STUDY ON THEORY AND APPLICABILITY OF LASER TECHNIQUES FOR MEASURING ATMOSPHERIC PARAMETERS

APPENDIX 1

OF

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APPENDIX I

COMPILATION OF KNOWN FRANCK-CONDON FACTORS AND r-CENTROIDS

The following table lists a compilation* of sources of $q_{v'v''}$ and $\bar{r}_{v'v''}$ matrices. This is PRELIMINARY and will be revised for the final report under Contract No. NAS12-540 in early 1968. Readers are requested to report any errors or omissions, suggestions to improve utility, and particularly any new references or unpublished but retrievable new results.

In the tables, we list references to the original arrays for approximately 50 diatomic molecules and in some cases additionally theit ions or isotopic modifications, and some 165 separate band systems. The matrix size (extent in maximum v' and v'' covered) is given, whether it is based on the Morse or RKR (more realistic, tabular) potential assumption, and if the known calculation included an equivalent r-centroid array. The $q_{v'v''}$ and/or $\bar{r}_{v'v''}$ may not be published but are listed if they are retrievable.

We have refrained from judgements as to the best array, although we intend this later. In general, the largest $q_{v'v''}$ matrix size, especially if accompanied by a $\bar{r}_{v'v''}$ matrix, is a indication that modern large computers have been used and also is fairly recent and so probably is a best choice. This is particularly true if an RKR potential well was used. An important exception, based on our experience, is Reference F-5 for NO(γ); Reference W-7 is recommended instead.

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* By T. Wentink, Jr. and E. D. Schultz.

The 96 references pertaining to this Appendix and following Table 1 have been typed by an IBM printer directly from IBM cards. This approach was chosen to facilitate present and future editing, and subsequent printings of an anticipated expanded reference list.

KEY TO TABLE 1

a: Includes some modification of potential such as Morse-Pekeris.

b: Rydberg-Klein-Rees or alternative experimentally determined potential.

c: Matrix size given means maximum valve of v′ and v″; e.g., 4 x 9 covers v′ = 0 through 4 and v″ = 0 through 9. In many publications, the arrays are not complete, and often $\sum_{v''} q_{v'v''}$ or $\sum_{v'} q_{v'v''}$ are less than unity. 0 x 0 means only v′ = 0, v″ = 0 data given.

d: ( ) indicates unpublished data but usually available on request.

e: [ ] indicates reference for potentials used in calculation of RKR arrays.

f: N-11 quoted as unpublished in Reference N-10.

g: Data of Reference S-8 for D-A of MgO are applicable to a good approximation to C-A since the vibrational constants of C and D are so similar.

h: $q_{v'v''}$ not given explicitly.

TABLE 1

SOURCES OF FRANCK-CONDON FACTORS AND r-CENTROIDS FOR DIATOMIC MOLECULES

Molecule	System Name	Transition		Morse Potential[a]			RKR Potential[b]		
		Upper State	Lower State	$q_{v'v''}$ (Note c,d)	$r_{v'v''}$ (Note c,d)	Reference	$q_{v'v''}$ (Note c,d)	$r_{v'v''}$ (Note c,d)	Reference (Note e)
AlO	Green	$A\ ^2\Sigma^+$	$X\ ^2\Sigma^+$	7 x 7		N-1	9 x 9	9 x 9	S-6 [S-6]
B_2		$A\ ^3\Sigma_u^-$	$X\ ^3\Sigma_g^-$	0 x 0		H-1			
				2 x 3		N-2			
BH		$B\ ^1\Sigma^+$	$A\ ^1\Pi$	0 x 0		H-1			
				2 x 2		N-2			
BCl		$A\ ^1\Pi$	$X\ ^1\Sigma$	4 x 8	(4 x 8)	W-5			
BBr		$A\ ^1\Pi$	$X\ ^1\Sigma$	(3 x 5)	(3 x 5)	S-4			
BF		$A\ ^1\Pi$	$X\ ^1\Sigma$	4 x 9	(4 x 9)	W-5			
		$b\ ^3\Sigma^+$	$a\ ^3\Pi$	3 x 3	3 x 3	P-1			
BN	Violet	$A\ ^3\Pi$	$X\ ^3\Pi$	0 x 0		H-1			
				3 x 4		N-2			
				(?)		(N-11) N-10[f]			
BO	Alpha	$A\ ^2\Pi_i$	$X\ ^2\Sigma^+$	0 x 0		H-1			
				8 x 8		N-2			
				5 x 5		N-3			
				(4 x 10)	(4 x 10)	S-4			
	Beta	$B\ ^2\Sigma^+$	$X\ ^2\Sigma^+$	0 x 0		H-1			
				4 x 8		N-2			
				(4 x 15)	(4 x 15)	S-4			
	(Combination)	$B\ ^2\Sigma^+$	$A\ ^2\Pi_i$	0 x 0		H-1			
				5 x 5		N-2			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
BaO		A $^1\Sigma$	X $^1\Sigma$	14 x 13		0-5			
				6 x 6		0-7			
				(?)	(?)	(N-11) N-10			
				(10 x 5)	(10 x 5)	S-4			
BeO		A $^1\Pi$	X $^1\Sigma^+$	(?)	(?)	(N-11) N-10			
	Blue-green	B $^1\Sigma^+$	X $^1\Sigma^+$	4 x 4	4 x 4	D-1			
				4 x 4		N-3			
				4 x 4		0-7			
	(Combination Band)	B $^1\Sigma^+$	A $^1\Pi$	(?)	(?)	(N-11) N-10			
C_2	Swan	A $^3\Pi_g$	X' $^3\Pi_u$	7 x 7		F-1	8 x 15	(8 x 15)	W-4 [S-2]
				3 x 6		H-1			
				14 x 14		H-2			
				4 x 5		N-2			
				13 x 13		N-13			
				4 x 4	4 x 4	N-21			
				5 x 9		O-1			
				9 x 13	(9 x 13)	S-1	9 x 13	(9 x 13)	S-1 [S-2, J-1]
				5 x 8	5 x 8	J-1	5 x 8	5 x 8	J-1 [S-2, R-2]
	Ballik-Ramsay	A' $^3\Sigma_g^-$	X' $^3\Pi_u$	6 x 6		H-1			
				4 x 13		N-13			
	Fox-Herzberg	B $^3\Pi_g$	X' $^3\Pi_u$	10 x 8		H-1	2 x 16	(2 x 16)	W-5 [R-1]

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note c)
C_2	Fox-Herzberg (continued)	$B\ ^3\Pi_g$	$X'\ ^3\Pi_u$	8 x 8		N-2			
				4 x 13		N-13			
				4 x 8	4 x 8	J-1	4 x 8	4 x 8	J-1 J-13, R-2
	Phillips	$b\ ^1\Pi_u$	$x\ ^1\Sigma_g^+$	8 x 6		H-1	(10 x 10)	(10 x 10)	S-3
				6 x 10		N-2			
				8 x 5		N-13			
				12 x 9		O-1			
				9 x 10		S-1	9 x 10		S-1 [S-1]
	Deslandres-d'Azambuja	$c\ ^1\Pi_g$	$b\ ^1\Pi_u$	5 x 6		H-1	3 x 11		W-5 [R-1]
				6 x 5		N-2			
				6 x 8		N-13			
	Mulliken	$d\ ^1\Sigma_u^+$	$x\ ^1\Sigma_g^+$	4 x 4		H-1	(?)	(?)	S-3 [R-1]
				8 x 8		N-2			
				5 x 5		N-13			
	Freymark	$e\ ^1\Sigma_g^+$	$b\ ^1\Pi_u$	6 x 6		H-1	3 x 13		W-S [R-1]
				5 x 8		N-13			
CH and CD	4300Å	$A\ ^2\Delta$	$X\ ^2\Pi$	6 x 7		C-1			
				2 x 2		H-1			
				2 x 3	2 x 4	P-1			
	3900Å	$B\ ^2\Sigma^-$	$X\ ^2\Pi$	6 x 7		C-1			
				3 x 2		H-1			
	3143Å	$C\ ^2\Sigma^+$	$X\ ^2\Pi$	0 x 4		H-1			
				(3 x 5)	(3 x 5)	S-4			
CH^+		$A\ ^1\Pi$	$X\ ^1\Sigma^+$	2 x 2		N-3, N-11			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note c)
CF		$A\ ^2\Sigma^+$	$X\ ^2\Pi$	2 x 13	(2 x 13)	W-3			
		$B\ ^2\Sigma^+$	$X\ ^2\Pi$	2 x 7	(2 x 7)	W-3			
$C\ell_2$		$A\ ^3\Pi$	$X\ ^1\Sigma_g^+$	0 x 0		H-1			
CN	Red	$A\ ^2\Pi_i$	$X\ ^2\Sigma^+$	6 x 6		N-1			
				8 x 5		H-1			
				9 x 8		N-2			
				19 x 18		N-4			
				15 x 18		S-1	18 x 18	(?)	S-1 [F-6]
				8 x 8		W-1			
					10 x 13	W-5			
	Violet	$B\ ^2\Sigma^+$	$X\ ^2\Sigma^+$	3 x 3		F-1			
				2 x 2		F-2			
				8 x 6		H-1			
						J-2			
				3 x 3		N-2			
				19 x 18		N-4			
				3 x 3	3 x 3	N-21			
				15 x 18		S-1	18 x 18	(?)	S-1 [F-6]
CO	Fourth Positive	$A\ ^1\Pi$	$X\ ^1\Sigma^+$	10 x 8		H-1			
				7 x 7	7 x 7	J-3			
				18 x 24		N-5			
				13 x 7		O-1			
				(17 x 24)	(17 x 24)	S-3	(17 x 24)	(17 x 24)	S-3 [ ]
	Hopfield-Birge	$B\ ^1\Sigma^+$	$X\ ^1\Sigma^+$						
	Angstrom	$B\ ^1\Sigma^+$	$A\ ^1\Pi$	1 x 6		N-3			
				11 x 13		O-1			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potnetial[b]: $q_{v'v''}$ (Note c,d)	RKR Potnetial[b]: $r_{v'v''}$ (Note c,d)	RKR Potnetial[b]: Reference (Note e)
CO (con'd)	Hopfield-Birge	$C\ ^1\Sigma^+$	$X\ ^1\Sigma^+$						
	Herzberg	$B\ ^1\Sigma^+$	$A\ ^1\Pi$						
	Cameron	$a\ ^3\Pi$	$X\ ^1\Sigma^+$	9 x 6 6 x 6 7 x 24		H-1 J-7 N-5			
	Hopfield-Birge-a	$a'\ ^3\Sigma^+$	$X\ ^1\Sigma^+$	8 x 8 10 x 24 (?)		H-1 N-5 (N-11) N-10			
	Asundi	$a'\ ^3\Sigma^+$	$a\ ^3\Pi$	10 x 8 12 x 2		H-1 J-7	9 x 10	9 x 10	W-5 [ ]
	Third-Positive	$b\ ^3\Sigma^+$	$a\ ^3\Pi$	1 x 7 10 x 13		N-3 O-1			
	Hopfield-Birge-b	$b\ ^3\Sigma^+$	$X\ ^1\Sigma^+$	1 x 24		N-5			
	Triplet	$d\ ^3\Delta$	$a\ ^3\Pi$	10 x 15	10 x 15	W-5			
CO^+	Comet-tail	$A\ ^2\Pi_i$	$X\ ^2\Sigma^+$	8 x 8 8 x 7 10 x 13	 10 x 13	H-1 J-7 N-6			
	First-Negative	$B\ ^2\Sigma^+$	$X\ ^2\Sigma^+$	6 x 6 10 x 13 10 x 13	 10 x 13	H-1 N-5 N-6			
	Baldet-Johnson	$B\ ^2\Sigma^+$	$A\ ^2\Pi_i$	6 x 6 10 x 10	 10 x 10	H-1 N-6			
$CO^+ \rightarrow CO$		$X\ ^2\Sigma$	$X\ ^1\Sigma^+$	(?) 10 x 0		(N-11) N-10 W-2			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
$CO^+ \rightarrow CO$ (Con'd)		A $^2\Pi$	X $^1\Sigma^+$	10 x 10		W-2			
		B $^2\Sigma^+$	X $^1\Sigma^+$	10 x 10		W-2			
CP	(like CN-red)	A $^2\Pi_i$	X $^2\Sigma^+$	5 x 5	5 x 5	S-4			
	(like CN-violet)	B $^2\Sigma^+$	X $^2\Sigma^+$	5 x 10	5 x 10	S-4			
		B $^2\Sigma^+$	A $^2\Pi_i$	5 x 5	5 x 5	S-4			
CS		A $^1\Pi$	X $^1\Sigma^+$	8 x 8	8 x 8	F-7			
CaH	6946Å	A $^2\Pi$	X $^2\Sigma$	3 x 3		O-7			
		B ?	X $^2\Sigma$	3 x 4	3 x 4	P-5			
CaO	Second-Infrared	? $^1\Sigma$	(X) $^1\Sigma$	6 x 6 11 x 9		O-7 O-5			
CrO		A ?	X ?	6 x 6	6 x 6	M-1			
CsH		A $^1\Sigma^+$	X $^1\Sigma^+$	0 x 0		H-1			
D_2 (see H_2)									
GaI		(?)A $^3\Pi_o$	X $^1\Sigma^+$	(?)		(N-11) N-10			
H_2	Lyman	B $^1\Sigma_u^+$	X $^1\Sigma_g^+$	10 x 8 14 x 14 13 x 14		H-1 H-2 N-17	36 x 14 20 x 0	0 x 0 20 x 0	S-7 [S-7] G-2 [N-23]
HD				10 x 8		H-1			
HT				10 x 8		H-1			
D_2				10 x 8 14 x 14		H-1 H-2			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
H_2		$B'\,^1\Sigma_u^+$	$X\,^1\Sigma_g^+$	10 x 7		H-1	9 x 14	0 x 0	S-7[S-7]
HD				10 x 7		H-1			
D_2				10 x 7		H-1			
H_2	Werner	$C\,^1\Pi_u$	$X\,^1\Sigma_g^+$	10 x 6		H-1	14 x 14 12 x 0	0 x 0 12 x 0	S-7[S-7] G-2[N-23]
HD				10 x 6		H-1			
HT				10 x 6		H-1			
D_2				10 x 6		H-1			
H_2		$D\,^1\Pi_u$	$X\,^1\Sigma_g^+$	10 x 5		H-1	15 x 14	0 x 0	S-7 [S-7]
HD				10 x 5		H-1			
D_2				10 x 5		H-1			
H_2		$E\,^1\Sigma_u^+$	$B\,^1\Sigma_u^+$				9 x 36	0 x 0	S-7 [S-7]
		$G\,^1\Sigma_g^+(1)$	$B\,^1\Sigma_u^+$				13 x 36	0 x 0	S-7 [S-7]
		$G\,^1\Sigma_g^+(2)$	$B\,^1\Sigma_u^+$				20 x 36	0 x 0	S-7 [S-7]
		$I\,^1\Pi_g$	$B\,^1\Sigma_u^+$				14 x 36	0 x 0	S-7 [S-7]
		$d\,^3\Pi_u$	$a\,^3\Sigma_g^+$				17 x 18	0 x 0	S-7 [S-7]
		$h\,^3\Sigma_g^+$	$c\,^3\Pi_u$				18 x 20	0 x 0	S-7 [S-7]
		$k\,^3\Pi_u$	$a\,^3\Sigma_g^+$				19 x 18	0 x 0	S-7 [S-7]

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
$H_2^+ \rightarrow H_2$		$X\ ^2\Sigma_g^+$	$X\ ^1\Sigma_g^+$	(?)		N-11			
I_2		$B\ ^3\Pi_{ou}^+$	$X\ ^1\Sigma_g^+$	Graphs		N-18			
KH (and KD)		$A\ ^1\Sigma^+$	$X\ ^1\Sigma^+$	0 x 0		H-1			
Li_2		$A\ ^1\Sigma_u^+$	$X\ ^1\Sigma_g^+$	0 x 0		H-1			
LiH (and LiD)		$A\ ^1\Sigma^+$	$X\ ^1\Sigma^+$	0 x 0		H-1			
LaO	Red	$A\ ^2\Pi$	$X\ ^2\Sigma$	7 x 7		0-5			
		$B\ ^2\Sigma$	$X\ ^2\Sigma$	8 x 8		0-5			
MgH		$A\ ^2\Pi_i$	$X\ ^2\Sigma^+$	2 x 2		H-1			
				(?)		(N-11) N-10			
		$C\ ^2\Pi$	$A\ ^2\Pi$ or $X\ ^2\Sigma^+$	4 x 4		0-7			
				(?)		(N-11) N-10			
MgO		$B\ ^1\Sigma$	$X\ ^1\Sigma^+$	7 x 7		N-1			
				8 x 8		0-5			
				3 x 3		0-6,0-7			
		$B\ ^1\Sigma$	$A\ ^1\Pi$	(2 x 5)	(2 x 5)	S-4			
				7 x 7		N-1			
		$A\ ^1\Pi$	$X\ ^1\Sigma^+$	(3 x 5)	(3 x 5)	S-4			
				(4 x 5)	(4 x 5)	S-4			
		$D\ ^1\Delta$	$A\ ^1\Pi$	3 x 4	3 x 4	S-8			
		$C\ ^1\Sigma$	$A\ ^1\Pi$	(3 x 4)	(3 x 4)	Note g			

TABLE 1 (Continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
N_2	Vegard-Kaplan	$A\ ^3\Sigma_u^+$	$X\ ^1\Sigma_g^+$	14 x 14		H-2	13 x 20		B-1 [B-2]
				9 x 20		J-4	9 x 20		Z-1 [Z-1]
				16 x 27		N-5			
				16 x 27		N-7			
					2 x 14	N-22			
		$B\ ^3\Pi_g$	$X\ ^1\Sigma_g^+$				17 x 20		B-1 [B-2]
	Ogawa-Tanaka-Wilkinson	$B'\ ^3\Sigma_u^-$	$X\ ^1\Sigma_g^+$				18 x 20		B-1 [B-2]
	IR-Afterglow	$B'\ ^3\Sigma_u^-$	$B\ ^3\Pi_g$				18 x 17		B-3 [B-2]
	Tanaka	$C\ ^3\Pi_u$	$X\ ^1\Sigma_g^+$				4 x 20		B-1 [B-2]
							4 x 15		Z-1 [Z-1]
	First-Positive	$B\ ^3\Pi_g$	$A\ ^3\Sigma_u^+$	6 x 6		F-4,J-4	17 x 13		B-3 [B-2]
				4 x 6	5 x 5	F-8		2 x 4	J-8 [F-1]
				14 x 14		H-2			
				12 x 12		J-5			
					5 x 5	J-10			
				21 x 16		N-7			
				20 x 20	20 x 20	W-6	20 x 20	20 x 20	W-6 [Z-1]
				1 x 10	12 x 12	T-1	12 x 9		Z-1 [Z-1]
	Second-Positive	$C\ ^3\Pi_u$	$B\ ^3\Pi_g$	4 x 17		B-3	4 x 17		B-3 [B-2]
				4 x 6		F-4, J-4	4 x 12		Z-1 [Z-1]
				4 x 12		J-5			
				4 x 21		N-7			
	Fourth-Positive	$D\ ^3\Sigma_u^+$	$B\ ^3\Pi_g$	Obsolete		W-6			
				0 x 10	(0 x10)	W-7			
	Gaydon Green	(?)	(?)	4 x 5		N-14			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
N_2 (con'd)	Lyman-Birge-Hopfield	a $^1\Pi_g$	X $^1\Sigma_g^+$	7 x 7 16 x 27	6 x 6	J-7 N-5, N-7 N-22	15 x 20 (6 x 21) 6 x 20	(6 x 21)	B-1[B-2] S-4[B-2] Z-1[Z-1]
	Birge-Hopfield #2	b $^1\Pi_u$	X $^1\Sigma_g^+$	5 x 27		N-5, (N-11)			
	Birge-Hopfield #1	b' $^1\Sigma_u^+$	X $^1\Sigma_g^+$	(15 x 22) 15 x 20	(15 x 22)	W-4, S-3 W-6			
	-----	w $^1\Delta_u$	X $^1\Sigma_g^+$				6 x 20		B-1 [B-2]
	Ogawa-Tanaka (or Wilkinson-Mulliken)	w $^1\Delta_u$	a $^1\Pi_g$				6 x 15		B-3 [B-2]
	------	a $^1\Pi_g$	a' $^1\Sigma_u^-$				5 x 19		B-3 [B-2]
	------	a' $^1\Sigma_u^-$	X $^1\Sigma_g^+$				19 x 20		B-1 [B-2]
N_2^+	Meinel	A $^2\Pi_u$	X $^2\Sigma_g^+$	6 x 6 5 x 21 5 x 5	5 x 5	F-1 N-7 N-20			
	First-Negative	B $^2\Sigma_u^+$	X $^2\Sigma_g^+$	6 x 17 6 x 6 29 x 21 20 x 20	20 x 20	C-1 J-4 N-7 W-6			
	Second-Negative	C $^2\Sigma_u^+$	X $^2\Sigma_g^+$	10 x 21		N-5			
	Janin-d' Incan	D $^2\Pi_g$	A $^2\Pi_u$	11 x 5 11 x 9	11 x 9	N-5 N-8			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
$N_2^+ \rightarrow N_2$		$X\ ^2\Sigma_g^+$	$X\ ^1\Sigma_g^+$	21 x 27		N-5			
				21 x 0		N-7			
		$A\ ^2\Pi_u$	$X\ ^1\Sigma_g^+$	5 x 27		N-5			
				5 x 0		N-7			
		$B\ ^2\Sigma_u^+$	$X\ ^1\Sigma_g^+$	29 x 27		N-5			
				29 x 0		N-7			
		$C\ ^2\Sigma_u^+$	$X\ ^1\Sigma_g^+$	10 x 27		N-5			
		$D\ ^2\Pi_g$	$X\ ^1\Sigma_g^+$	11 x 27		N-5			
NO	Gamma	$A\ ^2\Sigma$	$X\ ^2\Pi$	2 x 2		F-5	12 x 36		F-5 [V-1]
				6 x 6		J-4	0 x 10		W-7 [V-1]
				8 x 10	8 x 10	K-1	2 x 10	(2 x 10)	W-7 [V-2]
				7 x 18		N-1			
				15 x 23		N-12			
				11 x 13		0-1			
				12 x 20		0-2			
	Beta	$B\ ^2\Pi$	$X\ ^2\Pi$	2 x 12		J-7	12 x 33		F-5 [V-1]
				10 x 9		K-1			
				6 x 18		N-1			
				2 x 13		N-3			
				19 x 23		N-12			
				15 x 15		0-1			
				31 x 23		0-2			
	(Beta prime)	$B'\ ^2\Delta$	$X\ ^2\Pi$	6 x 23		N-12			
	Delta	$C\ ^2\Pi$	$X\ ^2\Pi$	4 x 23		N-12			
				6 x 6		0-3			
	Epsilon	$D\ ^2\Sigma^+$	$X\ ^2\Pi$	11 x 23		N-12			
				6 x 6		0-3			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
NO(cont'd)	Feast 1	D $^2\Sigma^+$	A $^2\Sigma^+$	11 x 15		N-12			
	Gamma (prime)	E $^2\Sigma^+$	X $^2\Pi$	5 x 23		N-12			
	Feast 2	E $^2\Sigma^+$	A $^2\Sigma^+$	5 x 15		N-12			
	Ogawa 1	B' $^2\Delta$	B $^2\Pi$	6 x 19		N-12			
	M	a $^4\Pi$	X $^2\Pi$	3 x 23		N-12			
	Ogawa 2	b $^4\Sigma^-$	a $^4\Pi$	6 x 7 3 x 3		C-1 N-12			
NO^+		A $^1\Pi$	X $^1\Sigma^+$	(?) 5 x 17 (20 x 20)	 (20 x 20)	(N-11) N-10 W-7 (S-4)			
$NO^+ \rightarrow NO$		X $^1\Sigma^+$	X $^2\Pi$	10 x $0^{h?}$		W-2, (N-10)			
		A $^1\Pi$	X $^2\Pi$	10 x $0^{h?}$		W-2, (N-10)			
NaH		A $^1\Sigma^+$	X $^1\Sigma^+$	0 x 0		H-1			
O_2	IR Atmospheric	a $^1\Delta_g$	X $^3\Sigma_g^-$	2 x 2 5 x 6		N-3 N-15			
	Atmospheric	b $^1\Sigma_g^+$	X $^3\Sigma_g^-$	6 x 6 3 x 6		F-1 N-15			
	Noxon	b $^1\Sigma_g^+$	a $^1\Delta_g$	3 x 5		N-15			
	Herzberg I	A $^3\Sigma_u^+$	X $^3\Sigma_g^-$	10 x 9 12 x 12		J-7 N-15	11 x 2		J-9 [J-9]
	Herzberg II	c $^1\Sigma_u^-$	X $^3\Sigma_g^-$	6 x 6		N-15			
	Herzberg III	D $^3\Delta_u$	X $^3\Sigma_g^-$	6 x 6		N-15			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential [a]: $q_{v'v''}$ (Note c,d)	Morse Potential [a]: $r_{v'v''}$ (Note c,d)	Morse Potential [a]: Reference	RKR Potential [b]: $q_{v'v''}$ (Note c d)	RKR Potential [b]: $r_{v'v''}$ (Note c,d)	RKR Potential [b]: Reference (Note e)
O_2 (Con'd)	Schumann-Runge	B $^3\Sigma_u^-$	X $^3\Sigma_g^-$	25 x 15		F-1			
				14 x 14		H-2			
				fragments		J-6	fragments		J-6 [J-11, 12, R-2]
				15 x 2		J-7			
				15 x 21		N-2			
				21 x 21		N-5			
				21 x 21		N-9			
				15 x 0	15 x 0	N-21			
				21 x 25		O-4			
	Chamberlain (Airglow)	D $^3\Delta_u$	a $^1\Delta_g$	6 x 5		N-15			
	Broida-Gaydon	A $^3\Sigma_u^+$	b $^1\Sigma_g^+$	12 x 3		N-15			
O_2^+	Second Negative	A $^2\Pi_u$	X $^2\Pi_g$	9 x 9		J-4			
				8 x 8		N-3			
				15 x 15		N-19			
					12 x 12	N-22			
				20 x 20	20 x 20	W-6			
	First Negative	b $^4\Sigma_g^-$	a $^4\Pi_u$	7 x 7		J-7			
				10 x 10		N-19			
				20 x 20	20 x 20	W-6			
$O_2^+ \rightarrow O_2$		X $^2\Pi_g$	X $^3\Sigma_g^-$	10 x 0		W-2			
				(?)		N-11			
		A $^2\Pi_u$	X $^3\Sigma_g^-$	20 x 0		W-2			
				(?)		N-11			
		b $^4\Sigma_g^-$	X $^3\Sigma_g^-$	10 x 0		W-2			
				(?)		N-11			
		a $^4\Pi_u$	X $^3\Sigma_g^-$	15 x 0		W-2			
				(?)		N-11			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
OH	Violet	$A\ ^2\Sigma^+$	$X\ ^2\Pi_i$	10 x 12	10 x 12	F-8			
				4 x 3		H-1			
				7 x 7		J-7			
				4 x 4		L-1			
				4 x 4		N-2			
				4 x 4		N-16			
				3 x 3	3 x 3	N-21			
		$B\ ^2\Sigma^+$	$X\ ^2\Pi_i$	1 x 12	1 x 12	F-8			
		$B\ ^2\Sigma^+$	$A\ ^2\Sigma^+$	1 x 10	1 x 10	F-8			
		$C\ ^2\Sigma^+$	$X\ ^2\Pi_i$	3 x 12	3 x 12	F-8			
		$C\ ^2\Sigma^+$	$A\ ^2\Sigma^+$	3 x 10	3 x 10	F-8			
PH									
PbO		A	$X\ ^1\Sigma^+$	0 x 0		H-1			
				5 x 8		N-2			
		D	$X\ ^1\Sigma^+$	0 x 0		H-1			
				4 x 6		N-2			
RbH		$A\ ^1\Sigma^+$	$X\ ^1\Sigma^+$	0 x 0		H-1	11 x 5	(11 x 5)	J-14[J-14]
				(5 x 10)-h		G-1			
S_2		$B\ ^3\Sigma_u^-$	$X\ ^3\Sigma_g^-$	12 x 12	12 x 5	H-3			
SH		$A\ ^2\Sigma^+$	$X\ ^2\Pi_i$	3 x 3		N-3			
ScF		$C\ ^1\Sigma$	$X\ ^1\Sigma^+$	(?)		M-3			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
SiF	Alpha	$A\ ^2\Sigma$	$X\ ^2\Pi$	3 x 8	(3 x 8)	W-5			
	Beta	$B\ ^2\Sigma$	$X\ ^2\Pi$	3 x 10	(3 x 10)	W-5			
SiN		$B\ ^2\Sigma^+$	$X\ ^2\Sigma^+$	5 x 10	(5 x 10)	W-5			
SiO		$A\ ^1\Pi$	$X\ ^1\Sigma^+$	10 x 10 ( )		N-1 S-4			
ScO	Orange	$A\ ^2\Pi$	$X\ ^4\Sigma$	8 x 8		O-5			
	Blue-Green	$B\ ^2\Sigma$	$X\ ^4\Sigma$	10 x 9		O-5			
SrO		$A\ ^1\Sigma$	$X\ ^1\Sigma$	6 x 6		N-1			
TiO	Gamma (IR)	$A\ ^3\Delta$	$X\ ^3\Pi$	6 x 6 5 x 5	 5 x 5	F-1, O-6 P-2			
	Alpha (Blue-Green)	B or C $^3\Pi$	$X\ ^3\Pi$	5 x 6		O-6			
VO	Gamma (Yellow-Blue)	$A\ ^2\Delta$	$X\ ^2\Delta$	10 x 10 6 x 6 5 x 5		N-1 O-6 P-2			
YO	Orange	$A\ ^2\Pi$	$X\ ^2\Sigma$	4 x 4		O-6			
		$B\ ^2\Sigma$	$X\ ^2\Sigma$	8 x 10 4 x 4		O-5 O-6			
ZrO	Gamma	$A\ ^3\Phi$	$X\ ^3\Delta$	4 x 4 6 x 6 2 x 4	 6 x 6 4 x 4	O-6 N-24 S-9			
	Beta	$B\ ^3\Pi$	$X\ ^3\Delta$	6 x 6	6 x 6	N-24			

TABLE 1 (continued)

Molecule	System Name	Transition: Upper State	Transition: Lower State	Morse Potential[a]: $q_{v'v''}$ (Note c,d)	Morse Potential[a]: $r_{v'v''}$ (Note c,d)	Morse Potential[a]: Reference	RKR Potential[b]: $q_{v'v''}$ (Note c,d)	RKR Potential[b]: $r_{v'v''}$ (Note c,d)	RKR Potential[b]: Reference (Note e)
ZrO (con'd)	Alpha	C $^3\Delta$	X $^3\Delta$	5 x 6 6 x 6 3 x 4	 3 x 4	N-24 O-6 S-5			
	A (b-a)	b $^1\Sigma$ or $^1\Delta$	a $^1\Sigma$ or $^1\Delta$	6 x 6	6 x 6	N-24			
	B (d-c)	d $^1\Sigma$ or $^1\Delta$	c $^1\Sigma$ or $^1\Delta$	3 x 2	3 x 2	N-24			

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