tilde{B}^1A''$–$\tilde{X}^1A'$ System of CuOH and CuOD

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The $\tilde{B}^1A''$–$\tilde{X}^1A'$ perpendicular system of CuOH and CuOD in the green was first measured and analyzed by Trkula and Harris for $K'_a \leq 1$ (*J. Chem. Phys.* **79,** 1138–1144 (1983)). We have extended their measurements up to $K'_a = 9$ and $K'_a = 12$ for CuOH and CuOD, respectively, and completed a distortion analysis for both electronic states. Extensive perturbations were observed for $K'_a \geq 2$ in CuOH, and these are suspected to arise from interaction with the OH stretch of a lower-lying triplet state. An improved partial r_s structure for the molecule was also evaluated for both electronic states. The ground state geometric parameters are $r_{Cu-O} = 1.76893(25)$ Å, $r_{O-H} = 0.9520(50)$ Å, and $\angle_{CuOH} = 110.245(80)°$.

INTRODUCTION

In recent years, much spectroscopic effort has been devoted to the study of diatomics containing transition metals, particularly hydrides and oxides, but as yet little has been done to extend this work to polyatomics. Such investigations will yield more information on the covalent/ionic nature of transition metal bonds, and also provide experimental observations to test ab initio theory.

It was the initial aim of this work to investigate the chemiluminescence spectra of copper-containing polyatomics using a hollow cathode sputtering source similar to that developed by Trkula, Harris, and Hilborn (*1*). These authors used such a source to produce CuOH, and they rotationally analyzed the green system by high-resolution laser-excitation spectroscopy (*2*). As a test of our source, we repeated the work of Trkula and Harris, using H_2O and D_2O as oxidants, and obtained a very strong green chemiluminescent flame. When this light was dispersed through a monochromator, we obtained a spectrum in the green which agreed very well with the chemiluminescence spectrum reported by Trkula and Harris (*2*).

However, two additional features were observed in the red, one with a closed parallel structure and the other more open. Antić-Javanović and Pesić reported a red transition in their work on flames containing copper salts (*3*) in 1969, and more recently Parson and co-workers have observed these two red systems in the chemiluminescence spectra of the reaction of excited Cu atoms with H_2O_2 (*4*). The structure of the more open band closed up on deuteration, indicating that the molecule responsible for this band contained hydrogen. Furthermore, the ratios of the intensities of both red systems to the green system were insensitive to the discharge conditions and this led us to conclude that both red systems were due to CuOH. High-resolution laser excitation spectra of

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TABLE I

Spectroscopic Constants for ^{63}CuOH

(cm^{-1})		$\tilde{X}\ ^1A'$	$\tilde{B}\ ^1A''$
A		23.03905(19)	25.89822(66)
B		0.3922118(84)	0.3822428(67)
C		0.3846294(84)	0.3759555(67)
Δ_J	$\times 10^{-7}$	5.808(31)	5.507(30)
Δ_{JK}	$\times 10^{-5}$	3.964(11)	9.429(67)
Δ_K	$\times 10^{-2}$	2.3109(26)	6.709(32)
δ_J	$\times 10^{-8}$	1.445(35)	1.172(25)
δ_K	$\times 10^{-5}$	2.26(32)	9.32(19)
H_{JKK}	$\times 10^{-6}$	0.1247(50)	1.619(28)
H_K	$\times 10^{-4}$	1.511(12)	8.72(15)
L_{JKKK}	$\times 10^{-9}$	0.637(74)	15.41(32)
L_K	$\times 10^{-6}$	0.835(18)	9.58(24)
M_K	$\times 10^{-8}$		4.00(12)
E		18406.77929(58)	
σ		0.0041	

these red systems have now been recorded, confirming that both transitions connect to the ground electronic state. These spectra and their analyses will be presented elsewhere.

During the analysis of these red spectra, it became apparent that better ground state rotational constants were needed to form more accurate ground state combination differences. In the previous work on the green system (*2*), only transitions for $K_a \leq 1$ were measured, and so the band origin and D_K were not determined for either state,

TABLE II

Spectroscopic Constants for ^{65}CuOH

(cm^{-1})		$\tilde{X}\ ^1A'$	$\tilde{B}\ ^1A''$
A		23.03790(15)	25.90029(61)
B		0.389720(12)	0.3797962(87)
C		0.382175(12)	0.3735754(87)
Δ_J	$\times 10^{-7}$	5.823(47)	5.485(50)
Δ_{JK}	$\times 10^{-5}$	3.947(11)	9.427(15)
Δ_K	$\times 10^{-2}$	2.30646(70)	6.7154(17)
δ_J	$\times 10^{-8}$	0.73(15)	1.013(53)
δ_K	$\times 10^{-5}$	4.16(41)	9.32
H_{JKK}	$\times 10^{-6}$	0.1247	1.619
H_K	$\times 10^{-4}$	1.5047(13)	8.72
L_{JKKK}	$\times 10^{-9}$	0.637	15.41
L_K	$\times 10^{-6}$	0.835	9.58
M_K	$\times 10^{-8}$		4.00
E		18406.74459(73)	
σ		0.0032	

TABLE III

Spectroscopic Constants for ^{63}CuOD

(cm^{-1})		$\tilde{X}\ ^1A'$	$\tilde{B}\ ^1A''$
A		12.42647(29)	14.23511(40)
B		0.365932(14)	0.353836(15)
C		0.354308(14)	0.344590(15)
Δ_J	$\times 10^{-7}$	5.146(94)	4.783(97)
Δ_{JK}	$\times 10^{-5}$	1.5745(56)	1.9768(95)
Δ_K	$\times 10^{-2}$	0.6405(50)	2.8082(87)
δ_J	$\times 10^{-8}$	1.81(17)	1.570(91)
δ_K	$\times 10^{-5}$	4.00(24)	1.38(42)
H_{JJK}	$\times 10^{-10}$		-4.28(31)
H_{JKK}	$\times 10^{-8}$		4.68(18)
H_K	$\times 10^{-4}$	-0.166(33)	4.084(81)
L_{JKKK}	$\times 10^{-10}$		2.509(87)
L_K	$\times 10^{-6}$	-2.246(99)	7.25(35)
M_K	$\times 10^{-8}$	-6.58(23)	7.07(65)
N_K	$\times 10^{-10}$	-8.92(45)	-1.92(23)
O_K	$\times 10^{12}$	-4.61(31)	-6.72(45)
E		18422.33545(65)	
σ		0.0048	

and the values for D_{JK} were ill-determined. Consequently, we have re-recorded the high-resolution spectrum of the green system and extended the measurements to higher K_a. This paper contains the results of our analysis.

TABLE IV

Spectroscopic Constants for ^{65}CuOD

(cm^{-1})		$\tilde{X}\ ^1A'$	$\tilde{B}\ ^1A''$
A		12.43046(66)	14.23570(74)
B		0.363450(33)	0.351535(34)
C		0.352099(33)	0.342367(34)
Δ_J	$\times 10^{-7}$	5.82(36)	5.56(37)
Δ_{JK}	$\times 10^{-5}$	1.572(10)	2.018(19)
Δ_K	$\times 10^{-2}$	0.741(13)	2.828(12)
δ_J	$\times 10^{-8}$	1.29(34)	1.98(16)
δ_K	$\times 10^{-5}$	1.68(96)	1.68
H_{JKK}	$\times 10^{-8}$		4.77(53)
H_K	$\times 10^{-4}$	0.757(94)	4.325(98)
L_{JKKK}	$\times 10^{-10}$		2.48(32)
L_K	$\times 10^{-6}$	1.86(32)	9.20(44)
M_K	$\times 10^{-8}$	2.78(50)	15.2(11)
N_K	$\times 10^{-10}$	1.60(29)	14.1(11)
O_K	$\times 10^{-12}$		5.26(30)
P_K	$\times 10^{-15}$		9.61(52)
E		18422.3087(16)	
σ		0.0046	

TABLE V

Observed Line Positions (cm^{-1}) for ^{63}CuOH

J'	Ka'	Kc'	J''	Ka''	Kc''	OBS	O-C
2	0	2	3	1	2	18381.737	-6
3	0	3	4	1	3	18380.891	-5
5	0	5	6	1	5	18379.134	-0
6	0	6	7	1	6	18378.222	2
7	0	7	8	1	7	18377.268*	-16
8	0	8	9	1	8	18376.319	-7
9	0	9	10	1	9	18375.343	-2
10	0	10	11	1	10	18374.348	5
11	0	11	12	1	11	18373.320	2
12	0	12	13	1	12	18372.273	3
13	0	13	14	1	13	18371.204	2
14	0	14	15	1	14	18370.112	1
15	0	15	16	1	15	18368.997	-1
16	0	16	17	1	16	18367.861	-1
17	0	17	18	1	17	18366.703	-3
18	0	18	19	1	18	18365.530	4
19	0	19	20	1	19	18364.331	6
20	0	20	21	1	20	18363.104	2
21	0	21	22	1	21	18361.859	1
22	0	22	23	1	22	18360.592	0
23	0	23	24	1	23	18359.304	0
24	0	24	25	1	24	18357.991	-2
25	0	25	26	1	25	18356.662	1
26	0	26	27	1	26	18355.303	-4
27	0	27	28	1	27	18353.926	-6
28	0	28	29	1	28	18352.539	4
29	0	29	30	1	29	18351.119	2
31	0	31	32	1	31	18348.206	-8
32	0	32	33	1	32	18346.713*	-18
33	0	33	34	1	33	18345.235	8
3	0	3	3	1	3	18384.066	3
4	0	4	4	1	4	18384.007	4
5	0	5	5	1	5	18383.931	2
6	0	6	6	1	6	18383.844	3
7	0	7	7	1	7	18383.739	2
8	0	8	8	1	8	18383.617	-1
9	0	9	9	1	9	18383.482	-3
10	0	10	10	1	10	18383.337	1
11	0	11	11	1	11	18383.173	-1
12	0	12	12	1	12	18382.996	0
13	0	13	13	1	13	18382.801	-2
14	0	14	14	1	14	18382.593	-3
15	0	15	15	1	15	18382.372	-1
16	0	16	16	1	16	18382.136	-0
17	0	17	17	1	17	18381.882	-2
18	0	18	18	1	18	18381.618	1
19	0	19	19	1	19	18381.337	2
20	0	20	20	1	20	18381.038	-1
21	0	21	21	1	21	18380.728	-0
22	0	22	22	1	22	18380.386	-3
23	0	23	23	1	23	18380.056	-4
24	0	24	24	1	24	18379.704	-1
25	0	25	25	1	25	18379.333	-1
26	0	26	26	1	26	18378.948	0
27	0	27	27	1	27	18378.547	-0
28	0	28	28	1	28	18378.132	-0
29	0	29	29	1	29	18377.704	2
30	0	30	30	1	30	18377.264	6
31	0	31	31	1	31	18376.798	0
32	0	32	32	1	32	18376.325	2
33	0	33	33	1	33	18375.842	9
34	0	34	34	1	34	18375.342*	14
35	0	35	35	1	35	18374.813	3
36	0	36	36	1	36	18374.279	5
37	0	37	37	1	37	18373.729	4
38	0	38	38	1	38	18373.165	4
39	0	39	39	1	39	18372.583	1
40	0	40	40	1	40	18371.992	4
41	0	41	41	1	41	18371.383	3
42	0	42	42	1	42	18370.760	4
43	0	43	43	1	43	18370.115	-3
44	0	44	44	1	44	18369.463	-2
45	0	45	45	1	45	18368.796	-0
46	0	46	46	1	46	18368.112	-1
47	0	47	47	1	47	18367.411	-4
48	0	48	48	1	48	18366.707	6
49	0	49	49	1	49	18365.968	-4
50	0	50	50	1	50	18365.225	-5
2	0	2	1	1	0	18385.643	-3
3	0	3	2	1	1	18386.370*	10
4	0	4	3	1	2	18387.048	-2
5	0	5	4	1	3	18387.718	-2
6	0	6	5	1	4	18388.364	-2
7	0	7	6	1	5	18388.998	-2
8	0	8	7	1	6	18389.589	-2
9	0	9	8	1	7	18390.170	-1
10	0	10	9	1	8	18390.726	-2
11	0	11	10	1	9	18391.262	0
12	0	12	11	1	10	18391.773	-1
13	0	13	12	1	11	18392.262	-1
14	0	14	13	1	12	18392.728	-3
15	0	15	14	1	13	18393.177	2
16	0	16	15	1	14	18393.597	-1
17	0	17	16	1	15	18393.997	0
18	0	18	17	1	16	18394.376	1
19	0	19	18	1	17	18394.731	2
20	0	20	19	1	18	18396.060	-1
21	0	21	20	1	19	18395.372	0
22	0	22	21	1	20	18395.660	1
23	0	23	22	1	21	18395.923	-1
24	0	24	23	1	22	18396.164	-2
25	0	25	24	1	23	18396.382	-4
26	0	26	25	1	24	18396.582	-1
1	1	0	2	0	2	18430.664	1
2	1	1	3	0	3	18429.855	1
3	1	2	4	0	4	18429.028	-2
4	1	3	5	0	5	18428.191	1
5	1	4	6	0	6	18427.335	1
6	1	5	7	0	7	18426.468	4
7	1	6	8	0	8	18425.578	3
8	1	7	9	0	9	18424.666	-6
9	1	8	10	0	10	18423.760	7
10	1	9	11	0	11	18422.852*	33
11	1	10	12	0	12	18421.870	2
12	1	11	13	0	13	18420.898	-5
13	1	12	14	0	14	18419.922	-1
14	1	13	15	0	15	18418.923	-3
15	1	14	16	0	16	18417.925*	11
16	1	15	17	0	17	18416.888	1
17	1	16	18	0	18	18415.843	-2
18	1	17	19	0	19	18414.783	-3
19	1	18	20	0	20	18413.710	-4
20	1	19	21	0	21	18412.625	-1
21	1	20	22	0	22	18411.524	2
22	1	21	23	0	23	18410.404	1
23	1	22	24	0	24	18409.239*	-32
24	1	23	25	0	25	18408.123	0
25	1	24	26	0	26	18406.960	1
26	1	25	27	0	27	18405.781	-1
27	1	26	28	0	28	18404.589	0
28	1	27	29	0	29	18403.381	-1
29	1	28	30	0	30	18402.159	-1
30	1	29	31	0	31	18400.922	-1
31	1	30	32	0	32	18399.670	-3
32	1	31	33	0	33	18398.406	-1
33	1	32	34	0	35	18395.821*	-13
35	1	34	36	0	36	18394.526	-1
36	1	35	37	0	37	18393.199	-6
37	1	36	38	0	38	18391.869	-0
39	1	38	40	0	40	18389.158	1
40	1	39	41	0	41	18387.778	-2
41	1	40	42	0	42	18386.366	-4
42	1	41	43	0	43	18384.967	2
43	1	42	44	0	44	18383.591*	23
44	1	43	45	0	45	18382.141	4
45	1	44	46	0	46	18380.730*	37
46	1	45	47	0	47	18379.249*	13
3	1	3	3	0	3	18432.096	-5
4	1	4	4	0	4	18432.010	-5
5	1	5	5	0	5	18431.901	-4
6	1	6	6	0	6	18431.770	-5
7	1	7	7	0	7	18431.616	-7
8	1	8	8	0	8	18431.444	-5
9	1	9	9	0	9	18431.245	-8
10	1	10	10	0	10	18431.024*	-11
11	1	11	11	0	11	18430.791	-6
12	1	12	12	0	12	18430.530	-5
13	1	13	13	0	13	18430.250	-3
14	1	14	14	0	14	18429.947	-3
15	1	15	15	0	15	18429.624	-0
16	1	16	16	0	16	18429.276	-2
17	1	17	17	0	17	18428.912	2
18	1	18	18	0	18	18428.522	2
19	1	19	19	0	19	18428.114	5
20	1	20	20	0	20	18427.683	6
21	1	21	21	0	21	18427.230	6
22	1	22	22	0	22	18426.756	7
23	1	23	23	0	23	18426.260	7
24	1	24	24	0	24	18425.744	8
25	1	25	25	0	25	18425.206	7
26	1	26	26	0	26	18424.659*	19
27	1	27	27	0	27	18424.065	4
28	1	28	28	0	28	18423.455	4
29	1	29	29	0	29	18422.838	-1
30	1	30	30	0	30	18422.198	-0
31	1	31	31	0	31	18421.534	-2
32	1	32	32	0	32	18420.852	-1
33	1	33	33	0	33	18420.149	-0
34	1	34	34	0	34	18419.422	-4
35	1	35	35	0	35	18418.677	-6
36	1	36	36	0	36	18417.916	-3
37	1	37	37	0	37	18417.133	-1
38	1	38	38	0	38	18416.329	-2
39	1	39	39	0	39	18415.501	-6
40	1	40	40	0	40	18414.665	1
41	1	41	41	0	41	18413.803	2
42	1	42	42	0	42	18412.919	1
43	1	43	43	0	43	18412.014	-2
44	1	44	44	0	44	18411.091	-3
45	1	45	45	0	45	18410.149	-4
46	1	46	46	0	46	18409.188	-5
47	1	47	47	0	47	18408.239*	25
48	1	48	48	0	48	18407.211	-6
49	1	49	49	0	49	18406.206	6
50	1	50	50	0	50	18405.166	2
51	1	51	51	0	51	18404.109	-0
52	1	52	52	0	52	18403.038	1
53	1	53	53	0	53	18401.952	6
54	1	54	54	0	54	18400.843	5
1	1	1	1	0	1	18433.737	-1
2	1	2	2	0	2	18434.467	-1
3	1	3	3	0	3	18435.181	-0
4	1	4	4	0	4	18435.879	1
5	1	5	5	0	5	18436.561	1
6	1	6	6	0	6	18437.226	1
7	1	7	7	0	7	18437.876	1
8	1	8	8	0	8	18438.510	2
9	1	9	9	0	9	18439.127	1
10	1	10	10	0	10	18439.730	2
11	1	11	11	0	11	18440.314	0
12	1	12	12	0	12	18440.886	2
13	1	13	13	0	13	18441.435	-3
14	1	14	14	0	14	18441.976	-0
15	1	15	15	0	15	18442.499	-0
16	1	16	16	0	16	18443.005	-1
17	1	17	17	0	17	18443.494	-1
18	1	18	18	0	18	18443.970	-1
19	1	19	19	0	19	18444.431	0
20	1	20	20	0	20	18444.875	1
21	1	21	21	0	21	18445.300	-2
22	1	22	22	0	22	18445.712	-2
23	1	23	23	0	23	18446.110	-1
24	1	24	24	0	24	18446.491	-0
25	1	25	25	0	25	18446.855	-1
26	1	26	26	0	26	18447.204	-2
27	1	27	27	0	27	18447.540	-1
28	1	28	28	0	28	18447.856	-1
29	1	29	29	0	29	18448.162	-0
30	1	30	30	0	30	18448.450	0
31	1	31	31	0	31	18448.721	-1
32	1	32	32	0	32	18448.979	-0
33	1	33	33	0	33	18449.221	-1
34	1	34	34	0	34	18449.446	-2
35	1	35	35	0	35	18449.657	-3
36	1	36	36	0	36	18449.859	2
37	1	37	37	0	37	18450.054*	16
38	1	38	38	0	38	18450.203	-2
40	1	39	39	0	39	18450.348	-8
41	1	40	40	0	40	18450.488	-5
42	1	41	41	0	41	18450.609	-6
43	1	42	42	0	42	18450.725	3
44	1	43	43	0	43	18450.810	-5
45	1	44	44	0	44	18450.890	-3
46	1	45	45	0	45	18450.954	-3
1	1	1	2	2	1	18340.421	6
2	1	1	2	2	0	18340.418	-3
2	1	2	3	2	2	18339.608*	12
3	1	2	4	2	3	18339.606	-7
3	1	3	4	2	3	18338.754	-2
4	1	3	5	2	4	18338.782	-6
4	1	4	5	2	4	18337.905*	12
4	1	3	5	2	3	18337.950	-2
5	1	4	6	2	4	18337.101	3
5	1	5	6	2	5	18337.020*	11
6	1	6	7	2	6	18336.115*	11
6	1	5	7	2	5	18336.229	1
7	1	6	8	2	6	18335.346	3
7	1	7	8	2	7	18335.182	4
8	1	7	9	2	7	18334.447	4
8	1	8	9	2	8	18334.234	4
9	1	8	10	2	8	18333.531	5
9	1	9	10	2	9	18333.274*	13
10	1	10	11	2	10	18332.274	3
10	1	9	11	2	9	18332.604	10
11	1	10	12	2	10	18331.660*	12
11	1	11	12	2	11	18331.264	5
12	1	12	13	2	12	18330.228	1
12	1	11	13	2	11	18330.688	3
13	1	12	14	2	12	18329.708	1
13	1	13	14	2	13	18329.174	1
14	1	13	15	2	13	18328.099	1
14	1	14	15	2	14	18328.712	-1
15	1	14	16	2	14	18327.001	0
15	1	15	16	2	15	18327.702	-2
16	1	15	17	2	15	18326.885	2
16	1	16	17	2	16	18326.678	-1
17	1	16	18	2	16	18325.639	-0
17	1	17	18	2	17	18324.744	-1
18	1	18	19	2	18	18323.586	0
18	1	17	19	2	17	18324.567	3
19	1	18	20	2	19	18322.411	6
19	1	19	20	2	19	18322.512	-0
20	1	19	21	2	19	18321.201	-3
20	1	20	21	2	20	18321.422	-4
21	1	20	22	2	20	18321.324	1
21	1	21	22	2	21	18319.981	-1
22	1	21	23	2	21	18318.737	-1
22	1	22	23	2	22	18320.208	3
23	1	22	24	2	22	18319.074	2
23	1	23	24	2	23	18317.473	-1
24	1	24	25	2	24	18316.189	0
25	1	25	26	2	25	18317.922	-1
26	1	26	27	2	26	18316.756	-2
25	1	25	26	2	25	18314.863	0
26	1	26	27	2	26	18313.554	-2
25	1	25	27	2	25	18315.576	-1
27	1	27	28	2	27	18312.207	-2
26	1	26	28	2	26	18314.379	-3
27	1	26	28	2	26	18313.169	-1
28	1	28	29	2	28	18310.841	0
29	1	28	30	2	28	18311.941	-1
29	1	29	30	2	29	18309.446	-6
30	1	29	31	2	29	18310.697	-3
30	1	30	31	2	30	18308.041	-2
31	1	31	32	2	31	18306.613	-1
32	1	32	33	2	32	18305.157	-6
33	1	32	34	2	32	18308.167	1
33	1	32	34	2	32	18306.877	1
33	1	33	34	2	33	18303.689	-4
34	1	34	35	2	34	18302.201	-1
35	1	34	36	2	34	18305.571	1
34	1	34	36	2	34	18304.245	-2
35	1	35	36	2	35	18300.689	-2
36	1	35	37	2	35	18299.155	-4
36	1	36	37	2	35	18302.911	1
36	1	36	38	2	36	18301.555	-1
37	1	37	38	2	37	18297.606	-2
38	1	38	39	2	38	18296.032	-4
39	1	39	40	2	39	18294.442	-2
40	1	40	41	2	40	18292.829	-2
41	1	41	42	2	41	18291.199	-0
42	1	42	43	2	42	18289.544	-4
43	1	43	44	2	43	18287.876	0
44	1	44	45	2	44	18286.183	-2
45	1	45	46	2	45	18284.473	-0
46	1	46	47	2	46	18282.737	-5
47	1	47	48	2	47	18280.987	-4
48	1	48	49	2	48	18279.214	-8
49	1	49	50	2	49	18277.431	-1
50	1	50	51	2	50	18275.627	4
51	1	51	52	2	51	18273.794	-0
52	1	52	53	2	52	18271.947	0
53	1	53	54	2	53	18270.078	-2
54	1	54	55	2	54	18268.196	2
55	1	55	56	2	55	18266.295	6
2	1	2	2	2	0	18341.925	-1
3	1	3	3	2	1	18341.861	0
4	1	4	4	2	2	18341.776	1
4	1	3	4	2	3	18341.851*	16
5	1	5	5	2	3	18341.669	1
5	1	4	5	2	4	18341.766	9
6	1	5	6	2	5	18341.669	6
6	1	6	6	2	4	18341.547	8
7	1	6	7	2	6	18341.552	3
7	1	7	7	2	5	18341.393	5
8	1	7	8	2	7	18341.430	-0
9	1	8	9	2	7	18341.217	1
10	1	9	9	2	7	18341.023	1
10	1	9	10	2	9	18341.292	2
11	1	10	11	2	10	18341.135	0
11	1	10	11	2	10	18340.963	-1
12	1	11	12	2	11	18340.778	1
12	1	12	12	2	10	18340.573	0
13	1	12	13	2	11	18340.352	6
14	1	13	14	2	13	18340.352	6
14	1	14	14	2	12	18339.729	-5
15	1	15	15	2	13	18339.407	-5
15	1	14	15	2	14	18340.119	-5
16	1	16	16	2	14	18339.061	-6
16	1	15	16	2	15	18339.872	-4
17	1	16	17	2	15	18339.606	-6
17	1	17	17	2	15	18338.702	0
18	1	18	18	2	16	18338.315	0
18	1	17	18	2	17	18339.326	-6
19	1	18	19	2	18	18339.036	-2
19	1	19	19	2	17	18337.903	-3
20	1	19	20	2	19	18338.717	-1
20	1	20	20	2	18	18337.478	2
21	1	21	21	2	19	18337.018	6
21	1	20	21	2	20	18338.398	-5
22	1	21	22	2	21	18338.056	-4
22	1	22	22	2	20	18336.549	-1
23	1	22	23	2	22	18337.697	-6
23	1	23	23	2	21	18336.057	3
24	1	23	24	2	23	18337.329	-1
24	1	24	24	2	22	18335.543	6
25	1	25	25	2	23	18335.004	4
25	1	24	25	2	24	18336.945	-1
26	1	25	26	2	25	18336.544	-4
26	1	26	26	2	24	18334.445	6
27	1	26	27	2	26	18336.119	-2
27	1	27	27	2	25	18333.863	6

O–C Units of 10^{-3} cm^{-1}.

* Line not included in the fit.

\# Line used to form ground state combination differences.

TABLE V—*Continued*

J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C
28	1	27	28	2	27	18335.589	0
28	1	28	28	2	26	18333.263	10
29	1	29	29	2	27	18332.626	-2
29	1	28	29	2	28	18335.241	2
30	1	30	30	2	28	18331.982	2
30	1	29	30	2	29	18334.777	2
31	1	31	31	2	29	18331.311	-1
31	1	30	31	2	30	18334.299	3
32	1	31	32	2	31	18333.801	0
32	1	32	32	2	30	18330.621	0
33	1	33	33	2	31	18329.908	-0
33	1	32	33	2	32	18333.289	-2
34	1	34	34	2	32	18329.175	2
34	1	33	34	2	33	18332.771	6
35	1	35	35	2	33	18326.419	1
35	1	34	35	2	34	18332.232	7
36	1	36	36	2	34	18327.641	1
36	1	35	36	2	35	18331.668	1
37	1	37	37	2	35	18326.842	3
37	1	36	37	2	36	18331.100	3
38	1	37	38	2	37	18330.541*	30
38	1	38	38	2	36	18326.016	-1
39	1	39	39	2	37	18325.174	0
39	1	38	39	2	38	18329.910	1
40	1	40	40	2	38	18324.304	-4
40	1	39	40	2	39	18329.296	3
41	1	41	41	2	39	18323.421	1
41	1	40	41	2	40	18328.662	0
42	1	42	42	2	40	18322.509	-1
42	1	41	42	2	41	18328.009	-6
43	1	43	43	2	41	18321.579	1
43	1	42	43	2	42	18327.361	8
44	1	43	44	2	43	18326.675	-0
44	1	44	44	2	42	18320.624	-0
45	1	45	45	2	43	18319.650	1
45	1	44	45	2	44	18326.024*	40
46	1	46	46	2	44	18318.650	-1
46	1	45	46	2	45	18325.283	6
47	1	46	47	2	46	18324.573*	18
47	1	47	47	2	45	18317.628	-3
48	1	47	48	2	47	18323.823	5
48	1	48	48	2	46	18316.586	-4
49	1	48	49	2	48	18323.070	4
49	1	49	49	2	47	18315.523	-2
50	1	50	50	2	48	18314.438	-1
50	1	49	50	2	49	18322.304	4
51	1	51	51	2	49	18313.325	-6
51	1	50	51	2	50	18321.508*	-12
52	1	51	52	2	51	18320.730	9
52	1	52	52	2	50	18312.204	4
53	1	52	53	2	52	18319.911	1
53	1	53	53	2	51	18311.045	-2
54	1	54	54	2	52	18309.876	3
55	1	55	55	2	53	18308.677	1
55	1	54	55	2	54	18318.243	0
56	1	55	56	2	55	18317.383	-4
57	1	56	57	2	56	18316.521	4
59	1	58	59	2	58	18314.729	-3
60	1	59	60	2	59	18313.810	-8
3	1	2	2	2	0	18344.222	-4
3	1	3	2	2	1	18344.187	-4
4	1	4	3	2	2	18344.885	3
4	1	3	3	2	1	18344.940	-1
5	1	5	4	2	3	18345.555	5
5	1	4	4	2	2	18345.640	1
6	1	6	5	2	4	18346.203	5
6	1	5	5	2	3	18346.329	-3
7	1	7	6	2	5	18346.988	-1
7	1	6	6	2	4	18346.824	0
8	1	8	7	2	6	18347.641	0
8	1	7	7	2	5	18347.432	3
9	1	9	8	2	6	18348.279	2
9	1	8	8	2	7	18348.014	3
10	1	9	9	2	7	18348.886	1
10	1	10	9	2	8	18348.573	1
11	1	10	10	2	8	18349.503	1
11	1	11	10	2	9	18349.114	2
12	1	12	11	2	10	18349.632	2
13	1	11	12	2	9	18350.092	2
13	1	13	12	2	11	18350.126	-1
13	1	12	12	2	10	18350.663	0
14	1	14	13	2	12	18350.602	-0
14	1	13	13	2	11	18351.220	0
15	1	15	14	2	13	18351.057	1
15	1	14	14	2	12	18351.765	4
16	1	15	15	2	13	18352.289	2
16	1	16	15	2	14	18351.490	2
17	1	16	16	2	14	18352.799	3
17	1	17	16	2	15	18351.901	2
18	1	18	17	2	16	18352.267	-1
18	1	17	17	2	15	18353.290	1
19	1	18	18	2	16	18353.761	-5
19	1	19	18	2	17	18352.656	2
20	1	20	19	2	18	18353.000	-1
20	1	19	19	2	17	18354.229	1
21	1	21	20	2	19	18353.324	-1
21	1	20	20	2	18	18354.673	-0
22	1	22	21	2	20	18353.630	2
22	1	21	21	2	19	18355.103	1
23	1	23	22	2	21	18353.917	8
23	1	22	22	2	20	18355.509	-7
24	1	23	23	2	21	18355.911	-1
24	1	24	23	2	22	18354.169	0
25	1	24	24	2	22	18356.294	2
25	1	25	24	2	23	18354.408	1
26	1	25	25	2	23	18356.657	0
26	1	26	25	2	24	18354.624	-0
27	1	27	26	2	25	18354.818	-1
27	1	26	26	2	24	18357.006	1
28	1	28	27	2	26	18354.989	-5
28	1	27	27	2	25	18357.338	1
29	1	29	28	2	27	18355.149	3
29	1	28	28	2	26	18357.653	1
30	1	29	29	2	27	18357.955	4
31	1	31	30	2	29	18355.386	-1
31	1	30	30	2	28	18358.235	2
32	1	32	31	2	30	18355.497*	12
32	1	31	31	2	29	18358.494	-4
33	1	33	32	2	31	18355.551	8
33	1	32	32	2	30	18358.753	5
34	1	33	33	2	31	18356.983	2
34	1	34	33	2	32	18355.603*	15
35	1	34	34	2	32	18359.200	4
35	1	35	34	2	33	18355.616	4
36	1	36	35	2	34	18355.620	4
37	1	36	36	2	34	18359.579	2
37	1	37	36	2	35	18355.610*	13
38	1	37	37	2	35	18359.767*	25
38	1	38	37	2	36	18355.565	7
39	1	39	38	2	37	18355.505	7
39	1	38	38	2	36	18359.889	-3
40	1	39	39	2	37	18360.017	-6
41	1	40	40	2	38	18360.151*	13
42	1	41	41	2	39	18360.234	-1
43	1	42	42	2	40	18360.321	6
4	2	2	5	1	4	18481.954#	879
5	2	3	6	1	5	18481.068#	887
6	2	4	7	1	6	18480.168#	905
6	2	5	7	1	7	18480.370#	898
7	2	5	8	1	7	18479.246#	925
7	2	6	8	1	8	18479.522#	932
8	2	7	9	1	9	18478.665#	971
8	2	6	9	1	8	18478.313#	955
8	2	8	10	1	10	18477.757#	975
9	2	7	10	1	9	18477.352#	981
11	2	11	14	1	13	18471.481#	-715
13	2	13	15	1	15	18471.340#	-652
15	2	13	16	1	15	18469.366#	-608
16	2	15	17	1	17	18469.430#	-540
17	2	16	18	1	18	18468.444#	-491
17	2	15	18	1	17	18467.180#	-502
18	2	17	19	1	19	18467.446#	-440
18	2	16	19	1	18	18466.005#	-466
19	2	17	20	1	19	18464.842#	-417
19	2	18	20	1	20	18466.426#	-395
20	2	18	21	1	20	18463.649#	-375
20	2	19	21	1	21	18465.393#	-349
21	2	20	22	1	22	18464.325#	-322
21	2	19	22	1	21	18462.417#	-350
22	2	21	23	1	23	18463.246#	-292
22	2	22	24	1	24	18462.145#	-269
23	2	21	24	1	23	18459.880#	-308
24	2	23	25	1	25	18460.992#	-282
24	2	22	25	1	24	18456.786#	-79
24	2	22	25	1	24	18456.554#	-311
25	2	24	26	1	26	18459.999#	-120
25	2	23	26	1	25	18457.386#	-134
26	2	25	27	1	27	18458.824#	-126
26	2	24	27	1	26	18456.005#	-148
27	2	26	28	1	28	18457.651#	-114
27	2	25	28	1	27	18454.627#	-138
28	2	26	29	1	28	18453.226#	-128
28	2	27	29	1	29	18456.464#	-102
29	2	28	30	1	30	18455.261#	-91
29	2	27	30	1	29	18451.808#	-115
30	2	29	31	1	31	18454.044#	-79
31	2	30	32	1	32	18452.814#	-86
32	2	31	33	1	33	18451.567#	-55
3	2	2	3	1	2	18485.936#	863
3	2	1	3	1	3	18485.860#	875
4	2	2	4	1	4	18485.936#	883
4	2	3	4	1	3	18485.864#	886
5	2	3	5	1	5	18485.864#	889
5	2	4	5	1	4	18485.760#	897
6	2	4	6	1	6	18485.788#	906
6	2	5	6	1	5	18485.623#	898
7	2	6	7	1	6	18485.491#	928
7	2	5	7	1	7	18485.705#	931
8	2	6	8	1	8	18485.606#	956
9	2	7	9	1	9	18485.491#	981
9	2	8	9	1	8	18485.157#	984
10	2	9	10	1	9	18484.962#	1039
11	2	10	11	1	10	18484.813#	1123
12	2	10	12	1	12	18485.194#	1195
12	2	11	12	1	11	18484.526#	1212
13	2	12	13	1	12	18484.391#	1276
13	2	11	13	1	13	18485.067#	1289
14	2	13	14	1	13	18484.141#	1347
14	2	12	14	1	14	18484.954#	1373
15	2	13	15	1	15	18484.813#	1464
15	2	14	15	1	14	18483.867#	1418
16	2	14	16	1	16	18484.626#	1524
17	2	16	17	1	16	18483.268#	1575
17	2	15	17	1	17	18484.444#	1605
18	2	17	18	1	17	18482.911#	1631
18	2	16	18	1	18	18484.245#	1683
19	2	18	19	1	18	18482.544#	1700
19	2	17	19	1	19	18484.032#	1763
20	2	18	20	1	20	18483.800#	1839
20	2	19	20	1	19	18482.149#	1763
21	2	19	21	1	21	18483.568#	1931
21	2	20	21	1	20	18481.745#	1840
22	2	20	22	1	22	18483.329#	2030
23	2	21	23	1	23	18483.060#	2115
10	2	8	10	1	10	18483.450#	-905
11	2	9	11	1	11	18483.329#	-856
11	2	10	11	1	10	18482.839#	-852
12	2	10	12	1	12	18483.202#	-797
12	2	11	12	1	11	18482.633#	-782
13	2	12	13	1	12	18482.392#	-724
14	2	12	14	1	14	18482.911#	-670
14	2	13	14	1	13	18482.149#	-646
15	2	13	15	1	15	18482.733#	-617
15	2	14	15	1	14	18481.853#	-596
16	2	14	16	1	16	18482.544#	-558
17	2	15	17	1	17	18482.332#	-507
17	2	16	17	1	16	18481.212#	-480
18	2	17	18	1	18	18480.842#	-497
18	2	16	18	1	18	18482.096#	-466
19	2	17	19	1	19	18481.853#	-415
19	2	18	19	1	18	18480.450#	-395
20	2	19	20	1	19	18480.035#	-350
21	2	19	21	1	21	18481.288#	-349
21	2	20	21	1	20	18479.587#	-318
22	2	21	22	1	21	18479.110#	-291
22	2	20	22	1	22	18480.974#	-324
23	2	21	23	1	23	18480.636#	-309
23	2	22	23	1	22	18478.804#	-270
24	2	23	24	1	23	18478.045#	-280
24	2	23	24	1	24	18478.255#	-71
24	2	22	24	1	24	18480.260#	-316
24	2	22	24	1	23	18480.483#	-93
24	2	24	25	1	24	18477.639#	-116
25	2	24	25	1	25	18477.032#	-128
26	2	25	26	1	25	18477.032#	-608
26	2	24	26	1	26	18479.645#	-149
27	2	26	27	1	26	18476.432#	-111
27	2	25	27	1	27	18479.246#	-134
28	2	27	28	1	27	18475.807#	-98
28	2	26	28	1	28	18478.819#	-133
29	2	27	29	1	29	18478.389#	-119
29	2	28	29	1	28	18475.152#	-91
30	2	29	30	1	29	18474.482#	-77
30	2	28	30	1	30	18477.946#	-104
31	2	30	31	1	30	18473.793#	-60
31	2	29	31	1	31	18477.483#	-94
32	2	31	32	1	31	18473.066#	-58
33	2	31	33	1	33	18476.520#	-67
33	2	32	33	1	32	18472.329#	-45
34	2	32	34	1	34	18476.015#	-55
35	2	33	35	1	35	18475.487#	-51
36	2	34	36	1	36	18474.947#	-44
37	2	35	37	1	37	18474.396#	-36
37	2	36	37	1	36	18469.135#	-14
38	2	37	38	1	37	18468.279#	-9
39	2	38	39	1	38	18467.402#	-3
39	2	37	39	1	39	18473.240#	-27
39	2	39	40	1	39	18466.499	-1
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41	2	40	41	1	40	18465.571	-2
42	2	41	42	1	41	18464.625	1
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43	2	42	43	1	42	18463.649	-5
44	2	43	44	1	43	18462.658	-4
44	2	42	44	1	44	18470.100	-8
45	2	43	45	1	45	18469.430	-4
46	2	45	46	1	45	18460.616	3
46	2	44	46	1	46	18468.744	-2
47	2	46	47	1	46	18459.558	1
49	2	47	49	1	49	18466.600	1
49	2	48	49	1	48	18457.384	4
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51	2	50	51	1	50	18455.120	1
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24	2	24	24	1	24	18499.345#	-121
25	2	23	24	1	23	18497.115#	-130
25	2	24	25	1	25	18499.713#	-120
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26	2	25	26	1	26	18500.068#	-116
27	2	25	26	1	25	18497.447#	-143
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43	2	42	42	1	42	18503.693	3
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26	2	25	27	3	25	18278.174#	-123
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TABLE V—*Continued*

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13	2	12	- 13	3	10	18305.326#	1276
14	2	13	- 14	3	11	18305.149#	1360
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27	3	24	- 27	2	26	18533.713#	-164
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28	3	25	- 28	2	27	18533.173#	-174
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33	3	30	- 33	2	32	18530.212#	-96
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33	3	30	- 33	4	30	18263.863#	-91
34	3	31	- 34	4	31	18263.271#	-65
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36	3	33	- 36	4	33	18262.002#	-4
37	3	34	- 37	4	34	18261.350#	37
38	3	35	- 38	4	35	18260.700#	99
39	3	36	- 39	4	36	18260.047#	175
3	3	0	- 4	4	0	18278.370#	241
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5	3	3	- 4	4	3	18280.332#	274
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9	3	7	- 8	4	7	18282.804#	439
10	3	8	- 9	4	8	18283.388#	494
11	3	9	- 10	4	9	18283.918#	514
12	3	10	- 11	4	10	18286.272#	-172
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21	3	19	- 21	4	19	18286.941#	-200
21	3	20	- 21	4	19	18287.257#	-204
22	3	20	- 23	4	20	18287.282#	-178
23	3	21	- 23	4	19	18287.563#	-199
24	3	22	- 24	4	21	18287.616#	-146
25	3	23	- 24	4	21	18287.862#	-183
25	3	24	- 25	4	22	18287.934#	-110
26	3	24	- 26	4	22	18288.126#	-181
27	3	25	- 26	4	23	18288.262#	-45
27	3	24	- 26	4	22	18288.373#	-178
28	3	25	- 27	4	23	18593.027#	-1696
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11	4	8	- 12	3	10	18587.134#	-1027
13	4	10	- 14	3	12	18585.237#	-667
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15	4	12	- 16	3	14	18583.230#	-738
16	4	13	- 17	3	15	18582.190#	-680
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11	4	8	- 11	3	8	18596.441#	-1029
12	4	9	- 12	3	9	18596.273#	-954
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24	4	21	- 24	3	21	18592.455#	-280
25	4	22	- 25	3	22	18591.991#	-238
26	4	23	- 26	3	23	18591.508#	-197
27	4	24	- 27	3	24	18590.998#	-160
28	4	25	- 28	3	25	18590.472#	-121
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31	4	28	- 31	3	28	18588.763#	-13
32	4	29	- 32	3	29	18588.153#	24
33	4	30	- 33	3	30	18587.519#	55
34	4	31	- 34	3	31	18586.864#	87
35	4	32	- 35	3	32	18586.197#	126
36	4	33	- 36	3	33	18585.500#	155
37	4	34	- 37	3	34	18584.797#	198
38	4	35	- 38	3	35	18584.056#	223
39	4	36	- 39	3	36	18583.288#	250
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7	4	7	- 9	3	7	18604.347#	-1106
8	4	8	- 10	3	8	18604.978#	-1028
12	4	9	- 11	3	9	18605.586#	-951
13	4	10	- 12	3	10	18606.171#	-879
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15	4	12	- 14	3	12	18607.267#	-745
16	4	13	- 15	3	13	18607.780#	-683
17	4	14	- 16	3	14	18608.269#	-624
18	4	15	- 17	3	15	18608.733#	-569
19	4	16	- 18	3	16	18609.176#	-516
20	4	17	- 19	3	17	18609.594#	-466
21	4	18	- 20	3	18	18609.992#	-417
22	4	19	- 21	3	19	18610.366#	-371
23	4	20	- 22	3	20	18610.713#	-331
24	4	21	- 23	3	21	18611.050#	-282
25	4	22	- 24	3	22	18611.352#	-247
26	4	23	- 25	3	23	18611.641#	-203
27	4	24	- 26	3	24	18611.906#	-164
28	4	25	- 27	3	25	18612.147#	-128
29	4	26	- 28	3	26	18612.365#	-95
30	4	27	- 29	3	27	18612.570#	-54
31	4	28	- 30	3	28	18612.747#	-21
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33	4	30	- 32	3	30	18613.038#	43
34	4	31	- 33	3	31	18613.151#	74
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13	4	10	- 14	5	10	18233.577#	-880
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16	4	13	- 17	5	13	18230.593#	-685
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19	4	16	- 20	5	16	18227.413#	-516
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22	4	19	- 23	5	19	18224.041#	-373
23	4	20	- 24	5	20	18222.871#	-333
24	4	21	- 25	5	21	18221.694#	-282
25	4	22	- 26	5	22	18220.486#	-243
26	4	23	- 27	5	23	18219.260#	-204
27	4	24	- 28	5	24	18218.012#	-168
28	4	25	- 29	5	25	18216.749#	-129
29	4	26	- 30	5	26	18215.465#	-92
30	4	27	- 31	5	27	18214.161#	-57
31	4	28	- 32	5	28	18212.838#	-23
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TABLE V—*Continued*

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36	4	33	37	5	33	18205.951#	153
37	4	34	38	5	34	18204.527#	196
38	4	35	39	5	35	18203.077#	231
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13	4	10	13	5	8	18244.425#	-876
14	4	11	14	5	9	18244.223#	-810
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16	4	13	16	5	11	18243.758#	-683
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24	4	21	24	5	19	18241.027#	-288
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26	4	23	26	5	21	18240.142#	-201
27	4	24	27	5	22	18239.663#	-166
28	4	25	28	5	23	18239.172#	-124
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35	4	32	35	5	30	18235.181#	122
36	4	33	36	5	31	18234.525#	189
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14	4	11	13	5	9	18255.063#	-814
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18	4	15	17	5	13	18257.145#	-565
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23	4	20	22	5	18	18259.242#	-327
24	4	21	23	5	19	18259.605#	-278
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27	4	24	26	5	22	18260.551#	-158
28	4	25	27	5	23	18260.826#	-119
29	4	26	28	5	24	18261.076#	-87
30	4	27	29	5	25	18261.311#	-50
31	4	28	30	5	26	18261.527#	-14
32	4	29	31	5	27	18261.719#	18
33	4	30	32	5	28	18261.894#	53
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35	4	32	34	5	30	18262.182#	117
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16	5	12	16	4	12	18642.814#	-10427
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39	5	35	40	6	35	18203.110#	-6791
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51	5	47	52	6	47	18195.444#	-5059
52	5	48	53	6	48	18194.572#	-2214
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10	6	4	11	7	4	18190.855#	2242
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16	6	10	17	7	10	18184.772#	2349
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18	6	12	19	7	12	18182.598#	2390
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28	6	22	29	7	22	18170.834#	2833
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8	6	3	8	7	1	18199.705#	2223
9	6	4	9	7	2	18199.539#	2230
10	6	5	10	7	3	18199.360#	2244
11	6	6	11	7	4	18199.160#	2255
12	6	7	12	7	5	18198.943#	2269
13	6	8	13	7	6	18198.708#	2283
14	6	9	14	7	7	18198.455#	2299
15	6	10	15	7	8	18198.186#	2319
16	6	11	16	7	9	18197.901#	2341
17	6	12	17	7	10	18197.596#	2364
18	6	13	18	7	11	18197.275#	2388
19	6	14	19	7	12	18196.940#	2418
20	6	15	20	7	13	18196.585#	2447
21	6	16	21	7	14	18196.214#	2480
22	6	17	22	7	15	18195.826#	2515
23	6	18	23	7	16	18195.427#	2558
24	6	19	24	7	17	18195.007#	2598
26	6	21	26	7	19	18194.130#	2700
28	6	23	28	7	21	18193.196#	2822
30	6	25	30	7	23	18192.219#	2977
31	6	26	31	7	24	18191.718#	3071
32	6	27	32	7	25	18191.211#	3178
33	6	28	33	7	26	18190.686#	3285
34	6	29	34	7	27	18190.167#	3417
35	6	30	35	7	28	18189.650#	3572
7	7	0	8	8	0	18167.500	2
8	7	1	9	8	1	18166.574	2
9	7	2	10	8	2	18165.624	-1
10	7	3	11	8	3	18164.657	-3
11	7	4	12	8	4	18163.678	2
12	7	5	13	8	5	18162.672	-1
13	7	6	14	8	6	18161.654	4
14	7	7	15	8	7	18160.610	2
15	7	8	16	8	8	18159.550	2
16	7	9	17	8	9	18158.473	6
17	7	10	18	8	10	18157.366	-2
18	7	11	19	8	11	18156.253	3
19	7	12	20	8	12	18155.117	4
20	7	13	21	8	13	18153.971#	14
21	7	14	22	8	14	18152.814#	32
8	7	2	8	8	0	18173.523	1
9	7	3	9	8	1	18173.351	3
10	7	4	10	8	2	18173.156	2
11	7	5	11	8	3	18172.941	-0
12	7	6	12	8	4	18172.708	-1
13	7	7	13	8	5	18172.456	-2
14	7	8	14	8	6	18172.181	-7
15	7	9	15	8	7	18171.892	-5
16	7	10	16	8	8	18171.583	-5
17	7	11	17	8	9	18171.255	-4
18	7	12	18	8	10	18170.907	-4
19	7	13	19	8	11	18170.543	-0
20	7	14	20	8	12	18170.166#	9
21	7	15	21	8	13	18169.776#	25
22	7	16	22	8	14	18169.382#	56
23	7	17	23	8	15	18169.079#	198
24	7	18	24	8	16	18168.323#	-94
25	7	19	25	8	17	18167.850#	-84
26	7	20	26	8	18	18167.354#	-78
27	7	21	27	8	19	18166.840#	-69
28	7	22	28	8	20	18166.299#	-69
29	7	23	29	8	21	18165.743#	-65
30	7	24	30	8	22	18165.163#	-65
31	7	25	31	8	23	18164.564#	-65
32	7	26	32	8	24	18163.951#	-59
33	7	27	33	8	25	18163.316#	-57
34	7	28	34	8	26	18162.667#	-49
35	7	29	35	8	27	18161.991#	-47
36	7	30	36	8	28	18161.297#	-47
37	7	31	37	8	29	18160.586#	-33
38	7	32	38	8	30	18159.864#	-33
39	7	33	39	8	31	18159.114#	-29
40	7	34	40	8	32	18158.347#	-24
41	7	35	41	8	33	18157.558#	-21
42	7	36	42	8	34	18156.769#	1
11	7	4	10	8	2	18181.438	2
12	7	5	11	8	3	18181.977	2
13	7	6	12	8	4	18182.495	0
14	7	7	13	8	5	18182.993	-2
15	7	8	14	8	6	18183.473	-3
16	7	9	15	8	7	18183.937	-1
17	7	10	16	8	8	18184.374	-6
18	7	11	17	8	9	18184.804	2
19	7	12	18	8	10	18185.213	9
20	7	13	19	8	11	18185.600#	13
21	7	14	20	8	12	18185.982#	31
22	7	15	21	8	13	18186.356#	61
25	7	18	24	8	16	18187.140#	-69
26	7	19	25	8	17	18187.406#	-69
27	7	20	26	8	18	18187.653#	-67
28	7	21	27	8	19	18187.887#	-59
29	7	22	28	8	20	18188.099#	-54
30	7	23	29	8	21	18188.282#	-57
31	7	24	30	8	22	18188.441#	-65
32	7	25	31	8	23	18188.596#	-57
33	7	26	32	8	24	18188.726#	-55
34	7	27	33	8	25	18188.834#	-54
9	8	1	9	9	0	18140.942	-4
10	8	2	10	9	1	18139.989	-5
11	8	3	11	9	2	18139.019	-4
12	8	4	12	9	3	18138.021*	-11
13	8	5	13	9	4	18137.021	-0
14	8	6	14	9	5	18134.942	2
15	8	7	15	9	6	18133.875	6
16	8	8	16	9	7	18132.784	6
17	8	9	17	9	8	18131.675	7
18	8	10	18	9	9	18130.540	2
19	8	11	19	9	10	18129.392	4
20	8	12	20	9	11	18128.221	3
21	8	13	21	9	12	18127.030	2
22	8	14	22	9	13	18125.821	2
23	8	15	23	9	14	18124.590	0
9	8	2	9	9	0	18147.703	-3
10	8	3	10	9	1	18147.506	1
11	8	4	11	9	2	18147.286	1
12	8	5	12	9	3	18147.044	-0
13	8	6	13	9	4	18146.785	2
14	8	7	14	9	5	18146.505	2
15	8	8	15	9	6	18146.203	2
16	8	9	16	9	7	18145.882	2
17	8	10	17	9	8	18145.539	0
18	8	11	18	9	9	18145.172	-6
19	8	12	19	9	10	18144.795	-2
20	8	13	20	9	11	18144.394	-2
21	8	14	21	9	12	18143.974	-1
22	8	15	22	9	13	18143.531	-2
23	8	16	23	9	14	18143.070	-1
24	8	17	24	9	15	18142.588	-2
25	8	18	25	9	16	18142.089	4
26	8	19	26	9	17	18141.561	-5
27	8	20	27	9	18	18141.020	-4
28	8	21	28	9	19	18140.458	-4
29	8	22	29	9	20	18139.875	-5
30	8	23	30	9	21	18139.274	-3
31	8	24	31	9	22	18138.655	-0
32	8	25	32	9	23	18138.021	8
33	8	26	33	9	24	18137.346	-4
34	8	27	34	9	25	18136.668	1
35	8	28	35	9	26	18135.243	2
36	8	29	36	9	27	18135.243	2
37	8	30	37	9	28	18134.500	2
38	8	31	38	9	29	18133.737	3
39	8	32	39	9	30	18132.953	2
40	8	33	40	9	31	18132.150	4
41	8	34	41	9	32	18131.321	-2
42	8	35	42	9	33	18130.481	2
43	8	36	43	9	34	18129.612	-3
44	8	37	44	9	35	18128.729	-1
45	8	38	45	9	36	18127.824	-1
46	8	39	46	9	37	18126.899	-1
47	8	40	47	9	38	18125.955	0
48	8	41	48	9	39	18124.988	-1
9	9	0	10	10	0	18113.946#	-26
10	9	1	11	10	1	18112.977	-2
11	9	2	12	10	2	18111.996#	32
12	9	3	13	10	3	18110.983#	55
14	9	4	14	10	4	18109.974#	106
15	9	5	15	10	5	18108.946#	160
16	9	6	16	10	6	18107.911#	228
17	9	7	17	10	7	18106.868#	311
18	9	8	18	10	8	18105.824#	414
19	9	9	19	10	9	18104.767#	528
20	9	10	20	10	10	18103.706#	658
21	9	11	21	10	11	18102.645#	812
22	9	12	22	10	12	18101.567#	970
23	9	13	23	10	13	18100.480#	1142
10	9	2	10	10	0	18121.450	2
11	9	3	11	10	1	18121.233#	31
12	9	4	12	10	2	18120.998#	64
13	9	5	13	10	3	18120.757#	114
14	9	6	14	10	4	18120.492#	161
15	9	7	15	10	5	18120.233#	237
16	9	8	16	10	6	18119.961#	323
17	9	9	17	10	7	18119.678#	419
18	9	10	18	10	8	18119.388#	531
19	9	11	19	10	9	18119.093#	662
20	9	12	20	10	10	18118.781#	796
21	9	13	21	10	11	18118.478#	963
22	9	14	22	10	12	18118.155#	1132
23	9	15	23	10	13	18117.830#	1321
24	9	16	24	10	14	18117.492#	1520
25	9	17	25	10	15	18117.138#	1739
26	9	18	26	10	16	18116.810#	1979

TABLE VI

Observed Line Positions (cm^{-1}) for ^{65}CuOH

J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C	J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C	J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C	J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C
11	0	11	12	1	11	18373.355	2	27	1	26	26	0	26	18447.075	-2	19	1	18	18	2	16	18353.646	-5	22	5	18	23	4	20	18623.854#	-9319
12	0	12	13	1	12	18372.309	-4	28	1	27	27	0	27	18447.409	1	20	1	20	19	2	18	18352.897	-0	23	5	19	24	4	21	18622.822#	-9114
13	0	13	14	1	13	18371.252	0	29	1	28	28	0	28	18447.727	2	20	1	19	19	2	17	18354.108	-3	24	5	20	25	4	22	18621.765#	-8914
14	0	14	15	1	14	18370.168	-0	30	1	29	29	0	29	18448.021	-4	21	1	21	20	2	19	18353.220	0	25	5	21	26	4	23	18620.689#	-8712
15	0	15	16	1	15	18369.062	-0	31	1	30	30	0	30	18448.308	-4	21	1	20	20	2	18	18354.553	-1	26	5	22	27	4	24	18619.595#	-8509
16	0	16	17	1	16	18367.933	-2	34	1	33	33	0	33	18449.078	-0	22	1	21	21	2	19	18354.988	8	27	5	23	28	4	25	18618.479#	-8309
17	0	17	18	1	17	18366.786	0	35	1	34	34	0	34	18449.303	-1	22	1	22	21	2	20	18353.522	1	28	5	24	29	4	26	18617.336#	-8114
18	0	18	19	1	18	18365.620	5	37	1	36	36	0	36	18449.701	-9	23	1	23	22	2	21	18353.795	-6	29	5	25	30	4	27	18616.174#	-7920
19	0	19	20	1	19	18364.429	7	13	1	13	14	2	13	18329.219	0	23	1	22	22	2	20	18355.388	-2	30	5	26	31	4	28	18614.987#	-7730
20	0	20	21	1	20	18363.210	2	14	1	14	15	2	14	18328.152	1	24	1	23	23	2	21	18355.785	-0	31	5	27	32	4	29	18613.774#	-7547
21	0	21	22	1	21	18361.973	1	14	1	13	15	2	13	18328.757	-3	24	1	24	23	2	22	18354.061	1	41	5	37	41	4	37	18632.571#	-5898
22	0	22	23	1	22	18360.714	0	15	1	15	16	2	15	18327.083	1	25	1	24	24	2	22	18356.171	8	42	5	38	42	4	38	18631.864#	-5750
23	0	23	24	1	23	18359.431	-3	15	1	14	16	2	14	18327.756	-1	25	1	25	24	2	23	18354.296	-1	43	5	39	43	4	39	18631.122#	-5618
24	0	24	25	1	24	18358.132	-1	16	1	16	17	2	16	18325.953	0	26	1	25	25	2	23	18356.526	0	44	5	40	44	4	40	18630.354#	-5492
25	0	25	26	1	25	18356.812	2	16	1	15	17	2	15	18326.737	-3	26	1	26	25	2	24	18354.515	2	45	5	41	45	4	41	18629.572#	-5359
27	0	27	28	1	27	18354.107	7	17	1	16	18	2	16	18325.705	-1	27	1	26	26	2	24	18356.869	-2	46	5	42	46	4	42	18628.763#	-5234
29	0	29	30	1	29	18351.302	-1	17	1	17	18	2	17	18324.823	1	28	1	27	27	2	25	18357.199	-2	47	5	43	47	4	43	18627.931#	-5111
30	0	30	31	1	30	18349.872	-0	18	1	17	19	2	17	18324.659	2	28	1	28	27	2	26	18354.877	-4	48	5	44	48	4	44	18627.078#	-4989
31	0	31	32	1	31	18348.420	-0	18	1	18	19	2	18	18323.673	3	29	1	28	28	2	26	18357.514	0	49	5	45	49	4	45	18626.194#	-4879
32	0	32	33	1	32	18346.942	-5	19	1	18	20	2	18	18323.591	-1	29	1	29	28	2	27	18355.028	-5	50	5	46	50	4	46	18625.290#	-4769
33	0	33	34	1	33	18345.452	0	19	1	19	20	2	19	18322.506	9	30	1	29	29	2	27	18357.808	-3	51	5	47	51	4	47	18624.363#	-4662
2	0	2	1	1	0	18385.604	4	20	1	19	21	2	19	18322.510	-3	31	1	30	30	2	28	18358.088	-4	52	5	48	52	4	48	18623.414#	-4557
3	0	3	2	1	1	18386.303	-6	21	1	20	22	2	20	18321.413	-4	32	1	31	31	2	29	18358.340*	-16	53	5	49	53	4	49	18622.450#	-4447
4	0	4	3	1	2	18386.995	-1	21	1	21	22	2	21	18320.087	-2	33	1	32	32	2	30	18358.612	8	54	5	50	54	4	50	18621.454#	-4350
5	0	5	4	1	3	18387.658	-3	22	1	22	23	2	22	18318.854	1	34	1	33	33	2	31	18358.838	2	9	5	5	8	4	5	18650.477#	-11585
6	0	6	5	1	4	18388.301	-2	22	1	21	23	2	21	18320.306	2	35	1	34	34	2	32	18359.050	-1	11	5	7	10	4	7	18651.853#	-11319
7	0	7	6	1	5	18388.923	-0	23	1	22	24	2	22	18319.181	0	5	4	2	4	3	2	18600.745#	-1622	12	5	8	11	4	8	18652.529#	-11167
8	0	8	7	1	6	18389.522	-0	23	1	23	24	2	23	18317.601	3	6	4	3	5	3	3	18601.499#	-1518	13	5	9	12	4	9	18653.192#	-11008
9	0	9	8	1	7	18390.095	-2	24	1	23	25	2	23	18318.029	-9	7	4	4	6	3	4	18602.230#	-1417	15	5	11	14	4	11	18654.483#	-10662
10	0	10	9	1	8	18390.648	-3	24	1	24	25	2	24	18316.325	3	8	4	5	7	3	5	18602.932#	-1325	16	5	12	15	4	12	18655.102#	-10484
11	0	11	10	1	9	18391.182	-0	25	1	24	26	2	24	18316.884	3	9	4	6	8	3	6	18603.611#	-1235	17	5	13	16	4	13	18655.707#	-10300
12	0	12	11	1	10	18391.692	1	25	1	25	26	2	25	18315.024	-0	10	4	7	9	3	7	18604.270#	-1146	19	5	15	18	4	15	18656.876#	-9911
13	0	13	12	1	11	18392.177	-2	26	1	25	27	2	25	18315.702	-7	11	4	8	10	3	8	18604.894#	-1071	20	5	16	19	4	16	18657.431#	-9715
14	0	14	13	1	12	18392.641	-2	26	1	26	27	2	26	18313.707	1	12	4	9	11	3	9	18605.499#	-994	21	5	17	20	4	17	18657.967#	-9517
15	0	15	14	1	13	18393.082	-3	27	1	26	28	2	26	18314.521	1	13	4	10	12	3	10	18606.083#	-919	22	5	18	21	4	18	18658.485#	-9316
16	0	16	15	1	14	18393.504	-1	27	1	27	28	2	27	18312.369	1	14	4	11	13	3	11	18606.638#	-852	16	5	12	16	6	10	18208.858#	-10485
17	0	17	16	1	15	18393.901	-2	28	1	27	29	2	27	18313.321	4	15	4	12	14	3	12	18607.166#	-792	17	5	13	17	6	11	18208.726#	-10292
18	0	18	17	1	16	18394.276	-2	28	1	28	29	2	28	18311.010	1	16	4	13	15	3	13	18607.681#	-724	18	5	14	18	6	12	18208.569#	-10106
19	0	19	18	1	17	18394.631	-0	29	1	28	30	2	28	18312.092	-5	17	4	14	16	3	14	18608.169#	-663	19	5	15	19	6	13	18208.403#	-9910
20	0	20	19	1	18	18394.962	0	29	1	29	30	2	29	18309.624	-6	18	4	15	17	3	15	18608.632#	-607	20	5	16	20	6	14	18208.218#	9713
21	0	21	20	1	19	18395.267	-4	30	1	29	31	2	29	18310.849*	-13	19	4	16	18	3	16	18609.071#	-555	21	5	17	21	6	15	18208.015#	-9516
22	0	22	21	1	20	18395.553	-3	30	1	30	31	2	30	18308.231	-0	20	4	17	19	3	17	18609.489#	-503	22	5	18	22	6	16	18207.795#	-9316
23	0	23	22	1	21	18395.820	0	31	1	31	32	2	31	18306.811	0	21	4	18	20	3	18	18609.885#	-454	23	5	19	23	6	17	18207.558#	-9114
25	0	25	24	1	23	18396.281	0	31	1	30	32	2	30	18309.610	-2	22	4	19	21	3	19	18610.258#	-407	24	5	20	24	6	18	18207.303#	-8912
26	0	26	25	1	24	18396.478	1	32	1	31	33	2	31	18308.335*	-11	23	4	20	22	3	20	18610.611#	-359	25	5	21	25	6	19	18207.028#	-8712
12	1	11	13	0	13	18420.940	-4	33	1	32	34	2	32	18307.072	8	24	4	21	23	3	21	18610.938#	-317	26	5	22	26	6	20	18206.729#	-8515
13	1	12	14	0	14	18419.967	-2	34	1	34	35	2	34	18302.429	-1	25	4	22	24	3	22	18611.247#	-273	27	5	23	27	6	21	18206.419#	-8311
14	1	13	15	0	15	18418.977	-2	34	1	33	35	2	33	18305.769	2	26	4	23	25	3	23	18611.530#	-234	28	5	24	28	6	22	18206.083#	-8114
16	1	15	17	0	17	18416.955	2	35	1	35	36	2	35	18300.936	8	27	4	24	26	3	24	18611.794#	-194	12	5	8	11	6	6	18218.509#	-11169
17	1	16	18	0	18	18415.918	2	35	1	34	36	2	34	18304.455	1	28	4	25	27	3	25	18612.030#	-162	13	5	9	12	6	7	18219.186#	-11012
18	1	17	19	0	19	18414.867	2	36	1	36	37	2	36	18299.410	2	29	4	26	28	3	26	18612.255#	-121	14	5	10	13	6	8	18219.864#	-10835
19	1	18	20	0	20	18413.797	-2	36	1	35	37	2	35	18303.123	-2	30	4	27	29	3	27	18612.455#	-84	16	5	12	15	6	10	18221.157#	-10486
20	1	19	21	0	21	18412.718	0	37	1	37	38	2	37	18297.868	2	31	4	28	30	3	28	18612.636#	-45	20	5	16	19	6	14	18223.584#	-9715
21	1	20	22	0	22	18411.626	5	37	1	36	38	2	36	18301.790	9	18	4	15	19	5	15	18228.531#	-617	22	5	18	21	6	16	18224.695#	-9317
22	1	21	23	0	23	18410.510	1	38	1	38	39	2	38	18296.305	0	19	4	16	20	5	16	18227.464#	-556	25	5	21	24	6	19	18226.227#	-8709
26	1	25	27	0	27	18405.918	2	39	1	39	40	2	39	18294.725	1	20	4	17	21	5	17	18226.372#	-502	20	6	15	21	7	15	18180.413*	2422
27	1	26	28	0	28	18404.733	2	40	1	40	41	2	40	18293.118	-6	21	4	18	22	5	18	18225.253#	-456	21	6	16	22	7	16	18179.289*	2465
28	1	27	29	0	29	18403.533	1	42	1	42	43	2	42	18289.856	-6	22	4	19	23	5	19	18224.118#	-408	22	6	17	23	7	17	18178.137*	2498
29	1	28	30	0	30	18402.319	2	43	1	43	44	2	43	18288.201	-0	23	4	20	24	5	20	18222.962#	-362	23	6	18	24	7	18	18176.971*	2536
30	1	29	31	0	31	18401.092	3	44	1	44	45	2	44	18286.522	-0	24	4	21	25	5	21	18221.790#	-314	24	6	19	25	7	19	18175.797*	2583
31	1	30	32	0	32	18399.844	-2	47	1	47	48	2	47	18281.369	5	25	4	22	26	5	22	18220.590#	-276	25	6	20	26	7	20	18174.600*	2627
35	1	34	36	0	36	18394.731	-2	48	1	48	49	2	48	18279.605	-3	26	4	23	27	5	23	18219.373#	-235	26	6	21	27	7	21	18173.394*	2681
37	1	36	38	0	38	18392.093	-0	49	1	49	50	2	49	18277.825	-5	27	4	24	28	5	24	18218.136#	-197	27	6	22	28	7	22	18172.176*	2741
39	1	38	40	0	40	18389.397	-1	50	1	50	51	2	50	18276.034	0	28	4	25	29	5	25	18216.881#	-159	28	6	23	29	7	23	18170.942*	2804
40	1	39	41	0	41	18388.026	-5	51	1	51	52	2	51	18274.217	-1	29	4	26	30	5	26	18215.606#	-122	8	6	3	8	7	1	18199.636*	2204
41	1	40	42	0	42	18386.648	-2	52	1	52	53	2	52	18272.385	2	30	4	27	31	5	27	18214.310#	-87	9	6	4	9	7	2	18199.482*	2222
42	1	41	43	0	43	18385.260	5	53	1	53	54	2	53	18270.526	4	31	4	28	32	5	28	18212.998#	50	10	6	5	10	7	3	18199.301*	2232
43	1	42	44	0	44	18383.847	-0	54	1	54	55	2	54	18268.659	2	32	4	29	33	5	29	18211.664#	-18	11	6	6	11	7	4	18199.099*	2241
44	1	43	45	0	45	18382.427	0	55	1	55	56	2	55	18266.768	2	33	4	30	34	5	30	18210.317#	20	12	6	7	12	7	5	18198.882*	2253
45	1	44	46	0	46	18380.992	0	56	1	56	57	2	56	18264.854	-1	34	4	31	35	5	31	18208.947#	53	13	6	8	13	7	6	18198.651*	2270
33	1	33	33	0	33	18420.213	9	57	1	57	58	2	57	18262.929	3	35	4	32	36	5	32	18207.561#	89	14	6	9	14	7	7	18198.404*	2291
34	1	34	34	0	34	18419.489	3	33	1	33	33	2	31	18329.959	-2	37	4	34	38	5	34	18204.735#	159	15	6	10	15	7	8	18198.133*	2307
35	1	35	35	0	35	18418.750	2	34	1	34	34	2	32	18329.232	-1	38	4	35	39	5	35	18203.293#	192	16	6	11	16	7	9	18197.847*	2326
36	1	36	36	0	36	18417.984	-5	35	1	35	35	2	33	18328.485	3	39	4	36	40	5	36	18201.830#	222	19	7	13	20	8	13	18155.155	-7
37	1	37	37	0	37	18417.214	3	37	1	37	37	2	35	18326.920	4	40	4	37	41	5	37	18200.363#	267	8	7	2	8	8	0	18173.458	3
38	1	38	38	0	38	18416.414	1	38	1	38	38	2	36	18326.102	2	10	4	7	10	5	5	18244.815#	-1149	9	7	3	9	8	1	18173.289	7
39	1	39	39	0	39	18415.594	-1	39	1	39	39	2	37	18325.267	4	11	4	8	11	5	6	18244.688#	-1067	10	7	4	10	8	2	18173.093	3
42	1	42	42	0	42	18413.025	1	40	1	40	40	2	38	18324.403	-1	12	4	9	12	5	7	18244.535#	-992	11	7	5	11	8	3	18172.879	1
43	1	43	43	0	43	18412.130	1	42	1	42	42	2	40	18322.622	2	13	4	10	13	5	8	18244.358#	-923	12	7	6	12	8	4	18172.648	1
44	1	44	44	0	44	18411.211	-4	43	1	43	43	2	41	18321.693	-3	14	4	11	14	5	9	18244.166#	-849	13	7	7	13	8	5	18172.397	0
47	1	47	47	0	47	18408.359	4	44	1	44	44	2	42	18320.743	-7	15	4	12	15	5	10	18243.943#	-788	14	7	8	14	8	6	18172.127	1
48	1	48	48	0	48	18407.363	-2	50	1	50	50	2	48	18314.612	-1	16	4	13	16	5	11	18243.703#	-724	15	7	9	15	8	7	18171.839	-0
49	1	49	49	0	49	18406.356	-0	51	1	51	51	2	49	18313.518	5	17	4	14	17	5	12	18243.443#	-661	16	7	10	16	8	8	18171.532	-0
50	1	50	50	0	50	18405.329	-0	52	1	52	52	2	50	18312.390	-2	18	4	15	18	5	13	18243.157#	-606	17	7	11	17	8	9	18171.203	-2
51	1	51	51	0	51	18404.281	-2	53	1	53	53	2	51	18311.248	-0	19	4	16	19	5	14	18242.853#	-550	18	7	12	18	8	10	18170.858	1
52	1	52	52	0	52	18403.222	3	54	1	54	54	2	52	18310.079	-3	9	4	6	8	5	4	18251.851#	-1232	19	7	13	19	8	11	18170.498	4
3	1	2	2	0	2	18434.425	2	55	1	55	55	2	53	18308.891	-3	10	4	7	9	5	5	18252.518#	-1144	12	7	6	11	8	4	18181.657	3
4	1	3	3	0	3	18435.137	5	56	1	56	56	2	54	18307.691	6	11	4	8	10	5	6	18253.155#	-1068	13	7	7	12	8	5	18182.366	4
5	1	4	4	0	4	18435.828	3	4	1	4	3	2	2	18344.829	2	12	4	9	11	5	7	18253.773#	-991	14	7	8	13	8	6	18182.868	1
6	1	5	5	0	5	18436.504	2	5	1	5	4	2	3	18345.488	-3	14	4	11	13	5	9	18254.933#	-856	15	7	9	14	8	7	18183.336	-8
7	1	6	6	0	6	18437.165	3	6	1	6	5	2	4	18346.136	1	15	4	12	14	5	10	18255.484#	-789	16	7	10	15	8	8	18183.804	1
8	1	7	7	0	7	18437.811	3	6	1	5	5	2	3	18346.256	-2	16	4	13	15	5	11	18256.008#	-730	17	7	11	16	8	9	18184.243	1
9	1	8	8	0	8	18438.440	2	7	1	7	6	2	5	18346.756	-1	17	4	14	16	5	12	18256.521#	-663	18	7	12	17	8	10	18184.654	7
10	1	9	9	0	9	18439.053	2	8	1	7	7	2	5	18347.568	-0	19	4	16	18	5	14	18257.465#	-553	19	7	13	18	8	11	18185.065	5
11	1	10	10	0	10	18439.652	3	8	1	8	7	2	6	18347.355	-3	20	4	17	19	5	15	18257.910#	-497	21	8	13	22	9	13	18127.084	-4
12	1	11	11	0	11	18440.233	1	9	1	9	8	2	7	18347.938	1	21	4	18	20	5	16	18258.329#	-447	22	8	14	23	9	14	18125.893	8
13	1	12	12	0	12	18440.801	4	10	1	10	9	2	8	18348.497	2	22	4	19	21	5	17	18258.727#	-399	23	8	15	24	9	15	18124.667	3
14	1	13	13	0	13	18441.346	-2	10	1	9	9	2	7	18348.816	0	23	4	20	22	5	18	18259.102#	-355	9	8	2	9	9	0	18147.631	5
15	1	14	14	0	14	18441.885	2	11	1	10	10	2	8	18349.415	-2	24	4	21	23	5	19	18259.454#	-314	10	8	3	10	9	1	18147.437	-0
16	1	15	15	0	15	18442.402	1	11	1	11	10	2	9	18349.029	-3	25	4	22	24	5	20	18259.790#	-271	11	8	4	11	9	2	18147.216	-2
17	1	16	16	0	16	18442.907	2	12	1	12	11	2	10	18349.543	-4	26	4	23	25	5	21	18260.100#	-235	12	8	5	12	9	3	18146.976	-2
18	1	17	17	0	17	18443.391	-1	13	1	13	12	2	11	18350.037	-3	27	4	24	26	5	22	18260.400#	-190	13	8	6	13	9	4	18146.715	3
19	1	18	18	0	18	18443.863	-1	14	1	14	13	2	12	18350.513	1	29	4	26	28	5	24	18260.929#	-112	14	8	7	14	9	5	18146.440	1
20	1	19	19	0	19	18444.320	0	15	1	14	14	2	12	18351.662	1	30	4	27	29	5	25	18261.160#	-79	15	8	8	15	9	6	18146.142	3
21	1	20	20	0	20	18444.762	2	15	1	15	14	2	13	18350.965	2	31	4	28	30	5	26	18261.363#	-54	16	8	9	16	9	7	18145.819	-2
22	1	21	21	0	21	18445.183	-3	16	1	16	15	2	14	18351.394	0	16	5	12	17	4	14	18629.697#	-10477	17	8	10	17	9	8	18145.486	5
23	1	22	22	0	22	18445.593	-1	16	1	15	15	2	13	18352.186	3	17	5	13	18	4	15	18628.764#	-10294	44	8	37	44	9	35	18128.787	0
24	1	23	23	0	23	18445.985	-4	17	1	17	16	2	15	18351.798	-4	18	5	14	19	4	16	18627.818#	-10103	45	8	38	45	9	36	18127.889	-0
25	1	24	24	0	24	18446.371	5	18	1	18	17	2	16	18352.188	-0	19	5	15	20	4	17	18626.851#	-9913	47	8	40	47	9	38	18126.033	-2
26	1	25	25	0	25	18446.728	-1	18	1	17	17	2	15	18353.182	3	20	5	16	21	4	18	18625.875#	-9713	48	8	41	48	9	39	18125.078	1

O–C Units of 10^{-3} cm^{-1}.

* Line not included in the fit.

\# Line used to form ground state combination differences.

TABLE VII

Observed Line Positions (cm^{-1}) for $^{63}CuOD$

J"	Ka"	Kc"	J'	Ka'	Kc'	OBS	O-C
10	0	10	11	1	10	18400.804*	24
11	0	11	12	1	11	18399.766*	14
12	0	12	13	1	12	18398.706	9
13	0	13	14	1	13	18397.628*	15
14	0	14	15	1	14	18396.512	9
16	0	16	17	1	16	18394.209	8
17	0	17	18	1	17	18393.012	4
18	0	18	19	1	18	18391.788	-0
19	0	19	20	1	19	18390.548	8
20	0	20	21	1	20	18389.268	3
21	0	21	22	1	21	18387.965	2
24	0	24	25	1	24	18383.895	4
28	0	28	29	1	28	18378.081	5
29	0	29	30	1	29	18376.557	4
30	0	30	31	1	30	18375.006	2
32	0	32	33	1	32	18371.826	6
33	0	33	34	1	33	18370.192	5
35	0	35	36	1	35	18366.845	7
37	0	37	38	1	37	18363.364	5
38	0	38	39	1	38	18361.633*	26
39	0	39	40	1	39	18359.834*	26
40	0	40	41	1	40	18357.993*	11
41	0	41	42	1	41	18356.141*	13
4	0	4	4	1	4	18410.125	10
5	0	5	5	1	5	18410.034	-0
6	0	6	6	1	6	18409.935	-4
7	0	7	7	1	7	18409.824	-2
8	0	8	8	1	8	18409.694	-3
9	0	9	9	1	9	18409.546	-6
10	0	10	10	1	10	18409.387	-5
11	0	11	11	1	11	18409.213	-2
12	0	12	12	1	12	18409.019	-3
13	0	13	13	1	13	18408.810	-2
14	0	14	14	1	14	18408.582	-4
15	0	15	15	1	15	18408.343	-1
16	0	16	16	1	16	18408.087	2
17	0	17	17	1	17	18407.819	8
18	0	18	18	1	18	18407.534*	14
19	0	19	19	1	19	18407.218	6
20	0	20	20	1	20	18406.882	4
21	0	21	21	1	21	18406.558	10
22	0	22	22	1	22	18406.197	6
23	0	23	23	1	23	18405.826	9
24	0	24	24	1	24	18405.438*	11
25	0	25	25	1	25	18405.026	7
26	0	26	26	1	26	18404.608*	13
27	0	27	27	1	27	18404.166*	11
28	0	28	28	1	28	18403.704	7
29	0	29	29	1	29	18403.236*	14
30	0	30	30	1	30	18402.748*	18
31	0	31	31	1	31	18402.237*	16
33	0	33	33	1	33	18401.177*	25
34	0	34	34	1	34	18400.616*	24
35	0	35	35	1	35	18400.041*	27
36	0	36	36	1	36	18399.452*	33
37	0	37	37	1	37	18398.824*	19
38	0	38	38	1	38	18398.197*	22
2	0	2	1	1	0	18411.607*	-38
3	0	3	2	1	1	18412.274*	-14
4	0	4	3	1	2	18412.898	-6
5	0	5	4	1	3	18413.502	10
6	0	6	5	1	4	18414.055	2
7	0	7	6	1	5	18414.588	2
8	0	8	7	1	6	18415.103*	11
9	0	9	8	1	7	18415.592*	23
10	0	10	9	1	8	18416.033*	15
11	0	11	10	1	9	18416.457*	16
12	0	12	11	1	10	18416.861*	26
13	0	13	12	1	11	18417.212*	10
14	0	14	13	1	12	18417.541	1
15	0	15	14	1	13	18417.870*	19
16	0	16	15	1	14	18418.156*	22
17	0	17	16	1	15	18418.398	8
18	0	18	17	1	16	18418.641*	24
19	0	19	18	1	17	18418.835*	19
20	0	20	19	1	18	18419.014*	27
21	0	21	20	1	19	18419.160*	30
22	0	22	21	1	20	18419.266*	21
23	0	23	22	1	21	18419.346*	15
24	0	24	23	1	22	18419.416*	26
2	1	1	3	0	3	18433.961	-1
3	1	2	4	0	4	18433.212	3
4	1	3	5	0	5	18432.412	-9
5	1	4	6	0	6	18431.615	0
6	1	5	7	0	7	18430.794	2
7	1	6	8	0	8	18429.957	5
8	1	7	9	0	9	18429.100	6
10	1	9	11	0	11	18427.331	1
12	1	11	13	0	13	18425.504	4
13	1	12	14	0	14	18424.561	1
14	1	13	15	0	15	18423.607	4
16	1	15	17	0	17	18421.653*	11
17	1	16	18	0	18	18420.645	6
18	1	17	19	0	19	18419.624	7
19	1	18	20	0	20	18418.589	6
20	1	19	21	0	21	18417.545*	18
21	1	20	22	0	22	18416.457	-6
22	1	21	23	0	23	18415.384	3
23	1	22	24	0	24	18414.280	-4
24	1	23	25	0	25	18413.170	-2
25	1	24	26	0	26	18412.027	2
26	1	25	27	0	27	18410.907	2
27	1	26	28	0	28	18409.738*	-12
28	1	27	29	0	29	18408.582	2
29	1	28	30	0	30	18407.400	2
30	1	29	31	0	33	18403.757*	-11
32	1	31	33	0	33	18403.757*	-11
33	1	32	34	0	34	18402.527	-4
34	1	33	35	0	35	18401.265	-3
35	1	34	36	0	36	18399.952	-4
36	1	35	37	0	37	18398.616	-6
37	1	36	38	0	38	18397.253	-5
38	1	37	39	0	39	18395.861	-4
39	1	38	40	0	40	18394.442	-5
40	1	39	41	0	41	18392.974	-4
41	1	40	42	0	42	18391.482	-4
42	1	41	43	0	43	18389.967	-5
43	1	42	44	0	44	18388.424	-6
44	1	43	45	0	45	18386.855	-5
45	1	44	46	0	46	18385.247	-6
46	1	45	47	0	47	18383.609	-6
47	1	46	48	0	48	18381.944	-6
48	1	47	49	0	49	18380.247	-6
49	1	48	50	0	50	18378.522	-5
50	1	49	51	0	51	18376.760	-5
51	1	50	52	0	52	18374.966	-5
52	1	51	53	0	53	18373.139	-4
53	1	52	54	0	54	18371.276	-4
54	1	53	55	0	55	18369.380	-4
55	1	54	56	0	56	18367.450	-4
56	1	55	57	0	57	18365.485	-4
57	1	56	58	0	58	18363.488	-3
58	1	57	59	0	59	18361.456	-3
59	1	58	60	0	60	18359.391	-2
60	1	59	61	0	61	18357.293	-1
61	1	60	62	0	62	18355.161	0
62	1	61	63	0	63	18352.997	1
63	1	62	64	0	64	18350.800	2
64	1	63	65	0	65	18348.570	3
65	1	64	66	0	66	18346.308	4
66	1	65	67	0	67	18344.013	5
67	1	66	68	0	68	18341.686	6
68	1	67	69	0	69	18339.327	7
69	1	68	70	0	70	18336.936	8
70	1	69	71	0	71	18334.513	9
71	1	70	72	0	72	18332.059	10
72	1	71	73	0	73	18329.573	11
73	1	72	74	0	74	18327.056	12
74	1	73	75	0	75	18324.508	13
75	1	74	76	0	76	18321.929	14
76	1	75	77	0	77	18319.319	15
77	1	76	78	0	78	18316.679	16
78	1	77	79	0	79	18314.008	17
79	1	78	80	0	80	18311.307	18
80	1	79	81	0	81	18308.576	19
81	1	80	82	0	82	18305.815	20
82	1	81	83	0	83	18303.024	21
83	1	82	84	0	84	18300.203	22
84	1	83	85	0	85	18297.353	23
85	1	84	86	0	86	18294.473	24
86	1	85	87	0	87	18291.564	25
87	1	86	88	0	88	18288.626	26
88	1	87	89	0	89	18285.659	27
89	1	88	90	0	90	18282.663	28
90	1	89	91	0	91	18279.639	29
91	1	90	92	0	92	18276.586	30
92	1	91	93	0	93	18273.505	31
93	1	92	94	0	94	18270.396	32
94	1	93	95	0	95	18267.259	33
95	1	94	96	0	96	18264.094	34
96	1	95	97	0	97	18260.902	35
97	1	96	98	0	98	18257.683	36
98	1	97	99	0	99	18254.437	37
99	1	98	100	0	100	18251.164	38
100	1	99	101	0	101	18247.865	39
101	1	100	102	0	102	18244.539	40
102	1	101	103	0	103	18241.187	41
103	1	102	104	0	104	18237.809	42
104	1	103	105	0	105	18234.405	43
105	1	104	106	0	106	18230.975	44
106	1	105	107	0	107	18227.520	45
107	1	106	108	0	108	18224.039	46
108	1	107	109	0	109	18220.533	47
109	1	108	110	0	110	18217.002	48
110	1	109	111	0	111	18213.446	49
111	1	110	112	0	112	18209.865	50
112	1	111	113	0	113	18206.259	51
113	1	112	114	0	114	18202.628	52
114	1	113	115	0	115	18198.973	53
115	1	114	116	0	116	18195.293	54
116	1	115	117	0	117	18191.588	55
117	1	116	118	0	118	18187.859	56
118	1	117	119	0	119	18184.106	57
119	1	118	120	0	120	18180.328	58
120	1	119	121	0	121	18176.526	59
121	1	120	122	0	122	18172.700	60
122	1	121	123	0	123	18168.850	61
123	1	122	124	0	124	18164.976	62
124	1	123	125	0	125	18161.078	63
125	1	124	126	0	126	18157.156	64
126	1	125	127	0	127	18153.210	65
127	1	126	128	0	128	18149.241	66
128	1	127	129	0	129	18145.248	67
129	1	128	130	0	130	18141.232	68
130	1	129	131	0	131	18137.192	69
131	1	130	132	0	132	18133.129	70
132	1	131	133	0	133	18129.042	71
133	1	132	134	0	134	18124.932	72
134	1	133	135	0	135	18120.799	73
135	1	134	136	0	136	18116.643	74
136	1	135	137	0	137	18112.464	75
137	1	136	138	0	138	18108.262	76
138	1	137	139	0	139	18104.037	77
139	1	138	140	0	140	18099.790	78
140	1	139	141	0	141	18095.520	79
141	1	140	142	0	142	18091.228	80
142	1	141	143	0	143	18086.913	81
143	1	142	144	0	144	18082.576	82
144	1	143	145	0	145	18078.217	83
145	1	144	146	0	146	18073.836	84
146	1	145	147	0	147	18069.433	85
147	1	146	148	0	148	18065.008	86
148	1	147	149	0	149	18060.562	87
149	1	148	150	0	150	18056.094	88
150	1	149	151	0	151	18051.605	89
151	1	150	152	0	152	18047.094	90
152	1	151	153	0	153	18042.562	91
153	1	152	154	0	154	18038.009	92
154	1	153	155	0	155	18033.435	93
155	1	154	156	0	156	18028.840	94
156	1	155	157	0	157	18024.224	95
157	1	156	158	0	158	18019.588	96
158	1	157	159	0	159	18014.931	97
159	1	158	160	0	160	18010.253	98
160	1	159	161	0	161	18005.555	99
161	1	160	162	0	162	18000.837	100
162	1	161	163	0	163	17996.098	101
163	1	162	164	0	164	17991.339	102
164	1	163	165	0	165	17986.560	103
165	1	164	166	0	166	17981.761	104
166	1	165	167	0	167	17976.943	105
167	1	166	168	0	168	17972.105	106
168	1	167	169	0	169	17967.248	107
169	1	168	170	0	170	17962.372	108
170	1	169	171	0	171	17957.477	109
171	1	170	172	0	172	17952.563	110
172	1	171	173	0	173	17947.631	111
173	1	172	174	0	174	17942.680	112
174	1	173	175	0	175	17937.711	113
175	1	174	176	0	176	17932.724	114
176	1	175	177	0	177	17927.719	115
177	1	176	178	0	178	17922.696	116
178	1	177	179	0	179	17917.656	117
179	1	178	180	0	180	17912.598	118
180	1	179	181	0	181	17907.523	119
181	1	180	182	0	182	17902.431	120
182	1	181	183	0	183	17897.322	121
183	1	182	184	0	184	17892.196	122
184	1	183	185	0	185	17887.053	123
185	1	184	186	0	186	17881.894	124
186	1	185	187	0	187	17876.719	125
187	1	186	188	0	188	17871.527	126
188	1	187	189	0	189	17866.320	127
189	1	188	190	0	190	17861.097	128
190	1	189	191	0	191	17855.858	129
191	1	190	192	0	192	17850.604	130
192	1	191	193	0	193	17845.335	131
193	1	192	194	0	194	17840.051	132
194	1	193	195	0	195	17834.752	133
195	1	194	196	0	196	17829.438	134
196	1	195	197	0	197	17824.110	135
197	1	196	198	0	198	17818.767	136
198	1	197	199	0	199	17813.410	137
199	1	198	200	0	200	17808.039	138
200	1	199	201	0	201	17802.654	139
201	1	200	202	0	202	17797.256	140
202	1	201	203	0	203	17791.844	141
203	1	202	204	0	204	17786.419	142
204	1	203	205	0	205	17780.981	143
205	1	204	206	0	206	17775.530	144
206	1	205	207	0	207	17770.066	145
207	1	206	208	0	208	17764.590	146
208	1	207	209	0	209	17759.101	147
209	1	208	210	0	210	17753.600	148
210	1	209	211	0	211	17748.087	149
211	1	210	212	0	212	17742.562	150
212	1	211	213	0	213	17737.025	151
213	1	212	214	0	214	17731.477	152
214	1	213	215	0	215	17725.917	153
215	1	214	216	0	216	17720.346	154
216	1	215	217	0	217	17714.764	155
217	1	216	218	0	218	17709.171	156
218	1	217	219	0	219	17703.568	157
219	1	218	220	0	220	17697.955	158
220	1	219	221	0	221	17692.332	159
221	1	220	222	0	222	17686.700	160
222	1	221	223	0	223	17681.059	161
223	1	222	224	0	224	17675.409	162
224	1	223	225	0	225	17669.751	163
225	1	224	226	0	226	17664.085	164
226	1	225	227	0	227	17658.411	165
227	1	226	228	0	228	17652.730	166
228	1	227	229	0	229	17647.042	167
229	1	228	230	0	230	17641.348	168
230	1	229	231	0	231	17635.648	169
231	1	230	232	0	232	17629.943	170
232	1	231	233	0	233	17624.233	171
233	1	232	234	0	234	17618.519	172
234	1	233	235	0	235	17612.801	173
235	1	234	236	0	236	17607.080	174
236	1	235	237	0	237	17601.356	175
237	1	236	238	0	238	17595.630	176
238	1	237	239	0	239	17589.902	177
239	1	238	240	0	240	17584.173	178
240	1	239	241	0	241	17578.444	179
241	1	240	242	0	242	17572.715	180
242	1	241	243	0	243	17566.987	181
243	1	242	244	0	244	17561.260	182
244	1	243	245	0	245	17555.535	183
245	1	244	246	0	246	17549.813	184
246	1	245	247	0	247	17544.095	185
247	1	246	248	0	248	17538.381	186
248	1	247	249	0	249	17532.673	187
249	1	248	250	0	250	17526.971	188
250	1	249	251	0	251	17521.276	189
251	1	250	252	0	252	17515.589	190
252	1	251	253	0	253	17509.911	191
253	1	252	254	0	254	17504.242	192
254	1	253	255	0	255	17498.584	193
255	1	254	256	0	256	17492.937	194
256	1	255	257	0	257	17487.302	195
257	1	256	258	0	258	17481.680	196
258	1	257	259	0	259	17476.072	197
259	1	258	260	0	260	17470.479	198
260	1	259	261	0	261	17464.902	199
261	1	260	262	0	262	17459.342	200
262	1	261	263	0	263	17453.800	201
263	1	262	264	0	264	17448.277	202
264	1	263	265	0	265	17442.774	203
265	1	264	266	0	266	17437.292	204
266	1	265	267	0	267	17431.833	205
267	1	266	268	0	268	17426.398	206
268	1	267	269	0	269	17420.988	207
269	1	268	270	0	270	17415.605	208
270	1	269	271	0	271	17410.250	209
271	1	270	272	0	272	17404.925	210
272	1	271	273	0	273	17399.632	211
273	1	272	274	0	274	17394.372	212
274	1	273	275	0	275	17389.147	213
275	1	274	276	0	276	17383.959	214
276	1	275	277	0	277	17378.809	215
277	1	276	278	0	278	17373.699	216
278	1	277	279	0	279	17368.631	217
279	1	278	280	0	280	17363.606	218
280	1	279	281	0	281	17358.626	219
281	1	280	282	0	282	17353.693	220
282	1	281	283	0	283	17348.808	221
283	1	282	284	0	284	17343.973	222
284	1	283	285	0	285	17339.190	223
285	1	284	286	0	286	17334.461	224
286	1	285	287	0	287	17329.788	225
287	1	286	288	0	288	17325.173	226
288	1	287	289	0	289	17320.618	227
289	1	288	290	0	290	17316.126	228
290	1	289	291	0	291	17311.699	229
291	1	290	292	0	292	17307.340	230
292	1	291	293	0	293	17303.052	231
293	1	292	294	0	294	17298.838	232
294	1	293	295	0	295	17294.702	233
295	1	294	296	0	296	17290.647	234
296	1	295	297	0	297	17286.677	235
297	1	296	298	0	298	17282.797	236
298	1	297	299	0	299	17279.011	237
299	1	298	300	0	300	17275.324	238
300	1	299	301	0	301	17271.741	239
301	1	300	302	0	302	17268.268	240
302	1	301	303	0	303	17264.911	241
303	1	302	304	0	304	17261.677	242
304	1	303	305	0	305	17258.574	243
305	1	304	306	0	306	17255.611	244
306	1	305	307	0	307	17252.799	245
307	1	306	308	0	308	17250.150	246
308	1	307	309	0	309	17247.679	247
309	1	308	310	0	310	17245.403	248
310	1	309	311	0	311	17243.342	249
311	1	310	312	0	312	17241.520	250
312	1	311	313	0	313	17239.967	251
313	1	312	314	0	314	17238.719	252
314	1	313	315	0	315	17237.820	253
315	1	314	316	0	316	17237.325	254
316	1	315	317	0	317	17237.305	255

O–C Units of 10^{-3} cm^{-1}.

* Line not included in the fit.

\# Line used to form ground state combination differences.

TABLE VII—*Continued*

J'	Ka'	Kc'		J"	Ka"	Kc"	OBS	O-C
39	2	37	-	39	1	39	18453.345	-1
41	2	39	-	41	1	41	18452.156	-4
2	2	1	-	1	1	1	18466.775	0
2	2	0	-	1	1	0	18466.775*	12
3	2	1	-	2	1	1	18467.411	5
4	2	2	-	3	1	2	18468.028	7
4	2	3	-	3	1	3	18468.089	-1
5	2	3	-	4	1	3	18468.615	7
5	2	4	-	4	1	4	18468.727	4
6	2	4	-	5	1	4	18469.174	5
6	2	5	-	5	1	5	18469.344	3
7	2	5	-	6	1	5	18469.700	-1
7	2	6	-	6	1	6	18469.950	9
8	2	6	-	7	1	6	18470.215	9
8	2	7	-	7	1	7	18470.533	8
9	2	7	-	8	1	7	18470.677	-6
10	2	9	-	9	1	9	18471.656	10
11	2	9	-	10	1	9	18471.562	6
12	2	10	-	11	1	10	18471.954	4
13	2	12	-	12	1	12	18473.196	-8
13	2	11	-	12	1	11	18472.322	4
14	2	12	-	13	1	12	18472.666	8
14	2	13	-	13	1	13	18473.695	3
15	2	13	-	14	1	13	18472.974	3
16	2	14	-	15	1	14	18473.254	-3
17	2	15	-	16	1	15	18473.518	2
17	2	16	-	16	1	16	18475.062	-3
18	2	17	-	17	1	17	18475.477	-0
19	2	17	-	18	1	17	18473.950	-5
19	2	18	-	18	1	18	18475.880	-3
20	2	18	-	19	1	18	18474.143	9
20	2	19	-	19	1	19	18476.271	-2
21	2	19	-	20	1	19	18474.286	-0
21	2	20	-	20	1	20	18476.645	-2
22	2	20	-	21	1	20	18474.418	6
22	2	21	-	21	1	21	18477.006	2
23	2	22	-	22	1	22	18477.346	1
23	2	21	-	22	1	21	18474.508	-4
24	2	23	-	23	1	23	18477.671	1
25	2	24	-	24	1	24	18477.984	5
26	2	25	-	25	1	25	18478.272	-1
27	2	26	-	26	1	26	18478.562*	12
28	2	27	-	27	1	27	18478.810	0
29	2	28	-	28	1	28	18479.054	-1
30	2	29	-	29	1	29	18479.287	3
31	2	30	-	30	1	30	18479.501	4
32	2	31	-	31	1	31	18479.699	5
33	2	32	-	32	1	32	18479.881	6
34	2	33	-	33	1	33	18480.047	7
35	2	34	-	34	1	34	18480.188	-2
36	2	35	-	35	1	35	18480.307*	-16
37	2	36	-	36	1	36	18480.426*	-15
38	2	37	-	37	1	37	18480.552	10
5	2	3	-	6	3	3	18364.736	3
7	2	5	-	8	3	5	18363.015	4
8	2	6	-	9	3	6	18362.131*	13
9	2	7	-	10	3	7	18361.223*	19
10	2	8	-	11	3	8	18360.282*	14
11	2	9	-	12	3	9	18359.338*	28
12	2	10	-	13	3	10	18358.349*	16
13	2	11	-	14	3	11	18357.333	-0
14	2	12	-	15	3	12	18356.309	-4
15	2	13	-	16	3	13	18355.264	-6
16	2	14	-	17	3	14	18354.201	-7
3	2	2	-	3	3	0	18369.261*	14
3	2	1	-	3	3	1	18369.261*	14
4	2	2	-	4	3	2	18369.166	7
4	2	3	-	4	3	1	18369.166	7
5	2	4	-	5	3	2	18369.058	7
5	2	3	-	5	3	3	18369.058	7
6	2	5	-	6	3	3	18368.927	5
6	2	4	-	6	3	4	18368.927	5
7	2	6	-	7	3	4	18368.778	8
7	2	5	-	7	3	5	18368.778	8
8	2	6	-	8	3	6	18368.606	9
8	2	7	-	8	3	5	18368.606*	10
9	2	8	-	9	3	6	18368.399	-2
9	2	7	-	9	3	7	18368.399	-3
10	2	8	-	10	3	8	18368.181	-4
10	2	9	-	10	3	7	18368.181	-2
11	2	10	-	11	3	8	18367.935	-10
11	2	9	-	11	3	9	18367.935*	-13
12	2	10	-	12	3	10	18367.672*	-17
12	2	11	-	12	3	9	18367.672*	-12
13	2	12	-	13	3	10	18367.401	-1
13	2	11	-	13	3	11	18367.401	-7
14	2	13	-	14	3	11	18367.095	-2
14	2	12	-	14	3	12	18367.095*	-11
15	2	13	-	15	3	13	18366.773	-10
15	2	14	-	15	3	12	18366.773	1
16	2	15	-	16	3	13	18366.425	1
16	2	14	-	16	3	14	18366.425*	-13
17	2	16	-	17	3	14	18366.058	3
17	2	15	-	17	3	15	18366.058*	-14
18	2	17	-	18	3	15	18365.665	2
18	2	16	-	18	3	16	18365.665*	-20

J'	Ka'	Kc'		J"	Ka"	Kc"	OBS	O-C
19	2	18	-	19	3	16	18365.267*	18
19	2	17	-	19	3	17	18365.267	-10
20	2	19	-	20	3	17	18364.831*	16
20	2	18	-	20	3	18	18364.831*	-17
21	2	20	-	21	3	18	18364.400*	42
21	2	19	-	21	3	19	18364.400	2
22	2	20	-	22	3	20	18363.925	-2
22	2	21	-	22	3	19	18363.885	6
23	2	21	-	23	3	21	18363.431	-5
23	2	22	-	23	3	20	18363.384	6
24	2	23	-	24	3	21	18362.857	2
24	2	22	-	24	3	22	18362.925	2
25	2	24	-	25	3	22	18362.313	4
25	2	23	-	25	3	23	18362.397	7
26	2	25	-	26	3	23	18361.749	6
26	2	24	-	26	3	24	18361.836	-0
27	2	26	-	27	3	24	18361.153	-0
28	2	27	-	28	3	25	18360.549	7
28	2	26	-	28	3	26	18360.672	4
29	2	27	-	29	3	27	18360.052	-0
29	2	28	-	29	3	26	18359.910	1
30	2	29	-	30	3	27	18359.259	6
30	2	28	-	30	3	28	18359.414	-3
31	2	30	-	31	3	28	18358.579	3
31	2	29	-	31	3	29	18358.764	2
32	2	31	-	32	3	29	18357.877	1
32	2	30	-	32	3	30	18358.102*	15
33	2	32	-	33	3	30	18357.155	2
33	2	31	-	33	3	31	18357.378*	-15
34	2	32	-	34	3	32	18356.669	-10
35	2	34	-	35	3	32	18355.635	-6
35	2	33	-	35	3	33	18355.930*	-14
36	2	35	-	36	3	33	18354.851	-0
36	2	34	-	36	3	34	18355.175*	-15
37	2	35	-	37	3	35	18354.391*	-26
37	2	36	-	37	3	34	18354.028*	-12
6	2	4	-	5	3	2	18373.253*	12
7	2	5	-	6	3	3	18373.824*	15
8	2	6	-	7	3	4	18374.368*	13
9	2	7	-	8	3	5	18374.883	3
10	2	8	-	9	3	6	18375.400*	17
11	2	9	-	10	3	7	18375.880*	15
12	2	10	-	11	3	8	18376.326	2
13	2	11	-	12	3	9	18376.770	7
14	2	12	-	13	3	10	18377.169*	-11
15	2	13	-	14	3	11	18377.574	-2
16	2	14	-	15	3	12	18377.939*	-11
17	2	15	-	16	3	13	18378.291*	-12
5	3	2	-	6	2	4	18492.467	-7
5	3	3	-	6	2	5	18492.467	-8
7	3	5	-	8	2	7	18490.741	-9
7	3	4	-	8	2	6	18490.741	-7
11	3	8	-	12	2	10	18487.028	0
11	3	9	-	12	2	11	18487.028	-8
12	3	10	-	13	2	12	18486.046	-7
12	3	9	-	13	2	11	18486.046	4
13	3	11	-	14	2	13	18485.040	-9
13	3	10	-	14	2	12	18485.040	6
14	3	12	-	15	2	14	18484.013	-10
14	3	11	-	15	2	13	18484.013	9
15	3	12	-	16	2	14	18482.966*	16
15	3	13	-	16	2	15	18482.966	-8
3	3	0	-	3	2	2	18496.991	-3
3	3	1	-	3	2	1	18496.991	-3
4	3	1	-	4	2	3	18496.905	-1
4	3	2	-	4	2	2	18496.905	-1
5	3	3	-	5	2	3	18496.789	-6
5	3	2	-	5	2	4	18496.789	-6
6	3	4	-	6	2	4	18496.660	-3
6	3	3	-	6	2	5	18496.660	-3
7	3	4	-	7	2	6	18496.514	5
7	3	5	-	7	2	5	18496.514	6
8	3	5	-	8	2	7	18496.329	-4
8	3	6	-	8	2	6	18496.329	-2
9	3	7	-	9	2	7	18496.133	0
9	3	6	-	9	2	8	18496.133	-2
10	3	8	-	10	2	8	18495.912	1
10	3	7	-	10	2	9	18495.912	-3
11	3	9	-	11	2	9	18495.669	1
11	3	8	-	11	2	10	18495.669	-4
12	3	9	-	12	2	11	18495.405	-4
12	3	10	-	12	2	10	18495.405	4
13	3	10	-	13	2	12	18495.120	-4
13	3	11	-	13	2	11	18495.120	7
14	3	11	-	14	2	13	18494.809	-8
14	3	12	-	14	2	12	18494.809	7
15	3	13	-	15	2	13	18494.479*	11
15	3	12	-	15	2	14	18494.479	-8
16	3	13	-	16	2	15	18494.128	-8
16	3	14	-	16	2	14	18494.128*	16
17	3	15	-	17	2	15	18493.758*	25
17	3	14	-	17	2	16	18493.758	-6
18	3	16	-	18	2	16	18493.354*	23
18	3	15	-	18	2	17	18493.354*	-16
19	3	16	-	19	2	18	18492.955	2
19	3	17	-	19	2	17	18492.916*	10

J'	Ka'	Kc'		J"	Ka"	Kc"	OBS	O-C
20	3	18	-	20	2	18	18492.467	9
20	3	17	-	20	2	19	18492.515	-1
21	3	18	-	21	2	20	18492.063	6
21	3	19	-	21	2	19	18491.994	7
22	3	20	-	22	2	20	18491.501	8
22	3	19	-	22	2	21	18491.586	9
23	3	20	-	23	2	22	18491.084	9
23	3	21	-	23	2	21	18490.980	6
24	3	22	-	24	2	22	18490.438	5
24	3	21	-	24	2	23	18490.560	8
25	3	23	-	25	2	23	18489.868	-0
25	3	22	-	25	2	24	18490.012	4
26	3	23	-	26	2	25	18489.456*	15
26	3	24	-	26	2	24	18489.272	-7
27	3	25	-	27	2	25	18488.664	-3
27	3	24	-	27	2	26	18488.855	1
28	3	25	-	28	2	27	18488.248	2
28	3	26	-	28	2	26	18488.024	-7
29	3	26	-	29	2	28	18487.619	2
29	3	27	-	29	2	27	18487.367	-3
30	3	28	-	30	2	28	18486.681	-3
30	3	27	-	30	2	29	18486.968	0
31	3	29	-	31	2	29	18485.969	-6
31	3	28	-	31	2	30	18486.297	1
32	3	29	-	32	2	31	18485.600	-4
32	3	30	-	32	2	30	18485.232	-8
33	3	30	-	33	2	32	18484.885	-7
33	3	31	-	33	2	31	18484.471*	-10
34	3	32	-	34	2	32	18483.690	-7
34	3	31	-	34	2	33	18484.148*	-11
35	3	32	-	35	2	34	18483.403	-2
35	3	33	-	35	2	33	18482.882	-6
36	3	34	-	36	2	34	18482.039*	-15
36	3	33	-	36	2	35	18482.627	-4
3	3	1	-	2	2	1	18499.154	0
3	3	0	-	2	2	0	18499.154	0
4	3	2	-	3	2	2	18499.791	5
4	3	1	-	3	2	1	18499.791	5
5	3	2	-	4	2	2	18500.399	3
5	3	3	-	4	2	3	18500.399	3
6	3	3	-	5	2	3	18500.987	4
6	3	4	-	5	2	4	18500.987	4
7	3	4	-	6	2	4	18501.552	4
7	3	5	-	6	2	5	18501.552	3
8	3	5	-	7	2	5	18502.096	3
8	3	6	-	7	2	6	18502.095	2
9	3	6	-	8	2	6	18502.617	4
9	3	7	-	8	2	7	18502.617	2
10	3	7	-	9	2	7	18503.116	4
10	3	8	-	9	2	8	18503.116	2
11	3	9	-	10	2	9	18503.569	-3
11	3	8	-	10	2	8	18503.569	1
12	3	10	-	11	2	10	18504.044	-3
12	3	9	-	11	2	9	18504.044	3
13	3	11	-	12	2	11	18504.480	-1
13	3	10	-	12	2	10	18504.480	7
14	3	12	-	13	2	12	18504.891	-1
14	3	11	-	13	2	11	18504.891	9
15	3	12	-	14	2	12	18505.277	10
15	3	13	-	14	2	13	18505.277	-5
16	3	13	-	15	2	13	18505.644*	14
16	3	14	-	15	2	14	18505.644	-5
17	3	14	-	16	2	14	18505.986*	16
17	3	15	-	16	2	15	18505.986	-8
18	3	16	-	17	2	16	18506.310	-8
18	3	15	-	17	2	15	18506.310*	22
19	3	17	-	18	2	17	18506.611	-9
19	3	16	-	18	2	16	18506.591	9
20	3	17	-	19	2	17	18506.857	3
20	3	18	-	19	2	18	18506.900	-1
21	3	18	-	20	2	18	18507.103	2
21	3	19	-	20	2	19	18507.151	-7
22	3	19	-	21	2	19	18507.324	-1
22	3	20	-	21	2	20	18507.415*	20
23	3	20	-	22	2	20	18507.530	4
23	3	21	-	22	2	21	18507.617	7
24	3	21	-	23	2	21	18507.708	4
24	3	22	-	23	2	22	18507.800	-4
25	3	22	-	24	2	22	18507.864	7
25	3	23	-	24	2	23	18507.982	7
4	3	1	-	5	4	1	18350.017*	-11
5	3	2	-	6	4	2	18349.201	1
6	3	3	-	7	4	3	18348.365*	15
7	3	4	-	8	4	4	18347.486	6
8	3	5	-	9	4	5	18346.595	8
9	3	6	-	10	4	6	18345.675	2
10	3	7	-	11	4	7	18344.747*	10
11	3	8	-	12	4	8	18343.794*	14
12	3	9	-	13	4	9	18342.810	8
13	3	10	-	14	4	10	18341.805	3
14	3	11	-	15	4	11	18340.787	7
15	3	12	-	16	4	12	18339.738	1
16	3	13	-	17	4	13	18338.670	-3
5	3	3	-	5	4	1	18353.521	3
6	3	4	-	6	4	2	18353.387	-1
8	3	6	-	8	4	4	18353.068	5

J'	Ka'	Kc'		J"	Ka"	Kc"	OBS	O-C
9	3	7	-	9	4	5	18352.871	3
10	3	8	-	10	4	6	18352.653	1
11	3	9	-	11	4	7	18352.417	3
12	3	10	-	12	4	8	18352.150	-4
13	3	11	-	13	4	9	18351.872	-1
14	3	12	-	14	4	10	18351.568	-2
15	3	13	-	15	4	11	18351.240	-5
16	3	14	-	16	4	12	18350.883*	-16
17	3	15	-	17	4	13	18350.522	-10
18	3	16	-	18	4	14	18350.138	-5
19	3	17	-	19	4	15	18349.724	-8
20	3	18	-	20	4	16	18349.299	-1
21	3	19	-	21	4	17	18348.845	-1
22	3	20	-	22	4	18	18348.365	6
23	3	21	-	23	4	19	18347.872	-2
24	3	22	-	24	4	20	18347.353	3
25	3	23	-	25	4	21	18346.817	1
26	3	24	-	26	4	22	18346.259	4
27	3	25	-	27	4	23	18345.675	3
28	3	26	-	28	4	24	18345.071	3
29	3	27	-	29	4	25	18344.446	3
30	3	28	-	30	4	26	18343.794	3
31	3	29	-	31	4	27	18343.130	1
32	3	30	-	32	4	28	18342.433	-6
33	3	31	-	33	4	29	18341.726	-2
34	3	32	-	34	4	30	18340.994	-2
35	3	33	-	35	4	31	18340.239	-4
36	3	34	-	36	4	32	18339.462	-6
37	3	35	-	37	4	33	18338.670	-3
9	3	6	-	8	4	4	18359.341	3
10	3	7	-	9	4	5	18359.845	-2
12	3	9	-	11	4	7	18360.804*	17
13	3	10	-	12	4	8	18361.231	6
14	3	11	-	13	4	9	18361.636	-5
15	3	12	-	14	4	10	18362.038	3
16	3	13	-	15	4	11	18362.403	-4
17	3	14	-	16	4	12	18362.762	4
18	3	15	-	17	4	13	18363.088	2
19	3	16	-	18	4	14	18363.390	-4
20	3	17	-	19	4	15	18363.677	2
21	3	18	-	20	4	16	18363.931*	-11
22	3	19	-	21	4	17	18364.185	1
23	3	20	-	22	4	18	18364.402	-3
24	3	21	-	23	4	19	18364.603	-0
27	3	24	-	26	4	22	18365.075	7
28	3	25	-	27	4	23	18365.179	-1
30	3	27	-	29	4	25	18365.339	[illegible]
5	4	1	-	6	3	3	18525.870	5
6	4	2	-	7	3	4	18525.025*	13
7	4	3	-	8	3	5	18524.150*	13
8	4	4	-	9	3	6	18523.244	3
9	4	5	-	10	3	7	18522.328	6
10	4	6	-	11	3	8	18521.378	-3
11	4	7	-	12	3	9	18520.415	-4
12	4	8	-	13	3	10	18519.433	-1
15	4	11	-	16	3	13	18516.343	-4
16	4	12	-	17	3	14	18515.270	-4
4	4	1	-	4	3	1	18530.292	-3
5	4	2	-	5	3	2	18530.184	-0
6	4	3	-	6	3	3	18530.050	-1
7	4	4	-	7	3	4	18529.894	-2
8	4	5	-	8	3	5	18529.723	3
9	4	6	-	9	3	6	18529.521	1
10	4	7	-	10	3	7	18529.298	-1
11	4	8	-	11	3	8	18529.057	3
12	4	9	-	12	3	9	18528.790	1
13	4	10	-	13	3	10	18528.499	-2
14	4	11	-	14	3	11	18528.194	3
15	4	12	-	15	3	12	18527.861	2
16	4	13	-	16	3	13	18527.509	5
17	4	14	-	17	3	14	18527.131	3
18	4	15	-	18	3	15	18526.732	3
19	4	16	-	19	3	16	18526.311	2
20	4	17	-	20	3	17	18525.870	5
21	4	18	-	21	3	18	18525.403	2
22	4	19	-	22	3	19	18524.918	5
23	4	20	-	23	3	20	18524.409	6
24	4	21	-	24	3	21	18523.870	-1
25	4	22	-	25	3	22	18523.320	3
26	4	23	-	26	3	23	18522.748	6
27	4	24	-	27	3	24	18522.146	3
28	4	25	-	28	3	25	18521.520	-3
29	4	26	-	29	3	26	18520.876	-3
30	4	27	-	30	3	27	18520.214	-1
31	4	28	-	31	3	28	18519.522	-5
32	4	29	-	32	3	29	18518.811	-6
33	4	30	-	33	3	30	18518.081	-4
34	4	31	-	34	3	31	18517.339	8
35	4	32	-	35	3	32	18516.551	-4
36	4	33	-	36	3	33	18515.751	-5
37	4	34	-	37	3	34	18514.937	2
38	4	35	-	38	3	35	18514.085	-6
39	4	36	-	39	3	36	18513.222	-3
40	4	37	-	40	3	37	18512.336	-1
4	4	0	-	3	3	0	18533.181	6
5	4	1	-	4	3	1	18533.785	2

TABLE VII—*Continued*

J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C	J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C	J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C	J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C
6	4	2	5	3	2	18534.364	-6	13	5	9	13	4	9	18562.697	-8	19	5	14	18	6	12	18339.032	-3	22	6	16	21	7	14	18329.724*	16
7	4	3	6	3	3	18534.933	-2	14	5	10	14	4	10	18562.395	1	20	5	15	19	6	13	18339.320	1	24	6	18	23	7	16	18330.124*	-2
8	4	4	7	3	4	18535.481	3	15	5	11	15	4	11	18562.061	1	21	5	16	20	6	14	18339.583	1	25	6	19	24	7	17	18330.303*	1
9	4	5	8	3	5	18535.997	-2	16	5	12	16	4	12	18561.701	-4	22	5	17	21	6	15	18339.822	-3	26	6	20	25	7	18	18330.457*	-0
10	4	6	9	3	6	18536.499	3	17	5	13	17	4	13	18561.330	4	23	5	18	22	6	16	18340.046	2	27	6	21	26	7	19	18330.604*	14
11	4	7	10	3	7	18536.974	2	18	5	14	18	4	14	18560.926	-0	24	5	19	23	6	17	18340.245	2	13	7	6	14	6	8	18620.814*	-11
12	4	8	11	3	8	18537.426	0	19	5	15	19	4	15	18560.505	1	29	5	24	28	6	22	18340.917	9	14	7	7	15	6	9	18619.789	-3
13	4	9	12	3	9	18537.859	3	20	5	16	20	4	16	18560.062	4	6	6	1	6	5	1	18598.487*	-92	7	7	1	7	6	1	18632.301	0
14	4	10	13	3	10	18538.269	4	21	5	17	21	4	17	18559.600	8	7	6	2	7	5	2	18598.327*	-95	8	7	2	8	6	2	18632.124	3
15	4	11	14	3	11	18538.652	0	22	5	18	22	4	18	18559.107	5	8	6	3	8	5	3	18598.129*	-114	9	7	3	9	6	3	18631.926	7
16	4	12	15	3	12	18539.015	-2	23	5	19	23	4	19	18558.597	5	9	6	4	9	5	4	18597.900*	-142	10	7	4	10	6	4	18631.703	8
17	4	13	16	3	13	18539.357	-1	24	5	20	24	4	20	18558.064	7	10	6	5	10	5	5	18597.667*	-151	11	7	5	11	6	5	18631.457	10
18	4	14	17	3	14	18539.672	-6	25	5	21	25	4	21	18557.508	6	11	6	6	11	5	6	18597.417*	-156	12	7	6	12	6	6	18631.191*	13
19	4	15	18	3	15	18539.976	1	26	5	22	26	4	22	18556.929	5	12	6	7	12	5	7	18597.142*	-163	13	7	7	13	6	7	18630.898*	11
20	4	16	19	3	16	18540.250	-0	27	5	23	27	4	23	18556.330	6	14	6	9	14	5	9	18596.564*	-137	14	7	8	14	6	8	18630.587*	15
21	4	17	20	3	17	18540.507	5	28	5	24	28	4	24	18555.699	-3	15	6	10	15	5	10	18596.256*	-110	30	7	24	30	6	24	18622.494	-3
22	4	18	21	3	18	18540.732	-0	29	5	25	29	4	25	18555.060	3	16	6	11	16	5	11	18595.926*	-83	32	7	26	32	6	26	18621.084	-1
23	4	19	22	3	19	18540.939	-1	30	5	26	30	4	26	18554.395	4	17	6	12	17	5	12	18595.564*	-65	33	7	27	33	6	27	18620.342	-3
24	4	20	23	3	20	18541.120	-5	31	5	27	31	4	27	18553.699	-2	18	6	13	18	5	13	18595.184*	-43	34	7	28	34	6	28	18619.579	-5
25	4	21	24	3	21	18541.284	-4	32	5	28	32	4	28	18552.996	5	19	6	14	19	5	14	18594.768*	-34	35	7	29	35	6	29	18618.800	1
26	4	22	25	3	22	18541.420	-8	33	5	29	33	4	29	18552.258	1	20	6	15	20	5	15	18594.331*	-25	36	7	30	36	6	30	18617.990	-2
27	4	23	26	3	23	18541.548	3	5	5	0	4	4	0	18567.993	-1	6	6	0	5	5	0	18602.823*	-72	37	7	31	37	6	31	18617.163	-0
4	4	0	5	5	0	18336.990*	30	6	5	1	5	4	1	18568.579	-2	7	6	1	6	5	1	18603.373*	-84	38	7	32	38	6	32	18616.314	2
5	4	1	6	5	1	18336.133	1	7	5	2	6	4	2	18569.146	2	8	6	2	7	5	2	18603.895*	-103	39	7	33	39	6	33	18615.436	-3
6	4	2	7	5	2	18335.295*	11	8	5	3	7	4	3	18569.688	3	9	6	3	8	5	3	18604.388*	-127	40	7	34	40	6	34	18614.542	-0
7	4	3	8	5	3	18334.411	-2	9	5	4	8	4	4	18570.203	-1	10	6	4	9	5	4	18604.863*	-148	41	7	35	41	6	35	18613.626	1
8	4	4	9	5	4	18333.526	5	10	5	5	9	4	5	18570.684*	-17	11	6	5	10	5	5	18605.332*	-153	42	7	36	42	6	36	18612.691	7
9	4	5	10	5	5	18332.609	2	11	5	6	10	4	6	18571.173	-3	12	6	6	11	5	6	18605.783*	-152	43	7	37	43	6	37	18611.726	5
10	4	6	11	5	6	18331.674	1	12	5	7	11	4	7	18571.626	-2	13	6	7	12	5	7	18606.218*	-145	44	7	38	44	6	38	18610.737	1
11	4	7	12	5	7	18330.728*	12	13	5	8	12	4	8	18572.054	-3	14	6	8	13	5	8	18606.642*	-126	7	7	0	6	6	0	18637.327	-7
12	4	8	13	5	8	18329.743	5	14	5	9	13	4	9	18572.465	0	15	6	9	14	5	9	18607.050*	-102	8	7	1	7	6	1	18637.864	-9
13	4	9	14	5	9	18328.739	1	15	5	10	14	4	10	18572.849	-1	16	6	10	15	5	10	18607.442*	-70	9	7	2	8	6	2	18638.384	-5
14	4	10	15	5	10	18327.721	3	16	5	11	15	4	11	18573.210	-2	17	6	11	16	5	11	18607.800*	-50	10	7	3	9	6	3	18638.881	-2
15	4	11	16	5	11	18326.673	-2	17	5	12	16	4	12	18573.552	-0	18	6	12	17	5	12	18608.130*	-35	11	7	4	10	6	4	18639.351	-4
5	4	2	5	5	0	18340.454	6	18	5	13	17	4	13	18573.866	-4	19	6	13	18	5	13	18608.431*	-28	12	7	5	11	6	5	18639.803	-0
6	4	3	6	5	1	18340.321	2	19	5	14	18	4	14	18574.164	-1	20	6	14	19	5	14	18608.708*	-21	13	7	6	12	6	6	18640.224	-6
7	4	4	7	5	2	18340.172	5	20	5	15	19	4	15	18574.431	-7	21	6	15	20	5	15	18608.963*	-14	14	7	7	13	6	7	18640.641	7
8	4	5	8	5	3	18339.993	-1	21	5	16	20	4	16	18574.680	-8	22	6	16	21	5	16	18609.224*	22	7	7	0	8	8	0	18303.579*	-19
9	4	6	9	5	4	18339.803	4	22	5	17	21	4	17	18574.910	-6	23	6	17	22	5	17	18609.414*	8	8	7	1	9	8	1	18302.692*	-16
10	4	7	10	5	5	18339.583	-0	23	5	18	22	4	18	18575.117	-5	24	6	18	23	5	18	18609.599*	14	9	7	2	10	8	2	18301.791	-5
11	4	8	11	5	6	18339.341	-5	24	5	19	23	4	19	18575.300	-5	25	6	19	24	5	19	18609.756*	12	10	7	3	11	8	3	18300.854	-9
12	4	9	12	5	7	18339.085	-1	25	5	20	24	4	20	18575.465	-1	26	6	20	25	5	20	18609.898*	20	12	7	5	13	8	5	18298.929	-4
13	4	10	13	5	8	18338.805	0	26	5	21	25	4	21	18575.626*	23	27	6	21	26	5	21	18610.004*	13	13	7	6	14	8	6	18297.931	-4
14	4	11	14	5	9	18338.499	-3	27	5	22	26	4	22	18575.722	3	28	6	22	27	5	22	18610.095*	14	14	7	7	15	8	7	18296.922	6
15	4	12	15	5	10	18338.171	-7	28	5	23	27	4	23	18575.823*	12	6	6	0	7	7	0	18313.812*	-79	8	7	2	8	8	0	18309.165	-5
16	4	13	16	5	11	18337.835	3	29	5	24	28	4	24	18575.876	-6	8	6	2	9	7	2	18312.017*	-114	9	7	3	9	8	1	18308.973	-3
17	4	14	17	5	12	18337.461	-5	30	5	25	29	4	25	18575.944*	14	9	6	3	10	7	3	18311.086*	-133	10	7	4	10	8	2	18308.753	-8
18	4	15	18	5	13	18337.073	-4	5	5	0	6	6	0	18324.846	-4	10	6	4	11	7	4	18310.137*	-149	11	7	5	11	8	3	18308.516	-8
19	4	16	19	5	14	18336.662	-4	6	5	1	7	6	1	18324.015*	13	11	6	5	12	7	5	18309.169*	-161	12	7	6	12	8	4	18308.261	-4
20	4	17	20	5	15	18336.229	-5	7	5	2	8	6	2	18323.128	-4	12	6	6	13	7	6	18308.194*	-159	13	7	7	13	8	5	18307.978	-7
21	4	18	21	5	16	18335.775	-6	8	5	3	9	6	3	18322.237	-3	13	6	7	14	7	7	18307.206*	-149	14	7	8	14	8	6	18307.689	7
22	4	19	22	5	17	18335.295*	-11	9	5	4	10	6	4	18321.327	0	14	6	8	15	7	8	18306.209*	-126	28	7	22	28	8	20	18301.204	2
23	4	20	23	5	18	18334.806	-3	10	5	5	11	6	5	18320.392	-0	15	6	9	16	7	9	18305.184*	-110	29	7	23	29	8	21	18300.580	1
24	4	21	24	5	19	18334.290	-2	11	5	6	12	6	6	18319.451*	15	16	6	10	17	7	10	18304.148*	-84	31	7	25	31	8	23	18299.267	0
25	4	22	25	5	20	18333.750	-3	12	5	7	13	6	7	18318.464	5	17	6	11	18	7	11	18303.086*	-63	32	7	26	32	8	24	18298.584	5
26	4	23	26	5	21	18333.190	-1	13	5	8	14	6	8	18317.466	6	8	6	3	8	7	1	18318.481*	-117	33	7	27	33	8	25	18297.878	8
27	4	24	27	5	22	18332.609	-0	14	5	9	15	6	9	18316.447	7	9	6	4	9	7	2	18318.264*	-140	34	7	28	34	8	26	18297.149	9
28	4	25	28	5	23	18332.005	-1	6	5	2	6	6	0	18329.035	0	10	6	5	10	7	3	18318.040*	-148	35	7	29	35	8	27	18296.399*	11
29	4	26	29	5	24	18331.379	-2	7	5	3	7	6	1	18328.883	0	11	6	6	11	7	4	18317.782*	-158	36	7	30	36	8	28	18295.613	-2
30	4	27	30	5	25	18330.728	-7	8	5	4	8	6	2	18328.713	2	12	6	7	12	7	5	18317.531*	-160	38	7	32	38	8	30	18294.005	-0
31	4	28	31	5	26	18330.064	-3	9	5	5	9	6	3	18328.515	-1	13	6	8	13	7	6	18317.258*	-153	39	7	33	39	8	31	18293.172	4
32	4	29	32	5	27	18329.380	2	10	5	6	10	6	4	18328.300	-0	14	6	9	14	7	7	18316.974*	-135	40	7	34	40	8	32	18292.310	-0
33	4	30	33	5	28	18328.659	-9	11	5	7	11	6	5	18328.061	-1	15	6	10	15	7	8	18316.671*	-114	41	7	35	41	8	33	18291.437	6
34	4	31	34	5	29	18327.928	-8	12	5	8	12	6	6	18327.804	1	17	6	12	17	7	10	18316.014*	-59	42	7	36	42	8	34	18290.530	-0
35	4	32	35	5	30	18327.179	-4	13	5	9	13	6	7	18327.520	-2	18	6	13	18	7	11	18315.650*	-35	43	7	37	43	8	35	18289.615	6
36	4	33	36	5	31	18326.400	-10	14	5	10	14	6	8	18327.215	-5	19	6	14	19	7	12	18315.253*	-23	44	7	38	44	8	36	18288.665	-1
11	4	7	10	5	5	18347.267	10	15	5	11	15	6	9	18326.890	-6	20	6	15	20	7	13	18314.832*	-13	45	7	39	45	8	37	18287.703	1
12	4	8	11	5	6	18347.729*	13	16	5	12	16	6	10	18326.547	-3	21	6	16	21	7	14	18314.388*	-4	12	7	5	11	8	3	18316.678	-2
13	4	9	12	5	7	18348.163	9	17	5	13	17	6	11	18326.183	-1	22	6	17	22	7	15	18313.934*	16	13	7	6	12	8	4	18317.322	5
14	4	10	13	5	8	18348.574	5	18	5	14	18	6	12	18325.792	-3	23	6	18	23	7	16	18313.416*	-6	14	7	7	13	8	5	18317.734	2
15	4	11	14	5	9	18348.964	1	19	5	15	19	6	13	18325.381	-4	24	6	19	24	7	17	18312.913*	8	8	8	0	9	9	0	18293.709*	78
18	4	14	17	5	12	18350.022	6	20	5	16	20	6	14	18324.949	-4	25	6	20	25	7	18	18312.356*	-10	9	8	1	10	9	1	18292.801*	81
19	4	15	18	5	13	18350.329	7	21	5	17	21	6	15	18324.496	-4	26	6	21	26	7	19	18311.799*	-7	10	8	2	11	9	2	18291.864*	77
20	4	16	19	5	14	18350.607	-0	22	5	18	22	6	16	18324.015*	-11	27	6	22	27	7	20	18311.223*	-2	11	8	3	12	9	3	18290.916*	82
22	4	18	21	5	16	18351.116	4	23	5	19	23	6	17	18323.527	-3	28	6	23	28	7	21	18310.626*	3	12	8	4	13	9	4	18289.943*	84
23	4	19	22	5	17	18351.337	4	24	5	20	24	6	18	18323.013	1	29	6	24	29	7	22	18310.003*	5	13	8	5	14	9	5	18288.951*	88
26	4	22	25	5	20	18351.878*	15	25	5	21	25	6	19	18322.474	1	30	6	25	30	7	23	18309.359*	7	14	8	6	15	9	6	18287.936*	92
27	4	23	26	5	21	18352.000	4	26	5	22	26	6	20	18321.913	0	31	6	26	31	7	24	18308.695*	9	15	8	7	16	9	7	18286.896*	91
28	4	24	27	5	22	18352.122*	15	27	5	23	27	6	21	18321.327	-4	32	6	27	32	7	25	18308.012*	14	15	8	8	15	9	6	18298.366*	86
29	4	25	28	5	23	18352.208*	11	28	5	24	28	6	22	18320.732	4	33	6	28	33	7	26	18307.307*	19	16	8	9	16	9	7	18298.026*	91
30	4	26	29	5	24	18352.276*	12	29	5	25	29	6	23	18320.108	4	34	6	29	34	7	27	18306.577*	20	17	8	10	17	9	8	18297.662*	93
31	4	27	30	5	25	18352.330*	19	30	5	26	30	6	24	18319.451	-6	35	6	30	35	7	28	18305.820*	15	18	8	11	18	9	9	18297.277*	95
6	5	1	7	4	3	18559.230	5	31	5	27	31	6	25	18318.790	0	36	6	31	36	7	29	18305.051*	20	19	8	12	19	9	10	18296.870*	97
7	5	2	8	4	4	18558.355	5	32	5	28	32	6	26	18318.107	5	37	6	32	37	7	30	18304.284*	47	20	8	13	20	9	11	18296.435*	92
10	5	5	11	4	7	18555.596	4	34	5	30	34	6	28	18316.667	7	38	6	33	38	7	31	18303.445*	25	21	8	14	21	9	12	18295.987*	96
11	5	6	12	4	8	18554.630	3	35	5	31	35	6	29	18315.903	-5	39	6	34	39	7	32	18302.502*	18	22	8	15	22	9	13	18295.521*	103
12	5	7	13	4	9	18553.641	-1	9	5	4	8	6	2	18334.989	2	12	6	6	11	7	4	18326.161*	-151	23	8	16	23	9	14	18295.024*	100
13	5	8	14	4	10	18552.634	0	10	5	5	9	6	3	18335.486	-3	13	6	7	12	7	5	18326.598*	-152	24	8	17	24	9	15	18294.509*	102
5	5	1	5	4	1	18564.392	-4	11	5	6	10	6	4	18335.972	2	14	6	8	13	7	6	18327.038*	-127	25	8	18	25	9	16	18293.976*	106
6	5	2	6	4	2	18564.261	-1	12	5	7	11	6	5	18336.435	6	15	6	9	14	7	7	18327.460*	-99	26	8	19	26	9	17	18293.416*	105
7	5	3	7	4	3	18564.104	-2	13	5	8	12	6	6	18336.870	4	16	6	10	15	7	8	18327.841*	-91	27	8	20	27	9	18	18292.835*	105
8	5	4	8	4	4	18563.929	1	14	5	9	13	6	7	18337.289	7	17	6	11	16	7	9	18328.225*	-56	28	8	21	28	9	19	18292.229*	101
9	5	5	9	4	5	18563.724	-4	15	5	10	14	6	8	18337.676	0	18	6	12	17	7	10	18328.566*	-45	29	8	22	29	9	20	18291.629*	124
10	5	6	10	4	6	18563.504	-1	16	5	11	15	6	9	18338.047	-1	19	6	13	18	7	11	18328.888*	-29	30	8	23	30	9	21	18290.984*	123
11	5	7	11	4	7	18563.261	0	17	5	12	16	6	10	18338.397	-2	20	6	14	19	7	12	18329.182*	-20	31	8	24	31	9	22	18290.330*	135
12	5	8	12	4	8	18562.991	-4	18	5	13	17	6	11	18338.727	-0	21	6	15	20	7	13	18329.449*	-17	32	8	25	32	9	23	18289.651*	143

TABLE VII—*Continued*

J'	Ka'	Kc'	J"	Ka"	Kc"	OBS	O-C
33	8	26	33	9	24	18288.951*	152
34	8	27	34	9	25	18288.233*	164
35	8	28	35	9	26	18287.494*	177
36	8	29	36	9	27	18286.736*	191
37	8	30	37	9	28	18285.959*	208
38	8	31	38	9	29	18285.161*	225
39	8	32	39	9	30	18284.351*	251
40	8	33	40	9	31	18283.525*	283
41	8	34	41	9	32	18282.685*	322
42	8	35	42	9	33	18281.828*	365
12	8	4	11	9	2	18307.884*	91
13	8	5	12	9	3	18308.317*	67
14	8	6	13	9	4	18308.733*	88
15	8	7	14	9	5	18309.128*	90
16	8	8	15	9	6	18309.499*	89
17	8	9	16	9	7	18309.856*	98
18	8	10	17	9	8	18310.180*	92
19	8	11	18	9	9	18310.491*	96
20	8	12	19	9	10	18310.780*	100
21	8	13	20	9	11	18311.034*	90
22	8	14	21	9	12	18311.281*	96
23	8	15	22	9	13	18311.509*	104
24	8	16	23	9	14	18311.716*	113
25	8	17	24	9	15	18311.897*	117
26	8	18	25	9	16	18312.047*	113
27	8	19	26	9	17	18312.193*	126
9	9	0	10	10	0	18283.714	-2
10	9	1	11	10	1	18282.783	-1
11	9	2	12	10	2	18281.834	3
12	9	3	13	10	3	18280.854	-3
13	9	4	14	10	4	18279.860	-1
14	9	5	15	10	5	18278.843	-2
15	9	6	16	10	6	18277.809	3
16	9	7	17	10	7	18276.745	-2
17	9	8	18	10	8	18275.667	2
10	9	2	10	10	0	18290.672	2
11	9	3	11	10	1	18290.431	-2
12	9	4	12	10	2	18290.172	-3
13	9	5	13	10	3	18289.887	-6
14	9	6	14	10	4	18289.596	2
15	9	7	15	10	5	18289.271	-1
16	9	8	16	10	6	18288.929	2
17	9	9	17	10	7	18288.560	-1
18	9	10	18	10	8	18288.173	-1
19	9	11	19	10	9	18287.765	0
20	9	12	20	10	10	18287.333	-1
21	9	13	21	10	11	18286.879	-4
22	9	14	22	10	12	18286.406	-4
23	9	15	23	10	13	18285.913	-2
24	9	16	24	10	14	18285.397	-2
25	9	17	25	10	15	18284.857	-3
26	9	18	26	10	16	18284.297	-4
27	9	19	27	10	17	18283.714	-6
28	9	20	28	10	18	18283.114	-4
29	9	21	29	10	19	18282.491	-4
30	9	22	30	10	20	18281.834*	-15
31	9	23	31	10	21	18281.164	1
32	9	24	32	10	22	18280.481	-3
33	9	25	33	10	23	18279.782	-3
34	9	26	34	10	24	18279.051	-2
35	9	27	35	10	25	18278.296	-4
36	9	28	36	10	26	18277.526	-0
37	9	29	37	10	27	18276.745*	15
38	9	30	38	10	28	18275.912	-1
18	9	7	15	10	5	18300.393	1
17	9	8	16	10	6	18300.747	6
18	9	9	17	10	7	18301.079	9
19	9	10	18	10	8	18301.380	4
20	9	11	19	10	9	18301.667	7
21	9	12	20	10	10	18301.930	7
22	9	13	21	10	11	18302.172	8
23	9	14	22	10	12	18302.391	8
24	9	15	23	10	13	18302.582*	11
25	9	16	24	10	14	18302.757	1
26	9	17	25	10	15	18302.913	3
27	9	18	26	10	16	18303.042	0
28	9	19	27	10	17	18303.156	4
10	10	0	11	11	0	18273.537	-7
11	10	1	12	11	1	18272.586	-6
12	10	2	13	11	2	18271.616	-1
13	10	3	14	11	3	18270.626	4
14	10	4	15	11	4	18269.608	2
15	10	5	16	11	5	18268.575	7
17	10	7	18	11	7	18266.449*	21
11	10	2	11	11	0	18281.187	2
12	10	3	12	11	1	18280.933	6
13	10	4	13	11	2	18280.646	-1
14	10	5	14	11	3	18280.345	-1
15	10	6	15	11	4	18280.025	2
18	10	7	16	11	5	18279.674	-4
17	10	8	17	11	6	18279.323*	11
18	10	9	18	11	7	18278.930	5
19	10	10	19	11	8	18278.519	3
20	10	11	20	11	9	18278.088	4
21	10	12	21	11	10	18277.635	3
22	10	13	22	11	11	18277.161	3
23	10	14	23	11	12	18276.663	-0
24	10	15	24	11	13	18276.148	1
25	10	16	25	11	14	18275.608	-0
26	10	17	26	11	15	18275.047	-1
27	10	18	27	11	16	18274.464	-2
28	10	19	28	11	17	18273.858	-5
29	10	20	29	11	18	18273.232	-7
31	10	22	31	11	20	18271.916	-5
32	10	23	32	11	21	18271.234	0
33	10	24	33	11	22	18270.527	4
34	10	25	34	11	23	18269.794	4
35	10	26	35	11	24	18269.043	8
36	10	27	36	11	25	18268.267	8
13	10	3	12	11	2	18290.363	-7
15	10	5	14	11	3	18290.763	1
16	10	6	15	11	4	18291.130	-2
17	10	7	16	11	5	18291.494*	12
19	10	9	18	11	7	18292.116	2
20	10	10	19	11	8	18292.401	4
21	10	11	20	11	9	18292.655	-4
22	10	12	21	11	10	18292.892	-7
23	10	13	22	11	11	18293.120	3
24	10	14	23	11	12	18293.314	1
25	10	15	24	11	13	18293.476*	-11
26	10	16	25	11	14	18293.626*	-14
27	10	17	26	11	15	18293.767	-3
28	10	18	27	11	16	18293.874	-4
29	10	19	28	11	17	18293.958	-7
29	10	20	29	11	18	18294.029	-0
11	11	0	12	12	0	18263.013*	-19
12	11	1	13	12	1	18262.055	-3
13	11	2	14	12	2	18261.082	-0
14	11	3	15	12	3	18260.048	2
15	11	4	16	12	4	18259.012	4
16	11	5	17	12	5	18257.956	8
17	11	6	18	12	6	18256.876	9
12	11	1	13	12	1	18271.080	3
14	11	3	15	12	3	18270.778	3
15	11	4	16	12	4	18270.455	4
16	11	5	17	12	5	18270.107	1
17	11	6	18	12	6	18269.738	0
18	11	7	19	12	7	18269.348	-1
19	11	8	20	12	8	18268.939	0
20	11	9	21	12	9	18268.502	-4
21	11	10	22	12	10	18267.573	-5
22	11	11	23	12	11	18267.053*	-28
24	11	13	25	12	13	18266.025	3
25	11	14	26	12	14	18265.459	-1
26	11	15	27	12	15	18264.874	-2
27	11	16	28	12	16	18264.266	-5
28	11	17	29	12	17	18263.640	-4
29	11	18	30	12	18	18263.013*	17
30	11	19	31	12	19	18262.319	-5
31	11	20	32	12	20	18261.628	-5
32	11	21	33	12	21	18260.914	-4
33	11	22	34	12	22	18260.184	1
34	11	23	35	12	23	18259.424	-2
35	11	24	36	12	24	18258.645	-2
36	11	25	37	12	25	18257.846	-0
37	11	26	38	12	26	18257.021	-2
14	11	3	13	12	1	18280.797	8
16	11	5	15	12	3	18281.545	-3
17	11	6	16	12	4	18281.900	5
18	11	7	17	12	5	18282.226	7
19	11	8	18	12	6	18282.520	-3
20	11	9	19	12	7	18282.796	-8
21	11	10	20	12	8	18283.057	-7
22	11	11	21	12	9	18283.299	-2
12	12	0	13	13	0	18252.079*	-19
13	12	1	14	13	1	18251.089*	-12
15	12	3	16	13	3	18249.030*	-13
16	12	4	17	13	4	18247.975	-7
17	12	5	18	13	5	18246.904	5
18	12	6	19	13	6	18245.799	6
19	12	7	20	13	7	18244.674	7
20	12	8	21	13	8	18243.530*	11
21	12	9	22	13	9	18261.090*	-14
14	12	3	14	13	1	18260.791	-8
15	12	4	15	13	2	18260.484	-9
16	12	5	16	13	3	18260.116	-9
17	12	6	17	13	4	18256.747	-6
18	12	7	18	13	5	18259.355	-8
19	12	8	19	13	6	18256.946	-3
20	12	9	20	13	7	18258.511	-2
21	12	10	21	13	8	18258.052	-4
22	12	11	22	13	9	18257.578	2
23	12	12	23	13	10	18257.083	8
24	12	13	24	13	11	18256.561	9
25	12	14	25	13	12	18256.015	8
26	12	15	26	13	13	18255.446	6
27	12	16	27	13	14	18254.859	8
28	12	17	28	13	15	18254.234	-6
29	12	18	29	13	16	18253.612	5
30	12	19	30	13	17	18252.958	5
31	12	20	31	13	18	18252.280	4
32	12	21	32	13	19	18251.577	0
33	12	22	33	13	20	18250.857	1
34	12	24	35	13	22	18249.347	-0
36	12	25	36	13	23	18248.563	2
37	12	26	37	13	24	18247.753	2
39	12	28	39	13	26	18246.064	2
40	12	29	40	13	27	18245.185	-5
41	12	30	41	13	28	18244.291	-1
42	12	31	42	13	29	18243.355*	-17
16	12	4	15	13	2	18271.553	-2
17	12	5	16	13	3	18271.886*	-12
18	12	6	17	13	4	18272.207*	-12
19	12	7	18	13	5	18272.517	-1
20	12	8	19	13	6	18272.800	5
21	12	9	20	13	7	18273.042	-7
22	12	10	21	13	8	18273.260	-2

EXPERIMENTAL DETAILS

In the course of this work, it was noted that the hollow cathode sputtering source produced relatively noisy spectra, and so we investigated alternate sources of copper atoms. Ultimately, the best source proved to be a conventional Broida oven (5) equipped with a graphite crucible for the high temperatures necessary to melt copper. The copper vapor was then entrained in a flow of argon which entered at the top of the crucible, and this flow was channeled into the oxidant region through a graphite funnel. It was found that hydrogen peroxide produced far more CuOH than water, and so all spectra were recorded using H_2O_2 or D_2O_2 as the oxidant.

The laser used in this study was a single-frequency Coherent 699-29 ring dye laser operating with Rhodamine 110 dye and pumped by a Coherent Innova 20 argon ion laser. The laser beam was aligned vertically in the flame, and the laser-induced fluorescence at right angles to the beam was focused onto the entrance slit of a 0.64-m monochromator. The dispersed fluorescence was then detected with an RCA C31034 photomultiplier tube, processed by photon counting electronics, and recorded as a function of frequency using the Coherent Autoscan system.

The technique of laser excitation spectroscopy with filtered fluorescence detection was used to analyze the green system of CuOH and CuOD. Spectra were taken by

TABLE VIII

Observed Line Positions (cm^{-1}) for $^{65}CuOD$

J'	Ka'	Kc'		J"	Ka"	Kc"	OBS	O-C
16	0	16	-	17	1	16	18394.289	4
17	0	17	-	18	1	17	18393.105	3
19	0	19	-	20	1	19	18390.653	-0
20	0	20	-	21	1	20	18389.389	-0
22	0	22	-	23	1	22	18386.773	-4
26	0	26	-	27	1	26	18381.229	3
30	0	30	-	31	1	30	18375.237	-3
39	0	39	-	40	1	39	18360.170	2
42	0	42	-	43	1	42	18354.655	3
10	0	10	-	9	1	8	18415.953	0
13	0	13	-	12	1	11	18417.138	8
15	0	15	-	14	1	13	18417.792*	15
16	0	16	-	15	1	14	18418.088	9
13	1	12	-	14	0	14	18424.611	-1
14	1	13	-	15	0	15	18423.864	2
16	1	15	-	17	0	17	18421.719	6
18	1	17	-	19	0	19	18419.707	5
29	1	29	-	29	0	29	18424.992*	-11
30	1	30	-	30	0	30	18424.244	-7
31	1	31	-	31	0	31	18423.479	3
33	1	33	-	33	0	33	18421.862	3
34	1	34	-	34	0	34	18421.023	6
35	1	35	-	35	0	35	18420.158	4
41	1	41	-	41	0	41	18414.534	3
44	1	44	-	44	0	44	18411.442	-3
45	1	45	-	45	0	45	18410.381	3
46	1	46	-	46	0	46	18409.290	-2
8	1	7	-	7	0	7	18441.268	-9
10	1	9	-	9	0	9	18442.375	-8
12	1	11	-	11	0	11	18443.407*	-13
13	1	12	-	12	0	12	18443.910	-4
14	1	13	-	13	0	13	18444.393	2
15	1	14	-	14	0	14	18444.845	-6
16	1	15	-	15	0	15	18445.281*	-13
17	1	16	-	16	0	16	18445.710*	-12
19	1	18	-	18	0	18	18446.518	-8
20	1	19	-	19	0	19	18446.907	4
21	1	20	-	20	0	20	18447.265	-0
22	1	21	-	21	0	21	18447.613	2
23	1	22	-	22	0	22	18447.933	-8
24	1	23	-	23	0	23	18448.244*	-11
25	1	24	-	24	0	24	18448.549	-4
26	1	25	-	25	0	25	18448.830	-6
29	1	28	-	28	0	28	18449.605*	12
30	1	29	-	29	0	29	18449.816	-0
32	1	31	-	31	0	31	18450.222	5
13	1	13	-	14	2	13	18375.610	0
16	1	16	-	17	2	16	18372.293	-3
17	1	16	-	18	2	16	18372.484	-7
18	1	17	-	19	2	17	18371.461	-2
18	1	18	-	19	2	18	18369.958	0
20	1	19	-	21	2	19	18369.348	-5
29	1	29	-	29	2	27	18376.423	-7
30	1	30	-	30	2	28	18375.610	-8
32	1	32	-	32	2	30	18373.907	1
33	1	33	-	33	2	31	18373.005	-2
34	1	34	-	34	2	32	18372.082	4
42	1	41	-	42	2	41	18372.659	-8
44	1	43	-	44	2	43	18371.198	4
46	1	45	-	46	2	45	18369.657	4
12	1	12	-	11	2	10	18394.529	-9
13	1	13	-	12	2	11	18394.902*	-12
15	1	15	-	14	2	13	18395.585	0
16	1	16	-	15	2	14	18395.884	2
16	1	15	-	15	2	13	18397.100	2
17	1	17	-	16	2	15	18396.165*	12
18	1	17	-	17	2	15	18397.913	-6
18	1	18	-	17	2	16	18396.401	5
19	1	18	-	18	2	16	18398.308	7
19	1	19	-	18	2	17	18396.628*	13
21	1	20	-	20	2	18	18399.016	6
22	1	21	-	21	2	19	18399.339	3
23	1	22	-	22	2	20	18399.647	5
24	1	23	-	23	2	21	18399.938	8
25	1	24	-	24	2	22	18400.204	5
26	1	25	-	25	2	23	18400.446	-2
27	1	26	-	26	2	24	18400.679	2
6	2	4	-	5	1	4	18469.119	-3
7	2	5	-	6	1	5	18469.656	4
8	2	6	-	7	1	6	18470.152	-1
9	2	7	-	8	1	7	18470.627	-1
11	2	9	-	10	1	9	18471.491	-5
12	2	10	-	11	1	10	18471.892	3
14	2	12	-	13	1	12	18472.589	-4
15	2	13	-	14	1	13	18472.911	6
17	2	16	-	16	1	16	18474.953*	-11
18	2	17	-	17	1	17	18475.386	3
19	2	18	-	18	1	18	18475.792	6
20	2	19	-	19	1	19	18476.164	-7
21	2	20	-	20	1	20	18476.496*	-45

J'	Ka'	Kc'		J"	Ka"	Kc"	OBS	O-C
22	2	21	-	21	1	21	18476.888	-8
23	2	22	-	22	1	22	18477.231	-2
24	2	23	-	23	1	23	18477.553	-3
25	2	24	-	24	1	24	18477.859	-3
26	2	25	-	25	1	25	18478.158	7
27	2	26	-	26	1	26	18478.448*	23
28	2	27	-	27	1	27	18478.683	-0
29	2	28	-	28	1	28	18478.928	4
30	2	29	-	29	1	29	18479.154	4
31	2	30	-	30	1	30	18479.381*	21
6	2	4	-	5	3	2	18373.174	-4
7	2	5	-	6	3	3	18373.736	-7
8	2	6	-	7	3	4	18374.263	-2
9	2	7	-	8	3	5	18374.794*	-13
10	2	8	-	9	3	6	18375.307	-0
11	2	9	-	10	3	7	18375.788	2
12	2	10	-	11	3	8	18376.241	-1
14	2	12	-	13	3	10	18377.091	-1
15	2	13	-	14	3	11	18377.478	-7
12	3	9	-	13	2	11	18486.114*	20
13	3	10	-	14	2	12	18485.099	6
14	3	11	-	15	2	13	18484.071	2
15	3	12	-	16	2	14	18483.036*	13
29	3	27	-	29	2	27	18487.416	-3
30	3	28	-	30	2	28	18486.735	-4
31	3	28	-	31	2	30	18486.348	-5
32	3	29	-	32	2	31	18485.662	-4
32	3	30	-	32	2	30	18485.302	-4
33	3	30	-	33	2	32	18484.951	-8
34	3	32	-	34	2	32	18483.776	1
34	3	31	-	34	2	33	18484.218*	-12
35	3	32	-	35	2	34	18483.479	-3
36	3	33	-	36	2	35	18482.711	-3
36	3	34	-	36	2	34	18482.141	-3
7	3	4	-	6	2	4	18501.510*	12
9	3	6	-	8	2	6	18502.563	8
10	3	7	-	9	2	7	18503.056	5
11	3	8	-	10	2	8	18503.527	3
12	3	9	-	11	2	9	18503.984	10
13	3	10	-	12	2	10	18504.410	7
14	3	11	-	13	2	11	18504.814	5
15	3	12	-	14	2	12	18505.207*	14
16	3	13	-	15	2	13	18505.564*	11
18	3	15	-	17	2	15	18506.227*	20
14	3	11	-	13	4	9	18361.551	3
15	3	12	-	14	4	10	18361.941	2
16	3	13	-	15	4	11	18362.311	2
17	3	14	-	16	4	12	18362.655	-3
19	3	16	-	18	4	14	18363.290	1
20	3	17	-	19	4	15	18363.575	3
22	3	19	-	21	4	17	18364.076	1
23	3	20	-	22	4	18	18364.293	0
11	4	7	-	12	3	9	18520.462	-4
15	4	11	-	16	3	13	18516.420	-3
16	4	12	-	17	3	14	18515.351	-7
17	4	13	-	18	3	15	18514.268	-4
18	4	14	-	19	3	16	18513.161	-0
28	4	25	-	28	3	25	18521.558	-9
29	4	26	-	29	3	26	18520.918*	-11
30	4	27	-	30	3	27	18520.273	5
31	4	28	-	31	3	28	18519.583	-3
32	4	29	-	32	3	29	18518.879	-2
33	4	30	-	33	3	30	18518.154	-1
35	4	32	-	35	3	32	18516.637	1
36	4	33	-	36	3	33	18515.840	-2
39	4	36	-	39	3	36	18513.328	-3
40	4	37	-	40	3	37	18512.452	3
10	4	6	-	9	3	6	18536.436	-3
11	4	7	-	10	3	7	18536.913	2
12	4	8	-	11	3	8	18537.361	-1
13	4	9	-	12	3	9	18537.793	3
14	4	10	-	13	3	10	18538.198	2
15	4	11	-	14	3	11	18538.590	9
16	4	12	-	15	3	12	18538.948	5
17	4	13	-	16	3	13	18539.284	2
11	4	7	-	10	5	5	18347.173*	11
12	4	8	-	11	5	6	18347.624	5
13	4	9	-	12	5	7	18348.069*	16
14	4	10	-	13	5	8	18348.462	-4
17	4	13	-	16	5	11	18349.584	8
18	4	14	-	17	5	12	18349.910	8
21	4	17	-	20	5	15	18350.757	5
11	5	6	-	12	4	8	18554.671	-7
13	5	8	-	14	4	10	18552.697	-2
28	5	24	-	28	4	24	18555.745	-3
29	5	25	-	29	4	25	18555.112	3
30	5	26	-	30	4	26	18554.452	5
31	5	27	-	31	4	27	18553.764	1
32	5	28	-	32	4	28	18553.061	4
33	5	29	-	33	4	29	18552.334	4

J'	Ka'	Kc'		J"	Ka"	Kc"	OBS	O-C
8	5	3	-	7	4	3	18569.644	7
9	5	4	-	8	4	4	18570.157	4
11	5	6	-	10	4	6	18571.114	-4
12	5	7	-	11	4	7	18571.566	-1
14	5	9	-	13	4	9	18572.399	1
15	5	10	-	14	4	10	18572.779	-1
17	5	12	-	16	4	12	18573.478	0
18	5	13	-	17	4	13	18573.788	-5
19	5	14	-	18	4	14	18574.085	-2
6	5	2	-	6	6	0	18328.996	-1
7	5	3	-	7	6	1	18328.838	1
9	5	5	-	9	6	3	18328.469	-3
10	5	6	-	10	6	4	18328.258	-0
13	5	9	-	13	6	7	18327.480	-6
14	5	10	-	14	6	8	18327.190	5
11	5	6	-	10	6	4	18335.872	-5
12	5	7	-	11	6	5	18336.327	-7
13	5	8	-	12	6	6	18336.762	-6
14	5	9	-	13	6	7	18337.172	-8
15	5	10	-	14	6	8	18337.574	2
16	5	11	-	15	6	9	18337.930*	-11
17	5	12	-	16	6	10	18338.284	-5
18	5	13	-	17	6	11	18338.616	0
19	5	14	-	18	6	12	18338.921	0
20	5	15	-	19	6	13	18339.201	-3
21	5	16	-	20	6	14	18339.464	-1
6	6	1	-	6	5	1	18598.592	5
7	6	2	-	7	5	2	18598.439	8
8	6	3	-	8	5	3	18598.252	-1
9	6	4	-	9	5	4	18598.049	-5
10	6	5	-	10	5	5	18597.829	-3
11	6	6	-	11	5	6	18597.583	-5
12	6	7	-	12	5	7	18597.313	-9
13	6	8	-	13	5	8	18597.023	-9
14	6	9	-	14	5	9	18596.715	-6
15	6	10	-	15	5	10	18596.394	5
16	6	11	-	16	5	11	18596.032	-1
17	6	12	-	17	5	12	18595.658	2
18	6	13	-	18	5	13	18595.264	7
19	6	14	-	19	5	14	18594.846*	11
6	6	0	-	5	5	0	18602.893*	18
7	6	1	-	6	5	1	18603.444*	10
8	6	2	-	7	5	2	18603.976	5
9	6	3	-	8	5	3	18604.486	1
10	6	4	-	9	5	4	18604.979	1
11	6	5	-	10	5	5	18605.449	2
12	6	6	-	11	5	6	18605.896	2
14	6	8	-	13	5	8	18606.724	2
15	6	9	-	14	5	9	18607.100	-2
7	6	1	-	8	7	1	18313.023	3
8	6	2	-	9	7	2	18312.139	4
10	6	4	-	11	7	4	18310.302	1
12	6	6	-	13	7	6	18308.381	-1
13	6	7	-	14	7	7	18307.391	1
14	6	8	-	15	7	8	18306.381	4
15	6	9	-	16	7	9	18305.345	2
17	6	11	-	18	7	11	18303.219	7
18	6	12	-	19	7	12	18302.120	6
8	6	3	-	8	7	1	18318.557	-2
9	6	4	-	9	7	2	18318.367	1
10	6	5	-	10	7	3	18318.147	-5
11	6	6	-	11	7	4	18317.914	-2
12	6	7	-	12	7	5	18317.661	2
14	6	9	-	14	7	7	18317.082	3
15	6	10	-	15	7	8	18316.762	4
13	7	6	-	14	6	8	18620.880	-9
14	7	7	-	15	6	9	18619.862	-2
17	7	10	-	18	6	12	18616.662	6
19	7	12	-	20	6	14	18614.406	-1
20	7	13	-	21	6	15	18613.250	1
21	7	14	-	22	6	16	18612.067	-3
33	7	27	-	33	6	27	18620.419	1
34	7	28	-	34	6	28	18619.663	1
35	7	29	-	35	6	29	18618.888	4
36	7	30	-	36	6	30	18618.095*	11
37	7	31	-	37	6	31	18617.269	6
38	7	32	-	38	6	32	18616.421	3
39	7	33	-	39	6	33	18615.555	2
40	7	34	-	40	6	34	18614.668	3
41	7	35	-	41	6	35	18613.757	2
42	7	36	-	42	6	36	18612.821	-3
43	7	37	-	43	6	37	18611.884*	14
44	7	38	-	44	6	38	18610.891	-4
9	7	2	-	8	6	2	18638.337	-2
10	7	3	-	9	6	3	18638.831	1
11	7	4	-	10	6	4	18639.296	-2
12	7	5	-	11	6	5	18639.744	0
13	7	6	-	12	6	6	18640.165	-2
14	7	7	-	13	6	7	18640.567	-1
7	7	0	-	8	8	0	18303.579*	11

J'	Ka'	Kc'		J"	Ka"	Kc"	OBS	O-C
8	7	1	-	9	8	1	18302.692	7
9	7	2	-	10	8	2	18301.791*	12
10	7	3	-	11	8	3	18300.854	3
17	7	10	-	18	8	10	18293.773	5
18	7	11	-	19	8	11	18292.673	2
19	7	12	-	20	8	12	18291.556	3
20	7	13	-	21	8	13	18290.412	-3
21	7	14	-	22	8	14	18289.254	-2
22	7	15	-	23	8	15	18288.073	-2
11	7	5	-	11	8	3	18308.461	-0
12	7	6	-	12	8	4	18308.198	-7
13	7	7	-	13	8	5	18307.921	-5
14	7	8	-	14	8	6	18307.626	-0
39	7	33	-	39	8	31	18293.207	-6
40	7	34	-	40	8	32	18292.362	1
42	7	36	-	42	8	34	18290.590	-6
44	7	38	-	44	8	36	18288.752	5
45	7	39	-	45	8	37	18287.790	-2
12	7	5	-	11	8	3	18316.757	-6
13	7	6	-	12	8	4	18317.194	-3
14	7	7	-	13	8	5	18317.601	-8
15	7	8	-	14	8	6	18317.997	-3
16	7	9	-	15	8	7	18318.370	0
18	7	11	-	17	8	9	18319.048	5
19	7	12	-	18	8	10	18319.352	5
20	7	13	-	19	8	11	18319.635	4
21	7	14	-	20	8	12	18319.894	3
10	8	3	-	10	9	1	18299.692*	114
11	8	4	-	11	9	2	18299.458*	115
12	8	5	-	12	9	3	18299.211*	125
13	8	6	-	13	9	4	18298.931*	123
15	8	8	-	15	9	6	18298.319*	131
16	8	9	-	16	9	7	18297.970*	125
17	8	10	-	17	9	8	18297.614*	133
18	8	11	-	18	9	9	18297.231*	134
15	8	7	-	14	9	5	18309.001*	127
16	8	8	-	15	9	6	18309.363*	120
17	8	9	-	16	9	7	18309.720*	129
18	8	10	-	17	9	8	18310.041*	124
19	8	11	-	18	9	9	18310.350*	128
20	8	12	-	19	9	10	18310.635*	130
21	8	13	-	20	9	11	18310.905*	140
22	8	14	-	21	9	12	18311.138*	134
23	8	15	-	22	9	13	18311.361*	138
12	9	4	-	12	10	2	18290.101	-2
13	9	5	-	13	10	3	18289.825	-0
14	9	6	-	14	10	4	18289.525	-0
15	9	7	-	15	10	5	18289.200	-5
16	9	8	-	16	10	6	18288.858	-5
17	9	9	-	17	10	7	18288.502	3
18	9	10	-	18	10	8	18288.118	4
19	9	11	-	19	10	9	18287.713	4
16	9	7	-	15	10	5	18300.256	5
17	9	8	-	16	10	6	18300.597	-2
18	9	9	-	17	10	7	18300.921	-3
19	9	10	-	18	10	8	18301.228	-0
20	9	11	-	19	10	9	18301.514	3
11	10	2	-	11	11	0	18281.111	3
14	10	5	-	14	11	3	18280.279	5
15	10	6	-	15	11	4	18279.958	5
16	10	7	-	16	11	5	18279.616	6
17	10	8	-	17	11	6	18279.251	4
18	10	9	-	18	11	7	18278.862	0
19	10	10	-	19	11	8	18278.461	6
20	10	11	-	20	11	9	18278.029	1
21	10	12	-	21	11	10	18277.587	9
14	10	4	-	13	11	2	18290.237	5
15	10	5	-	14	11	3	18290.623	2
16	10	6	-	15	11	4	18290.990	1
17	10	7	-	16	11	5	18291.325	-10
18	10	8	-	17	11	6	18291.644*	-15
19	10	9	-	18	11	7	18291.955	-8
20	10	10	-	19	11	8	18292.236	-8
21	10	11	-	20	11	9	18292.500	-4
22	10	12	-	21	11	10	18292.734	-8
23	10	13	-	22	11	11	18292.949	-10
14	11	4	-	14	12	2	18270.698	-2
15	11	5	-	15	12	3	18270.377	-1
16	11	6	-	16	12	4	18270.035	1
17	11	7	-	17	12	5	18269.669	-0
18	11	8	-	18	12	6	18269.284	0
19	11	9	-	19	12	7	18268.876	1
20	11	10	-	20	12	8	18268.445	-2
21	11	11	-	21	12	9	18268.005	9
15	11	4	-	14	12	2	18281.049*	13
16	11	5	-	15	12	3	18281.396	-5
17	12	6	-	17	13	4	18259.668	-5
18	12	7	-	18	13	5	18259.284	0
20	12	9	-	20	13	7	18258.442	1
21	12	10	-	21	13	8	18257.990	2

O–C Units of 10^{-3} cm^{-1}.

* Line not included in the fit.

Line used to form ground state combination differences.

TABLE IX

r_s Structure for CuOH

		$\tilde{X}\ ^1A'$	$\tilde{B}\ ^1A''$
r_{Cu-O}	(Å)	1.76893(25)	1.78414(46)
r_{O-H}	(Å)	0.9520(50)	0.9508(27)
$\angle CuOH$	(°)	110.245(80)	117.670(98)

setting the monochromator on a feature resonant with the transitions excited by the laser, opening the monochromator slits to ~2 Å, and scanning the laser. In this way it was possible to record only the branches resonant with the feature covered by the monochromator bandpass. The frequency scale was calibrated by simultaneously recording the I_2 spectrum with each scan, and comparing these frequencies with the published line list after applying the 0.0056 cm^{-1} correction (*6*, *7*).

RESULTS AND DISCUSSION

The $\tilde{B}^1A''$–$\tilde{X}^1A'$ transition is a *c*-type electronic transition, and hence has rotational structure akin to a perpendicular band of a prolate symmetric top. The strongest features in the low-resolution spectra of both CuOH and CuOD are a series of ${}^{p,r}R_{K_a}$ subband heads and ${}^{p,r}Q_{K_a}$ subband origins converging to the red (*2*). These features were convenient for recording the spectra—low-J scans were accomplished by scanning the laser through the ${}^{p,r}PQR_{K_a}$ branches with the monochromator set on the connecting ${}^{r,p}Q_{K_a\mp2}$ origins, while high-J scans were made with the monochromator on the connecting ${}^{r,p}R_{K_a\mp2}$ heads. A total of 3724 lines for the four isotopic species ^{63}CuOH, ^{65}CuOH, ^{63}CuOD, and ^{65}CuOD have been assigned and measured.

The J assignment for the unperturbed ${}^{p,r}PR_{K_a}$ subbands was straightforward—lines were fit to a polynomial in m ($m = -J''$ for the P branch and $m = J'' + 1$ for the R branch), whose origin was adjusted until it coincided with the observed Q-branch origin. For these unperturbed subbands, the corresponding Q-branch assignment was also usually unequivocally established by fitting the lines to a polynomial and requiring the origin to coincide with the fitted origin of the PR branches. These unperturbed assigned transitions were then fit to a model which described the energies of both ground and upper electronic states with a Watson A reduced Hamiltonian in the I^r-representation (*8*). From this initial fit, it was then possible to predict and assign the remaining unperturbed Q branches, and include these lines in a further global fit. The perturbed subbands were assigned by using ground state combination differences predicted from the latest global fit, and then all possible ground state combination differences were calculated from this data and used in the next fit. This procedure iterated until all measured lines had been assigned for a particular isotopomer. The effective rotational constants of the final fits (one standard deviation in parentheses) are given in Tables I–IV for ^{63}CuOH, ^{65}CuOH, ^{63}CuOD, and ^{65}CuOD; the corresponding transitions and deviations from the fit are given in Tables V–VIII.

A partial r_s structure has also been determined for both electronic states from these rotational constants. For this determination, Kraitchman's equations (*9*, *10*) for single isotopic substitutions were used to locate the copper and hydrogen nuclei relative to

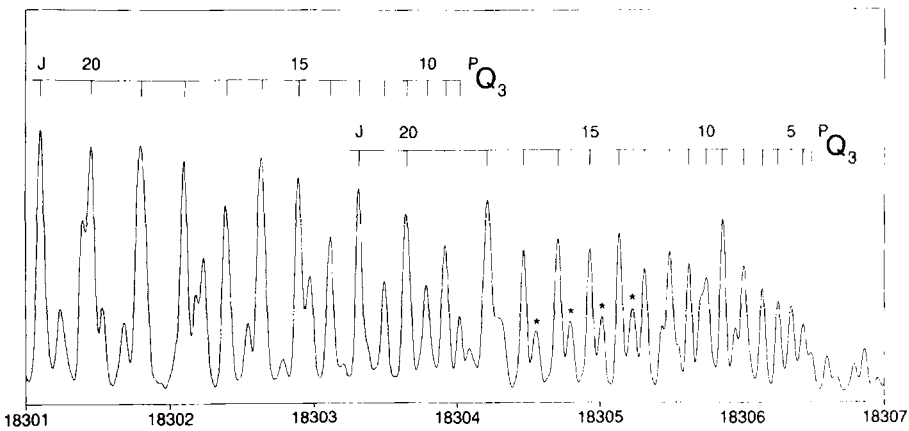

FIG. 1. A portion of the high-resolution spectrum of CuOH around the $^PQ_3$ subband origin. A strong local perturbation affects the upper $K_a = 2$ stack, and transitions to both interacting levels are seen. Lines marked with an asterisk (*) are assigned to ^{65}CuOH.

the center of mass of the "parent." It was necessary to impose one extra constraint to determine the coordinates of the oxygen nucleus (for which no isotopic data were measured). This could come either from the definition of the center of mass, or from the moment of inertia equation. However, the small b coordinate for the copper nucleus was badly determined, and so we chose to use the moment of inertia equation (which depends on the square of b_{Cu}—a very small number) to determine the position of the oxygen nucleus. This gave more consistent results than when the definition of the center of mass was used as the constraint. Each of the isotopomers were taken in turn as the "parent," and the average value for each molecular parameter is presented together with one standard deviation from this averaging procedure in Table IX.

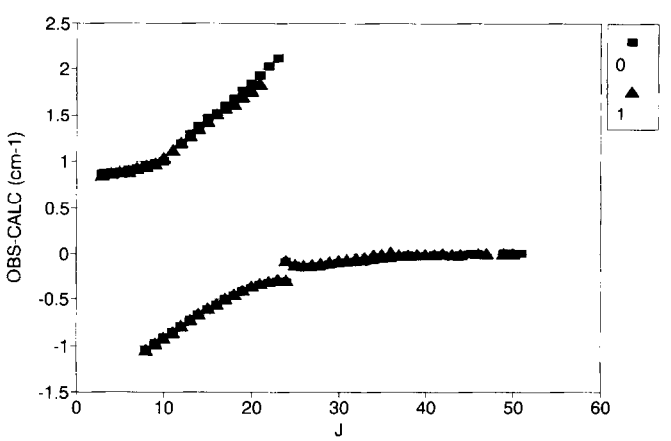

FIG. 2. A plot of deviation from the fit against J for the upper $K_a = 2$ stack in CuOH showing two perturbations. The lower asymmetry component (for which $K_a + K_c - J = 1$) are marked with triangles (△) while the upper asymmetry components (for which $K_a + K_c - J = 0$) are marked with squares (□).

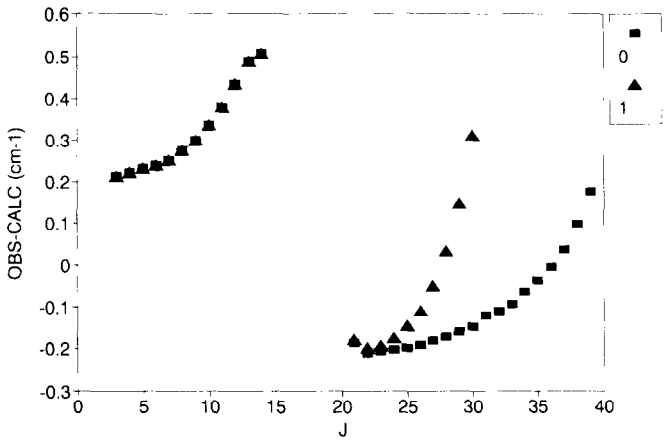

FIG. 3. A plot of deviation from the fit against J for the upper $K_a = 3$ stack in CuOH showing two perturbations. The lower asymmetry component (for which $K_a + K_c - J = 1$) are marked with triangles (△) while the upper asymmetry components (for which $K_a + K_c - J = 0$) are marked with squares (□).

Our results can be compared directly with those of Trkula and Harris (*2*), and most values for the rotational constants A, B, and C lie within 3 times their quoted errors. The slight differences are not surprising because we have included additional distortion terms in our fits, the effects of which were absorbed by the rotational constants in their fits. We have determined the A constants better by two orders of magnitude, and the B and C constants better by one order of magnitude. The improvement in the determination of the rotational constants is reflected in the improvement in the precision (but not necessarily the accuracy) of our structure determination (Table IX).

A surprising result of our reanalysis of the green system of CuOH was the number and magnitude of perturbations affecting the upper electronic state. These perturbations

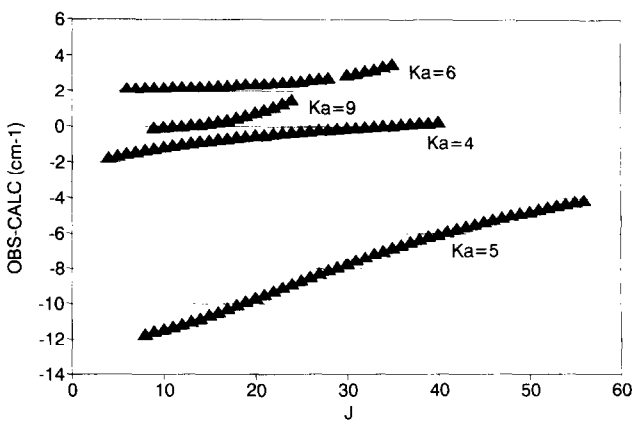

FIG. 4. A plot of deviation from the fit against J for the upper state of ^{63}CuOH showing the global perturbation affecting the $K_a = 4$–6 and $K_a = 9$ stacks.

were most evident in the spectrum of CuOH (for both Cu isotopes), and Fig. 1 clearly demonstrates the effect of a large local perturbation for $K_a = 2$ in the upper state. The portion of the spectrum displayed in Fig. 1 shows many extra lines near the ${}^{P}Q_3$ subband origin. This perturbation is also displayed in Fig. 2 which plots the average deviation for all observed transitions ending on this K_a stack against J. The different asymmetry components are depicted by squares for those levels where $\gamma = K_a + K_c - J = 0$ (upper asymmetry component) and triangles for those where $\gamma = 1$ (lower asymmetry component). As this plot shows, there is another small local perturbation centered on $J = 24$. Figure 3 presents a similar plot for $K_a = 3$, and clearly shows that there are also two perturbations affecting this stack—one centered on $J = 17$, and another which splits the asymmetry components after $J = 23$ which must be caused by a $K_a = 1$ stack.

The final perturbation plot for CuOH is given in Fig. 4, and this shows the global perturbations affecting some higher K_a stacks. The effect on $K_a = 4$–6 can be explained by an interaction with a higher-lying perturbing state which has a smaller A constant so that it lies just above the energy of the $\tilde{B}^1A''$ state for $K_a = 5$.

In contrast, the spectrum of CuOD revealed no large perturbations; the only observed perturbations were small ones for $K_a = 6$ and $K_a = 8$, shown in Fig. 5. Clearly there is a vibronic state associated with a lower-lying electronic state very close in energy to the $\tilde{B}^1A''$ state in CuOH but further away in CuOD. This perturbing state is likely to contain at least one quantum in either the O–H stretch or the Cu–O–H bend in order to show such a marked difference in its effect on the spectra of CuOH and CuOD. We hesitate to make any definite assignments, but note that one of the newly discovered red systems (a triplet state) has an origin around 15 100 cm^{-1}. One quantum in an O–H stretch would put this perturbing vibronic state just above the $\tilde{B}^1A''$ state—precisely the condition required to explain the large perturbations affecting $K_a = 4$–6 in CuOH.

Throughout this paper, we have labeled the upper electronic state as $\tilde{B}^1A''$ based on new evidence from the low-resolution spectra we have recorded. In the course of

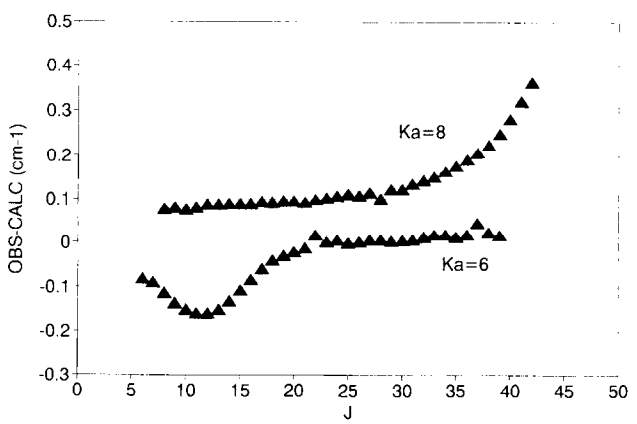

FIG. 5. A plot of deviation from the fit against J for the upper $K_a = 6$ and $K_a = 8$ stacks of CuOD showing two perturbations.

measuring the green system, we scanned the monochromator with the laser on an $^rQ_5$ line, and observed some structure further to the blue. This prompted us to take a low-resolution laser excitation spectrum of this region which revealed a series of sharp features spaced by $\sim 2A$, and one sharp feature midway between two of these at 19 040 cm^{-1}. Such rotational subband structure is consistent with an assignment to an *ab* hybrid band of an asymmetric top, and so we assign the band to the $\tilde{C}^1A'$–$\tilde{X}^1A'$ electronic transition. The $\tilde{C}$ state lies close in energy to the $\tilde{B}$ state, and we therefore correlate these states with the in-plane and out-of-plane components of the corresponding $C^1\Pi$ state of CuF at 20 259 cm^{-1} (*11, 12*). We assign the $\tilde{A}^1A'$–$\tilde{X}^1A'$ transition to a new band seen in laser-induced fluorescence spectra centered at 628 nm with a parallel rotational contour. Work is in progress in analyzing this transition at high resolution.

Some ab initio calculations on CuOH would be most helpful in interpreting the electronic structure and in correlating the observed states to those of the isoelectronic CuF molecule.

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