COMPILATION OF ELECTRONIC f-VALUES FOR DIATOMIC MOLECULES: 6, 13, 14, 15, 22 AND 23 ELECTRONS[1]

Ray Hefferlin, Joe Mashburn and Jorge Flechas
Southern Missionary College, Collegedale, Tennessee 37315

Roger P. Main
Spectra-Physics GmbH
Darmstadt, West Germany

Abstract

The absorption electronic f-values for free diatomic molecules with 6, 13, 14, 15, 22, and 23 electrons are listed and used to find "adopted values." For all practical purposes this compilation is a continuation of the work of R. P. Main. The results are presented in tabular form, printed by a computer in whose memory they are stored. The tables will be useful in low resolution spectroscopic studies of rocket plumes, ablation products, flames, and astronomical objects.

Introduction

R. P. Main has published compilations of f-values for diatomic molecules (Main, 1964, Main & Bauer, 1966 and 1967), and has continued to assemble material in the form of an annotated bibliography (Main, 1970), containing about 1000 references to about 360 articles regarding diatomic molecules published up through 1967. We had this bibliography; about 180 hard copies of the articles, assigned numbers between 5000[2] and 5375; approximately 180 hard copies of other articles not referenced but still published up through 1967, also assigned numbers between 5000 and 5375; and other articles and reports, mostly of more recent date gleaned from systematic reading and from the "Berkeley Newsletter" (University of California Departments of Astronomy and Physics). The (references to) articles *specifically* presenting or compiling *electronic* f-values or lifetimes were roughly one-fifth of the whole. While conversions from T, $f_{\nu\nu}$, and $f_1(\lambda)$ were made to obtain entries for this compilation (see "Theory"), there was no effort to get still more by summing $f_{\nu'\nu''}$ from various papers. In this particular report, the results from 64 papers are compiled. Several of these were in turn previously published compilations (for at least one transition, usually more), and they are listed in "Other Sources".

Method

If the bibliography (Main, 1970) stated an opinion as to the "correct" f-value, then the "correct" value was entered into our table with the reference number 4573C. If the bibliography gave only one reference,

then the f-values from that reference, and the reference, were entered into our table with the reference number 4573B. (B and C after any other reference number have the same meanings as after 4573.)

As each article was read it was assigned a weight on the basis of an arbitrarily selected scale, which is as follows:

1. Date

1950-1954	1
1955-1959	2
1960-1964	3
1965-1969	4
1970-1974	5
1975-1979	6

2. If the paper is a compilation, add—

   For a table giving f-value with no critical analysis ... 3

   For a table with critically analyzed best value ... 6

3. If the paper is not a compilation—
   a. Add for evidence of familiarity with other work on same f-value

For no evidence	0
For some evidence	1
For very good evidence	2

   b. Add for error statement

None	0
Unrealistically small	1
Realistic	2

   c. Subtract for extremely difficult equipment or theory ... (—1)

4. Whether compilation or not, subtract if not published in journal or book (—1)

The highest weight that could be assigned was 12. The "error" on assigning weights was probably ± 1, except for references ending B, where it was probably ± 2.

Information was stored in H-P 2000-F computer files and manipulated with a text-editing language. The columns contain the following information:

(1) The year of publication.
(2) The assigned weight.
(3) The article reference number.
(4) The term to denote the method used by the author in obtaining the f-value. Compilations, with reference numbers ending in C, of course have no entry. The terms are as follows:

AB = Absorption
BF = Beam-foil lifetime
CO = Electron beam collision for lifetime
EL = Electron beam to excite steady spectrum
EM = Emission from thermal source
ES = Estimate based on other molecule q_{00} (Main)
F(= $f_{el}(\lambda)$ for v' = 2, v" = 0
FL = Flight from discharge - length of glow measured
FQ = Author gives f_{00} and q_{00} to get f
IN = Interpretation from neighboring molecular f_{el} (Main)
LI = Lifetime from laser excitation (Wentink; at λ_{00})
PE = Resonance radiation decay
PH = Phase shift chamber (Lawrence, Hesser)
SH = Shock tube
TH = Theory
XP = Meter-atm path photography just shows band system
← = Added continuum or higher states

(5) The f-value with a realistic error margin given by us (*), or by the writers of the article (#). Errors given by us are very conservative, i.e.: we made them large. Our operating procedure was to think of them in terms of 90% confidence limits. FA means absorption f-value or f_{lu}. FAC means "a factor of"; *L means "*very large errors"
(6) The journal article, report, or other reference.
(7) Three spaces for volume number followed by four spaces for page number (both right-adjusted), or spaces as needed for the report number.
(8) Author(s) name(s).

Each set of entries is prefixed by a line designating the transition (l.c. means lower case; SI means Σ, PI means II, etc.), followed by an "adopted value" line, the adopted value being a weighted geometric mean (using the weight of the f-value as in (2), above). In cases where there were many entries we plotted graphs of f_{lu} vs. date, to see if there were trends which would require a more careful averaging procedure. If no "adopted value" is given for transitions for which more than one f-value is entered, it indicates our opinion that more work is necessary before a best value can be obtained with confidence. The error assigned by us (*) to the adopted value is a rough estimate (90% confidence limit) based entirely on the scatter of the quoted f-value, the stated errors of the individual points being often smaller. A reference giving no f-value may appear; it will be followed by a comment. We are tentatively of the opinion that the values of Popkie and Henneker are too high by a factor of 6.

The computer files may be obtained on paper tape or magnetic tape at cost.

Theory

We present here only just enough theory to allow an understanding of what we did in converting certain literature data into electronic f-values. In the left margin we have given the method codes for which the discussion is relevant.

The absorption oscillator strength, or f-value, for a band system is defined in c.g.s. units by (See Main, 1964 and Schadee, 1967)

$$f_{lu} = \frac{8\pi^2 mc}{3he^2} \frac{1}{\lambda_{lu}\varpi_l} \overline{\sum R_e^2} \, , \quad (1)$$

where

l = lower electronic level
p = upper electronic level
m = mass of electron (gm.)
ϖ_l = electronic statistical weight, sometimes called d or $g = (2-\delta_{0,\Lambda})(2S_l + 1)$ (Tatum, 1967)
λ_{lu} = average wavelength of the band system in absorption ($\varpi_l f_{lu} \neq \varpi_u f_{ul}$). $\sum R_e^2$ is a function of 1 and u (the electronic degrees of freedom) and of v' and v" (the nuclear vibration degree of freedom). As used in eq. (1) it is averaged over v' and v".

The manner in which $\sum R_e^2$ depends on v' and v" is important. To a certain approximation one can claim that for a given v' and v" there is a typical internuclear separation at which the transition occurs; this separation is called the r-centroid, $r_{v'v''}$. The r-centroid is, to this same approximation, a unique and monotonic function of the average band wavelength $\lambda_{v'v''}$. Therefore $\sum R_e^2$ is a function of $\lambda_{v'v''}$. (It is traditional to express this fact with the ambiguous notation $\sum R_e^2$ (r).), and (Schadee, 1967) defines a wavelength-dependent electronic f-value

$$F(\quad f_{el}(\lambda) = \frac{8\pi^2 mc}{3he^2} \frac{1}{\lambda\varpi_l} \sum R_e^2(r) \, , \quad (2)$$

which has the properties that

(1) Equation (1) is its "average" value,
(2) $f_{el}(\lambda) \propto 1/\lambda$ if $\sum R_e^2(r)$ is constant for all bands of the transition, and
(3) $f_{el}(\lambda) \cong$ constant for Δv constant (then it is called $f_{\Delta v}$).

When $f_{el}(\lambda)$ was given we converted this to f_{lu} simply by evaluating the function at λ for v" = 0 to v' = 2 (Compare eq. (1) and eq. (2)).

The relationship of f_{lu} to the lifetime is, if cascading effects can be ignored,

BF
CO
FL
LI
PH
PF
PE

$$f_{lu} = 1.499 \times 10^{-16} \lambda^2 \varpi_u /(\varpi_l \tau) \quad (3)$$

where λ is in Angstroms (Tatum, 1967).

Whenever an *ab initio* conversion from lifetime to f_{lu} was needed, we used eq. (3). The wavelength was arbitrarily chosen to be that of the $v'' = 0$ to $v' = 2$ transition. This wavelength was found from (Herzberg, 1967, and Pearse & Gaydon, 1963) directly, or by double interpolation from (Pearse & Gaydon, 1963). This wavelength appears in the compilation directly below the f-value entry (The lifetime is given also.).

The absorption f-value for a *single band*

$$f_{v'v''} = \frac{8\pi^2 mc}{3he^2} \frac{1}{\lambda_{v'v''} \bar{\omega}_e} R_e^2 q_{v'v''} \quad (1a)$$

If there is no interaction between the electronic and vibrational degrees of freedom then $q_{v'v''}$, the Franck-Condon factor (which was not in Eq. (1)), contains the entire dependence on v' and v''. It then follows from eq. (1) and eq. (1a) that

$$f_{lu} = (f_{v'v''}/q_{v'v''})(\lambda_{lu}/\lambda_{v'v''})(\overline{\textstyle\sum R_e^2}/R_e^2). \quad (4)$$

If the last two ratios are unity then one can very approximately write

$$f_{lu} = f_{00}/q_{00}. \quad (5)$$

The electronic and band oscillator strengths are also related by (Hesser, 1968)

$$f_{lu} = \sum_{v'=0}^{\infty} f_{v'0}, \quad (6)$$

where the summation must include continuum contributions.

From eq. (1) it follows that for transitions with the same $_{lu}$ and R_e^2 assumed,

$$f_{lu}(A)/f_{lu}(B) = \lambda_{lu}(B)/\lambda_{lu}(A) \quad (7)$$

One of us (RH) is also compiling transition moments of diatomic molecular transitions, beginning with the A-X(0,0) bands. A description of this compilation appeared in 1975 in JQSRT (Journal of Quantitative Spectroscopy and Radiative Transfer) 15:925.

Literature Cited[a]

Herzberg, G. 1967. *Spectra of Diatomic Molecules, Second Edition*, D. Van Nostrand Co., Princeton, New Jersey.
Hesser, J. E. 1968. Absolute transition probabilities in ultraviolet molecular spectra, J. Chem. Phys. 48: 2518. (#5234)
Main, R. P. 1970. (nominal date). *Annotated Bibliography on Transition Probabilities in Molecular Electronic Spectra*, personal communication, 232 p. (#5473)
Main, R. P. 1964. *Electronic Oscillator Strengths of C-N-O Molecules: Revision II*, unpublished memorandum, Philco-Ford Corporation, October 14, 10 p. (#4461)
Main, R. P., and E. Bauer. 1967. Equilibrium opacities and emissivities of hydrocarbon-air mixtures at high temperatures, J. Quant. Spectrose. Rad. Transfer 7:527. (#5220)
Main, R. P., and E. Bauer. 1966. Opacities of carbon-air mixtures at temperatures from 3000 - 10,000 K, J. Quant. Spectrosc. Rad. Transfer 6:1. (#5221)
Pearse, R. B. W., and A. G. Gaydon. 1963. *Identification of Molecular Spectra*, John Wiley & Sons, New York.
Schadee, A. 1967. The relation between the electronic oscillator strength and the wavelength for diatomic molecules, J. Quant. Spectrosc. Rad. Transfer 7:169. (#3430)
Tatum, J. B. 1967. The interpretation of intensities in diatomic molecular spectra, Astrophys. J. Supplement #124 (14:21).

Other Sources

Extensive compilations were found in the literature, aside from those of Main and of Main and Bauer. They are as follows:

Dalby, F. W. 1965. Handbuch der Physik 28:465 (#5222)
Kuznetsova, L. A. et al 1974. Soviet Phys, Uspeki 17:405 (#4950)
Soshnikov, V. N. 1961. Soviet Phys. Uspeki 4:425 (#5229)
Wilkerson, P. G. and R. S. Mulliken. 1959. J. Chem. Phys. 31:674 (#5232)

The existence of such compilations dated as recently as 1974 raises the question of justifying this present effort. We have done so on the basis that we offer the data in a form where (1) the sources are readily seen side-by-side with the data and (2) all of the source data are given instead of just the adopted values. Furthermore, (3) we trust that this will be a continuously updated effort which can respond to the needs of the scientific community (e.g. low resolution spectroscopy in astronomy, visible-light chemical lasers). Other compilation efforts of which we are aware in the United States and Europe (Donald Hsu at Princeton University Observatory and David Lambert at the University of Texas at Austin) are concerned with $f_{v'v''}$ and not with f_{lu}.

[a] Numbers following references are compatible with those used in the table.

TABLE 1: *Absorption electronic oscillator strengths for datomic molecules.*

ALH+ A2PIR—X2SI+
| 71 09 4424 | TH FA=.175 | | J.CHEM.PHYSICS | 55 617 | POPKIE & HENNEKER |

BCL A1PI—X1SI+
| 68 08 5234 | PHΔFA=0.12 | | J.CHEM.PHYSICS | 482518 | JAMES E. HESSER |

BEF A2PIR—X2SI+
| 71 09 4424 | TH FA=.371 | | J.CHEM.PHYSICS | 55 617 | POPKIE & HENNEKER |

BEF 2PII—X2SI+
| 71 09 4424 | TH FA=.038 | | J.CHEM.PHYSICS | 55 617 | POPKIE & HENNEKER |

BF A1PI—X1SI+
| 68 08 5234 | PHΔFA=0.41 | | J.CHEM.PHYSICS | 482518 | JAMES E. HESSER |

BF+ 2PII—X2SI+
| 71 09 4424 | TH FA=.0231 | | J.CHEM.PHYSICS | 55 617 | POPKIE & HENNEKER |

BF+ 2PIR—X2SI+
| 71 09 4424 | TH FA=.220 | | J.CHEM.PHYSICS | 55 617 | POPKIE & HENNEKER |

BH A1PI—X1SI+
FA=.06*.04 ADOPTED
73 10 4950C	FA=(42#10)E-3	ZH. FIZ. KHIM	47 1339	F.N.PUTILIN ETAL
59 05 5216	TH FA=.083*.010	PROC.ROY.SOC.	A249 402	A.C.HURLEY
56 03 5216B	TH FA=.12	J.CHEM.PHY.	25 332	R.C.SAHNI

BO A2PII—X2SI+
| 71 09 4424 | TH FA=.0294 | | J.CHEM.PHYSICS | 55 617 | POPKIE & HENNEKER |

BO 2PIR—X2SI+
| 71 09 4424 | TH FA=.190 | | J.CHEM.PHYSICS | 55 617 | POPKIE & HENNEKER |

C2—A2PIU—X2SIG+
| 71 09 4424 | TH FA=.0166*.004 | | J.CHEM.PHYSICS | 55 617 | POPKIE & HENNEKER |

C2— B2SIU—X2SI+
| 71 09 4424 | TH FA=.224 | | J.CHEM.PHYSICS | 55 617 | POPKIE & HENNEKER |

CF A2SI+—X2PI
FA=.026*.001 (ERROR PROBABLY COINCIDENTAL) ADOPTED
70 10 4573C	FA=.0250	PERS. COMMUNIC.		ROGER MAIN
68 08 5234	PHΔFA=.027	J.CHEM.PHYSICS	482518	HESSER
66 08 5234B	AB FA=.025	J.CHEM.PHYSICS	452720	HARRINGTON ET AL

CF B2SI+—X2PI
FA=.017*.001 (ERROR PROBABLY COINCIDENTAL) ADOPTED
| 70 10 4573C | FA=.0167 | PERS. COMMUNIC. | | ROGER MAIN |
| 68 08 5234 | PHΔFA=.016 | J.CHEM.PHYSICS | 482518 | HESSER |

CH+ A1PI—X1SI+
FA=.005*.005 ADOPTED
73 14 4993C	FA=.0125#.00125	ASTROPHYSIC. J.	196 307	BROOKS & SMITH
73 07 4990	TH FA=.003	ASTROPHYSIC. J.	183 69	W.H.SMITH ET AL.
71 09 4483	FQ FA=.0065	JQSRT IN PRESS	5	LISZT & SMITH
71?07 4483B	ESΔFA=.0011	LICK OBS. BULL.	NO. 616	B.LUTZ
51 02 4573R	ES FA=.004	ASTROPHYS. J.	113 441	BATES&SPITZER

CN A2PII—X2SI+RED
FA=.006*.001 ADOPTED, OMiTTING POPKIE & HENNEKER, FROM TREND GRAPH
				121435	ARHOLD & NICHOLLS
72 09 5309	F(FA=.006*.001	J.Q.S.R.T	55 617	POPKIE & HENNEKER
71-09 4424	TH FA=.0161	J.CHEM.PHYSICS		ROGER MAIN
70 10 4573C	FA=(58#5)E-4	PERS. COMMUNIC.	7 169	AERT SCHADEE
67 07 3430	F(FA=8.65E-3	J.Q.S.R.T.	41 278	WENTINK ET AL
65 07 5185R	SH FA=.0037	J.CHEM.PHYSICS	424086	JEUNEHOMME
65 08 5220B	FA=.007	J.CHEM.PHYSICS		
67 07 5267	LI FA=(58#5)E-4	AVCO/AFWL	67-30	WENTINK ET AL

CN B2SI+—X2SI+ VIOLET
FA=.025*.008 ADOPTED

73 09 5104	SH FA=.035#.005	J.Q.S.R.T.	13 115	J.O.ARNOLD
		PERS.COMMUNIC.		ROGER MAIN
70 10 4573C	FA=.025	J.Q.S.R.T.	7 169	AERT SHADEE
67 07 3430	F(FA=19.3E-3	J.CHEM.PHYSICS	484870	MOORE & ROBINSON
67 08 5184	FA=.020#.002	GIVEN TRANSITION PROBABILITY (1.21#.12)E7		
(NOTE) WL(V'=2.V''=0)=7598A				
67 10 5220C	FA=.027	J.Q.S.R.T.	7 527	ROGER MAIN
65 03 5185	SH FA=.02	AIAA PAPER	65-116	ARNOLD ET AL

CN D2PII—X2SI+

64 04 4461	ES FA=.04	UNPUBLISHED		ROGER MAIN

CN D2PII—A2PII

64 04 4461	ES FA=.02	UNPUBLISHED		ROGER MAIN

CN H2PIR—X2SI+

71 09 4424	TH FA=.0158	J.CHEM.PHYSICS	55 617	POPKIE & HENNEKER

CO A1PI—X1SI+ FOURTH POSITIVE
FA=.20*.02 ADOPTED FROM TREND GRAPH

72 09 4893C	FA=.182*.012	PHYS. REV. A	6 1327	BORNHAM ET AL
70 10 4573C	FA=.15*.04	PERS.COMMUNIC.		ROGER MAIN
66 05 5221	ES FA=0.05	J.Q.S.R.T.	6 1	MAIN & BAUER
64 04 5358	ES FA=0.01	HIGH TEMP.	2 431	V.N. SOSHNIKOV

CO B1SI+—X1SI+ HOPEFIELD-BIRGE
FA=.025*.009 ADOPTED

70 10 4573C	FA=.021*.013	PERS.COMMUNIC.		ROGER MAIN
66 05 5378B	CO FA=.034	J.CHEM.PHYS.	401256	LASSETTRE.SILVE

CO C1SI+—X1SI— HOPEFIELD BIRGE

70 10 4573C	FA=.20*.08	PERS.COMMUNIC.		ROGER MAIN

CO C1SI+—A1PI HERZBERG

66 07 4573B	TH FA=.0075	THESIS.PRINCETON		J.E.HESSER
66 05 5378B	CO FA>.28	J.CHEM.PHYS.	401256	LASSETTRE.SILVE

CO LC.A3PIR—X1SI+ CAMERON
FA=2.3E—6*L ADOPTED

71 06 5377	FL FA=(4*.8)E-6	BULL.AM.PHYS.S.	16 205	BORST & ZIPF
71 07 4496	PE FA=(.9#.2)E-6	J.CHEM.PHYSICS	552164	SLANGER & BLACK
70 10 4573C	FA=(3.16)E-6	PERS.COMMUNIC.		ROGER MAIN

CO LC.A'3SI+—LC.A3PIR ASUNDI

67 07 4573B	LI FA=.00156	AVCO/AFWL-TR	67-30	T.WENTINK ET AL
64 04 5358	ES FA=0.01	HIGH TEMP.	2 431	V.N. SOSHNIKOV

CO LC.D3PII—LC.A3PIR TRIPLET

67 07 4573B	LI FA=.00643	AVCO/AFWL-TR	67-30	T.WENTINK ET AL

CO LC.B3SI+—LC.A3PIR THIRD POSITIVE

70 10 4573C	FA=0.018*0.01	PERS.COMMUNIC.		ROGER MAIN
66 06 5236C	FA=(89#15)E-4	UNPUBL. CALTECH		AERT SCHADEE

CO C1SI+—B1SI+

66 07 4573B	TH FA=0.22	THESIS.PRINCETON		J.E.HESSER

CO E1PI—X1SI HOPEFIELD-BIRGE

71 09 4950C	FA=(94#9)E-2	J. CHEM.PHYSICS	48 4870	LASSETRE&SKERBELE

CO+ B2SI+—A2PII BOLDET JOHNSON

66 05 5221	ES FA=.004	J.Q.S.R.T.	6 1	MAIN & BAUER
70 10 4573C	TH FA=.004#FAC.2	PERS.COMMUNIC.		ROGER MAIN

CO+ A2PII—X2SI+ COMET TAIL
FA=.0044 ADOPTED, OMITTING POPKIE & HENNEKER

60 07 5221B	CO FA=0.0044	J.CHEM.PHYSICS	32 111	BENETT &DALBY
71 09 4424	TH FA=.0177	J.CHEM.PHYSICS	55 617	POPKIE & HENNEKER

CO+ 2PIR—X2SI+

71 09 4424	TH FA=.105	J.CHEM.PHYSICS	55 617	POPKIE & HENNEKER

CO+ B2SI+—X2SI+ FIRST NEGATIVE
FA=.029*.020 ADOPTED

66 05 5221	ES FA=0.05	J.Q.S.R.T.	6 1	MAIN & BAUER
66 07 5046	PH FA=0.018	J.Q.S.R.T.	6 215	K.C. JOSHI ET AL
66 07 5236B	LI FA=(79#7)E-4	UNPUBLISHED		AERT SCHADEE
70 10 4573C	TH FA=0.04	PERS. COMMUNIC.		ROGER MAIN

LI2 A1SI+U—X1SI+G

70 10 4573C	FA=.4*.1	PERS. COMMUNIC.		ROGER MAIN

LI2 B1PIU—X1SI+G

70 10 4573C	FA=.83*.17	PERS. COMMUNIC.		ROGER MAIN

MGH A2PIR—X2SI+
FA=.0125*FAC.2.5 ADOPTED, USING 1970 AND 1975 SOURCES

75 10	FQ FA=(45#15)F-4	RE (0-0) PROJECT 3 SOURCES TO 1970		
71 09 4424	TH FA=.265	J.CHEM.PHYSICS	55 617	POPKIE & HENNEKER
70 10 4573C	FA=.035#.0035	PERS. COMMUNIC.		ROGER MAIN
NOTE: DISSOCIATION POTENTIAL=1.85 EV				
67 08 4456	EM FA<2E-3	J.Q.S.R.T.	7 805	MAIN ET AL

N2A3SI+U—X1SI+G VEGARD-KAPLAN
FA=2E-7*L ADOPTED

71 06 5377	FL FA=1.26E-10	BULL.AM.PHYS.S.	16 205	BORST.ZIPF
(NOTE) WL(V'=2,V''=0)=750A				
67 10 5102C	FA=(1.9#.6)E-9	J.CHEM.PHYS.	46 822	WENTINK.ISAACSON
(NOTE) WL(V'=2,V''=0)=750A (EXTRAPOL.)		GIVEN LIFETIME WAS 13#4 SEC.		
61 06 5229C	FA=(15*13)E-6	SOV.PHYS.US.	4 425	V.N.SOSHNIKOV
59 06 5232B	AB FA=4.8E-3	J.CHEM.PHYS.	31 674	WILKINSON.MULLIK.

N2 LC.A1PI—G—X1SI+G LYMAN-BIRGE-HOPEFIELD
FA=7E-6*L ADOPTED

71 06 5377	FL FA=(34#5)E-7	BULL.AM.PHYS.S.	16 205	BORST.ZIPF
(NOTE) WL(V'=2,V''=0)=1070A (EXTRAPOL.)		GIVEN LIFETIME WAS 115E-6 SEC		
67 05 4918	AB FA=3.1E-5	J.Q.S.R.T.	7 323	CHING.COOK.BECKER
61 06 5229C	FA=1.02E-5	SOV.PHYS.US.	4 425	V.N.SOSHNIKOV
59 06 5232C	FA=3.9E-6	J.CHEM.PHYS.	31 674	WILKINSON.MULLIK.
57 03 3640B	XP FA=3.23E-6	ASTROPHYS J.	126 10	WILKINSON.MULLIK

N2 B'3SI—G—B3PIG Y

67 054573B	TH FA=0.01	HIGH TEMP.	4 148	BIBER. & MNATS.

N2 D3SI+U—B3PIG

66 05 4573B	PH FA=0.17	THESIS PRINCETON		J.E. HESSER

N2 B3PIG—A3SI+U FIRST POSITIVE
FA=(3.6*2)E-3 ADOPTED, OMITTING 59 DATA, AND BASED ON TREND GRAPH

68 10 5205C	FA=(45*15)E-4	AFWL-TR-67-76		CANN-DICKERMAN
			7 527	R. MAIN
67 10 5220C	FA=.0028	J.Q.S.R.T.	7 160	AERT SCHADEE
67 07 3430	F(FA=(215*2)E-5	J.Q.S.R.T.		AERT SCHADEE
66 05 5236C	FA=(28#7)E-4	UNPUBL CALTECH		
66 08 3358	SH FA=(280#98)E-5	OPTICS&SPECTRO.	21 301	A.P.DROVOV, ETAL.
64 06 5329	TH FA=.0104	J.CHEM.PHY.	411692	JEUNEHOM.DUNCAN
(NOTE) WL(V'=2,V''=0)=7753A		GIVEN LIFETIME WAS 1.73E-6 SEC		
64 06 5329	CO FA=.002	J.CHEM.PHY.	411692	JEUNEHOM.DUNCAN
(NOTE) WL(V'=2,V''=0)=7753A		GIVEN LIFETIME WAS 9.1E-6 SEC		
62 05 3325B	SH FA=(2.8#.7)E-3	J.CHEM.PHY.	362111	W.H.WRUSTER
59 03 3325B	SH FA=(25#8)E-3	ANNALS OF PHY.	7 1	KECK ET AL
59 06 5219	SH FA=(17.2E-3#32%	ANNALS OF PHY.	7 1	KECK ET AL

N2 C3PIU—B3PIG SECOND POSITIVE
FA=(4.5*1.0)E-2 ADOPTED

68 10 5205C		FA=49*7E-3	AFWL-TR 67-76		CANN.DICKERMAN
67 10 5220C		FA=.043	J.Q.S.R.T.	7 527	MAIN.BAUER
67 07 3430	F(	FA=.055E-3	J.Q.S.R.T.	7 169	AERT SCHADEE
65 08 5094C		FA=(3.6#.6)E-2	UNPUBLISHED		M.JEUNEHOMME

N2 D3SI+U—E3SI+G FOURTH POSITIVE
FA=.07 ADOPTED

| 66 05 4573R | PH FA=0.26 | THESIS PRINCETON | | J.E. HESSER |
| 64 06 5329 | TH FA=.0231 | J.CHEM.PHY. | 411692 | JEUNEHOM.DUNCAN |

(NOTE) WL(V'=2,V''=0)=2072A (EXTRAPOL.) GIVEN LIFETIME FAS 2.75E-6 SEC

N2 B'3SI+U—X1SI+G
FA=(4.1*1.5)E-8 ADOPTED

| 61 06 5229C | | FA=2.6E-8 | SOV.PHYS.US. | 4 425 | V.N.SOSHNIKOV |
| 59 06 5232 | AB | FA=6.6E-8 | J.CHEM.PHYS. | 31 674 | WILKINSON.MULLIK. |

N2 C3PIU—X1SI+G TANAKA
FA=1E-6 ADOPTED

| 61 06 5229C | | FA=1.6E-6 | SOV.PHYS.US. | 4 425 | V.N.SOSHNIKOV |
| 59 06 5232 | AB | FA=6.1E-7 | J.CHEM.PHYS. | 31 674 | WILKINSON.MULLIK. |

N2 LC.A'1SI—U—X1SI+G   WILKINSON-MULLIKEN VACUUM U.V.

| 61 06 5229C | | FA=1.02E-5 | SOV.PHYS.US. | 4 524 | V.N.SOSHNIKOV |
| 59 06 5232B | AB | FA=1.7E-8 | J.CHEM.PHY. | 31 674 | WILKINSON.MULLIK. |

N2 E3SI+G—A3SI+U   HERMAN-KAPLAN=GAMMA

| 71 06 5377 | FL FA=(319#50)E-8 | BULL.AM.PHYS.S. | 16 205 | BORST.ZIPF |

(NOTE) WL(V'=2,V''=0)=2010A (EXTRAPOL.) GIVEN LIFETIME WAS 190E-6 SEC

N2+ A2PIU—X2SI+ MEINEL
FA=.003*.002 ADOPTED, OMITTING POPKIE & HENNEKER

71 09 4424	TH FA=.0252	J.CHEM.PHYSICS	55 617	POPKIE & HENNEKER
69 06 4424B	CO FA=.0029	CAN. J. CHEM.	471858	M.HOLLSTEIN ET AL
68 06 4424B	CO FA=.0064	AFCRL-67-0277		O'NEIL & DAVIDSON
66 06 3422C		FA=1.549E-3	NASA CR-556		RICHARD ALLEN

(NOTE) WL(V'=2,V''=0)=7874.6   GIVEN LIFETIME WAS 3 MICROSEC

N2+ B2SIU+—X2SIG+ FIRST NEGATIVE
FA=.04*.005 ADOPTED, OMITTING POPKIE & HENNEKER, FROM TREND GRAPH

60 03 1904B	SH FA=0.18	GRD-TR-60-277		MEYEROTT ET AL
61 06 5229C		FA=0.11*0.06	SOV. PHYS. US.	4 524	SOSHNIKOV
63 06 1902C		FA=0.09*0.05	IAS PAPER	63-77	R.Q. ALLEN ET AL
64 04 4461	ES FA=0.007	UNPUBLISHED		ROGER MAIN
65 07 5222C		FA=0.108*0.06	HBCH. D. PHYS.	27 464	F.W.DALBY
65 05 5185B	SH FA=0.053	AIAA	65-116	J.O.ARNOLD ET AL
65 08 4555	SH FA=0.0343#14%	AVCO-EVERETT	208	WRAY & CONNOLLY
67 07 3430	F(FA=0.0416	J.Q.S.R.T.	7 169	AERT SCHADEE
70 10 4573C		FA=0.035	PERS. COMMUNIC.		ROGER MAIN
71 09 4424	TH FA=.193	J.CHEM.PHYSICS	55 617	POPKIE & HENNEKER
71 09 4424C		FA=.038	J.CHEM.PHYSICS	55 617	POPKIE & HENNEKER

N2+ C2SIU+—X2SIG+

| 64 04 4461 | ES FA=0.05 | UNPUBLISHED | | ROGER MAIN |

N2+ D2PIG—A2PIU

| 64 04 4461 | ES FA=0.02 | UNPUBLISHED | | ROGER MAIN |
| 67 05 5220 | ES FA=0.005 | J.Q.S.R.T. | 7 527 | ROGER MAIN |

NA2 A1SI+U—X1SI+G

| 58 04 5229B | TH FA=.2#L | TRANS.FARADAY | 541429 | D.W.DAVIES |
| 51 03 4573B | TH FA=.039 | PROC.PHYS.SOC. | 64A 425 | G.STEPHENSON |

NA2 B1PIU—X1SI+G

| 70-10 4573C | | FA=1.0*0.2 | PERS. COMMUNIC. | | ROGER MAIN |

NO A2SI+—X2PIR GAMMA
FA=.0022*.0004 ADOPTED

65 07 5222C		FA=(17*7)E-4	HBCH. D. PHYSIK	28 465	F.W.DALBY
66 06 5221C		FA=.0025	J.Q.S.R.T.	6 1	MAIN & BAUER
68 09 5209C		FA=(24*16)E-4	Z. NATURFORSCH.	23A 358	FINK & WELGE

NO B2PIR—X2PIR BETA
FA=(5.0*.1.0)E-3 ADOPTED FROM TREND GRAPH

64 06 5236B		FA=.0027	J. CHEM. PHYS.	40 562	H.A. ORY
64 05 5221B		FA=.0053	RAND RM-3997-ARPA		F.R. GILMORE
65 06 5222C		FA=(38*22)E-4	HBCH. D. PHYSIK	28 465	F.W. DALBY
68 10 5205C		FA=(45*25)E-4	AFWL-TR-67-76		CANN & DICKERMAN
70 10 4573		FA=.005#FAC.5	PERS. COMMUNIC.		ROGER MAIN

NO C2PI—X2PIR DELTA
FA=.0146*L ADOPTED

52 02 5129B		FA=.0032	ANN. PHYS.	7 453	J.MAYENCE
60 05 5129	TH FA=.0026	OPT. & SPECTR.	9 141	ERKO. & PISAREV
64 06 5236B		FA=.017	J.CHEM.PHYSICS	40 562	H.A. ORY

NO C2PI—A2SI+ HEATH
FA=.26*L ADOPTED

64 06 5236B		FA=.0737	J.CHEM.PHYSICS	40 562	H.A. ORY
67 05 5220	ES FA=0.05	J.Q.S.R.T.	7 527	MAIN & BAUER
68 06 4549	SH FA=.7	AVCO REPORT 300 (AUGUST)		KURT L. WRAY
73 11 4950C		FA=.61	J.Q.S.R.T.	111475	W.GROTH ET AL

NO D2SI+—A2SI+ FEAST 1
FA=.14*.10 ADOPTED

66 05 4573B	PH FA=0.3#FAC.5	THESIS PRINCETON		J.E.HESSER
67 05 5220	IN FA=.05	J.Q.S.R.T.	7 527	MAIN & BAUER
68 06 4549	SH FA=.18	AVCO REPORT 300 (AUGUST)		KURT L. WRAY

NO E2SI+—A2SI+   DUFFIEUX-GRILLET-FEAST=FEAST 2

| 67 05 5220 | IN FA=.05 | J.Q.S.R.T. | 7 527 | MAIN & BAUER |

NO B'2DEI—B2PIR TANAKA-OGAWA=OGAWA 1
FA=.02*L ADOPTED

67 06 4573B	EM FA=.005	HIGH TEMP.	4 148	BIBERMAN&MNATSAK.
67 05 5220	IN FA=.001	J.Q.S.R.T.	7 527	MAIN & BAUER
68 06 4549	SH FA=.9#FAC.2	AVCO REPORT 300 (AUGUST)		KURT L. WRAY

NO E2SI+—D2SI+ FEAST-HEATH

| 67 05 5220 | ES FA=0.05 | J.Q.S.R.T. | 7 527 | MAIN & BAUER |

NO B4SI——A4PII OGAWA 2
FA=.005*L ADOPTED

67 06 4573B	EM FA=0.02	HIGH TEMP.	4 148	BIBER. & MNAT.
67 05 5220	IN FA=.001	J.Q.S.R.T.	7 527	MAIN & BAUER
68 06 4549	SH FA=.004	AVCO REPORT 300 (AUGUST)		KURT L. WRAY

NO D2SI+—X2PIR EPSILON
FA=.008*.004 ADOPTED

| 67 10 5220C | IN FA=0.014 | J.Q.S.R.T. | 7 527 | MAIN & BAUER |
| 67 05 5123 | TH FA=0.0041 | J.CHEM.PHYSICS | 491446 | LEFEBURE & GUEREN |

NO E2SI+—X2PIR GAMMA PRIME

| 66 05 5221 | IN FA=0.01 | J.Q.S.R.T. | 6 1 | MAIN & BAUER |

NO B'2DEI—X2PIR BETA PRIME

| 67 05 5220 | IN FA=0.01 | J.Q.S.R.T. | 7 527 | MAIN & BAUER |

NO G2SI——X2PIR   LAGERQUIST-MIESCHER

| 67 05 5220 | ES FA=0.01 | J.Q.S.R.T. | 7 527 | MAIN & BAUER |

NO E2SI+—C2PI
FA=.2*L ADOPTED

| 67 05 5220 | ES FA=.05 | J.Q.S.R.T. | 7 527 | MAIN & BAUER |
| 68 06 4549 | SH FA=.50 | AVCO REPORT 300 (AUGUST) | | KURT L. WRAY |

NO G2SI——B2PIR   AVCO REPORT 300 (AUGUST)   KURT L. WRAY
68 06 4549   SH FA<.08

NO H'2PI—C2PI   AVCO REPORT 300 (AUGUST)   KURT L. WRAY
68 06 4549   SH FA=.15

NO H2SI+—C2PI   AVCO REPORT 300 (AUGUST)   KURT L. WRAY
68 06 4549   SH FA=.12

NO F2DE—C2PI   AVCO REPORT 300 (AUGUST)   KURT L. WRAY
68 06 4549   SH FA=.22

NO H'2PI—D2SI+   AVCO REPORT 300 (AUGUST)   KURT L. WRAY
68 06 4549   SH FA=.50

NO H2SI+—D2SI+   AVCO REPORT 300 (AUGUST)   KURT L. WRAY
68 06 459   SH FA=.25(>.07)

NO+ A1PI—X1SI+ GAMMA PRIME
FA=.03*.02 ADOPTED, USING MAIN & BAUER ONCE
68 08 5234   PHₐFA=.016#.002   J.CHEM.PHYSICS   482518   JAMES E. HESSER
67 05 5220   ES FA=.05   J.Q.S.R.T.   7 527   MAIN & BAUER
66 05 5221   ES FA=.05   J.Q.S.R.T.   6 1   MAIN & BAUER

O2+ B4SIG——A4PIU   FIRST NEGATIVE
65 05 5070C   FA=0.006   PRIVATE COMMUN.   ROGER MAIN

O2+ A2PIU—X2PIG SECOND NEGATIVE
65 05 5070C   FA=.0038   PERS. COMMUNIC.   ROGER MAIN

SIF A2SI—X2PIR
67 07 4573B   LI FA=.002846   AVCO/AFWL   67-30   T.WENTINK ET AL

SIF B2SI—X2PIR
67 07 4573B   LI FA=.00259   AVCO/AFWL   67-30   T.WENTINK ET AL

SIH A2DE—X2PI
FA=(3.9*0.2)E-3 ADOPTED
71 00 4483P   PHₐFA=(37#7)E-4   J.Q.S.R.T.   11 45   SMITHₐ& LISZT
? 04 4483PB   AB FA=4.5E-3   PERS. COMMUNIC.   LAMBERT & MALLIA

OCCURRENCE OF AN ALBINO *BLARINA BREVICAUDA* FROM WESTERN TENNESSEE

DWIGHT G. SMITH
Southern Connecticut State College
New Haven, Connecticut 06515

INTRODUCTION

Albinism is a form of coat color mutation which appears in most mammal populations. Svendsen and Svendsen (1975) suggested that the true albino is represented in about 1% of mutant insectivores and determined an incidence ratio of 1:20,000 to 1:50,000 in free living populations.

RESULTS

I would like to report the capture of an albino short-tailed shrew from Western Tennessee. The animal was captured approximately two miles north of Trenton, Gibson Co., on 14 August 1975 using a Museum Special snaptrap baited with a mixture of peanut butter and chopped mealworms. The specimen was a totally white male with pink eyes and feet. Its external measurements were: total length 114 mm, tail length 20 mm, hind feet 19 mm, ear 4 mm, weight 9.6 gm. Dentition pigment was normal and the animal appeared to be a normal, healthy adult when captured.

This specimen has been catalogued M 2011 in the mammalogy collection of the Biology Department, Southern Connecticut State College.

LITERATURE CITED

Svendsen, G. E., and M. G. Svendsen. 1975. An albino *Blarina brevicauda* from Southeastern Ohio. Ohio J. Sci. 75:32.