The UMIST database for astrochemistry 1995^{*}

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Abstract. We report the release of a new version of the UMIST database for astrochemistry. The database contains the rate coefficients of 3864 gas-phase reactions important in interstellar and circumstellar chemistry and involves 395 species and 12 elements. The previous (1990) version of this database has been widely used by modellers. In addition to the rate coefficients, we also tabulate permanent electric dipole moments of the neutral species and heats of formation. A numerical model of the chemical evolution of a dark cloud is calculated and important differences to that calculated with the previous database noted.

Key words: ISM: molecules — molecular data — molecular processes

1. Introduction

To date, over 100 molecules have been detected in interstellar and circumstellar regions (Table 1), and detailed models of chemical synthesis have been developed for dark clouds (Hasegawa & Herbst 1993; Herbst et al. 1994; Bergin et al. 1995; Neufeld et al. 1995; Mackay 1996), hot molecular cores (Charnley et al. 1992; Charnley et al. 1995; MacKay 1995), circumstellar envelopes (Cherchneff et al. 1993; Cherchneff & Glassgold 1993; Millar & Herbst 1994), and Photon-Dominated Regions (Sternberg & Dalgarno 1995). Many of these have used data from previous releases of the UMIST database (Millar et al. 1991b; Farquhar & Millar 1993), as have modellers of comet chemistry (Eberhardt et al. 1994; Meier et al. 1993, 1994; Eberhardt & Krankowsky 1995; Altwegg et al. 1994). In this paper, we report on our latest release of the UMIST database which has been extended to include rate coefficients on 3864 reactions among 395 species and 12 elements with neutral molecules containing up to 12 atoms ($\text{CH}_3\text{C}_7\text{N}$) and represents an increase of around one-third on the 1990 version (Millar et al. 1991b).

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^{*} Table 4 also available in electronic form at CDS

Section 2 contains a summary of the information contained in the species file and on related information such as electric dipole moments and heats of formation. Section 3 presents the rate coefficients and discusses the important changes made for this update, while Sect. 4 contains the results of a time-dependent calculation of a dense cloud model. Finally, Sect. 5 describes how the data may be obtained.

2. The species and related data

Our species set, given in Table 2, contains 395 atomic and molecular species involving the 12 elements H, He, C, N, O, Na, Mg, Si, P, S, Cl and Fe. The species are ordered by number of atoms, with a sub-ordering given by the number of H atoms, followed by the number of C atoms they contain. For computational convenience, some species are written in ‘shorthand’, for example, C_5H_4 represents methyl diacetylene, $\text{CH}_3\text{C}_4\text{H}$. We have included neutrals with up to 12 atoms. In such cases, the proper chemical formula is contained in parentheses after the ‘shorthand’ in Table 3 which lists the permanent electric dipole moments of the neutral species. Table 2 also lists the heats of formation of the species contained in the reaction set and can be used to check whether particular reactions are exothermic or endothermic. These data, which were mostly provided by H.-H. Lee (Ohio State University), have been used to exclude a number of highly endothermic ion-neutral reactions which were in the 1990 ratefile. Endothermic neutral-neutral reactions are still contained in this release because such reactions are important in shocked gas; ion-neutrals are relatively unimportant here, although those which are important, for example the reactions of H_nS^+ ($n = 0 - 2$) with H_2 which initiate sulfur chemistry in shocked gas, are included.

The permanent electric dipole moments for the 137 neutral molecules contained in the species set are given, where available, in Table 3. The rate file distinguishes between some isomers, such as HCN and HNC, as well as $\text{C}_2\text{H}_5\text{OH}$ and CH_3OCH_3 , and the dipole moments are listed for each isomer. In those cases in which the ratefile does not distinguish isomers, for example, the various forms of linear and cyclic C_3H , C_3H_2 and C_4H_2 , the dipole

Table 1. Observed interstellar and circumstellar molecules as of December 1995

Number of atoms							
2	3	4	5	6	7	8	≥ 9
Interstellar inorganic molecules (20)							
H ₂	H ₂ O	NH ₃					
OH	H ₂ S	H ₃ O ⁺					
SO	SO ₂						
SiO	HNO						
SiS	NH ₂						
NH	N ₂ H ⁺						
NO	N ₂ O						
NS							
PN							
HCl							
SO ⁺							
Interstellar organic molecules (70)							
CH ⁺	HCN	H ₂ CO	HC ₃ N	CH ₃ OH	HC ₅ N	CH ₃ OCHO	HC ₇ N
CH	HNC	H ₂ CS	C ₄ H	CH ₃ CN	CH ₃ CCH	CH ₃ C ₃ N	CH ₃ OCH ₃
CN	HCO	HNCO	CH ₂ NH	CH ₃ SH	CH ₃ NH ₂		CH ₃ CH ₂ OH
CO	OCS	HNCS	CH ₂ CO	NH ₂ CHO	CH ₃ CHO		CH ₃ CH ₂ CN
CS	HCO ⁺	c – C ₃ H	NH ₂ CN	CH ₃ NC	CH ₂ CHCN		CH ₃ C ₄ H
C ₂	HOC ⁺	l – C ₃ H	HOCHO	HC ₂ CHO	C ₆ H		HC ₉ N
CO ⁺	HCS ⁺	C ₃ N	c – C ₃ H ₂	C ₅ H			HC ₁₁ N
	C ₂ H	C ₃ O	CH ₂ CN	C ₅ O(?)			CH ₃ C ₅ N
	C ₂ O	C ₃ S	H ₂ CCC	H ₂ CCCC			CH ₃ COCH ₃
	C ₂ S	H ₂ CN	HCCNC	HC ₃ NH ⁺			
		C ₂ H ₂	HNCCC				
		HOCO ⁺	CH ₄				
		HCNH ⁺					
Circumstellar molecules (17)							
CP	C ₃	HCCN	C ₅	C ₂ H ₄			
SiC	c – SiC ₂		SiH ₄				
SiN	NaCN		SiC ₄				
NaCl	MgCN						
AlCl	MgNC						
KCl							
AlF							

moments for each form are given. The electric dipole moments are important for calculating reaction rate coefficients appropriate for low temperatures ($T < 50$ K). Various formulae have been suggested, based on theoretical and experimental approaches (Adams & Smith 1987; Troe 1987; Herbst & Leung 1986).

3. The reaction set

Table 4 contains the fundamental rate coefficient data. In this section, we discuss the general form of the data, describe the format of each entry, discuss particular reac-

tions or class of reactions and describe major differences since the 1990 release.

3.1. General form

The reactions and associated rate coefficients can be divided up into a number of categories, each of which has been ordered in terms of the mass number of the first reactant, and for a specific first reactant in terms of increasing mass number for the second reactant. The ratefile is organised as follows:

- Reactions 1 - 394. Neutral-neutral reactions.

Table 2. Species and heats of formation in kJ mol⁻¹ at 0 K

H	216.0	HE	0.0	C	711.2	N	470.8	O	246.8
NA	107.6	MG	146.5	SI	446.0	P	315.6	S	274.7
CL	119.6	FE	414.0	H2	0.0	CH	592.5	NH	376.5
OH	38.4	SIH	374.9	PH	237.0	HS	136.5	HCL	-92.1
C2	817.0	CN	436.8	CO	-113.8	SIC	734.7	CP	516.0
CS	262.0	CCL	384.0	N2	0.0	NO	90.8	SIN	485.0
PN	106.0	NS	263.0	O2	0.0	SIO	-101.6	PO	-32.0
SO	5.0	CLO	101.8	SIS	.....	S2	128.3	CH2	390.0
NH2	191.6	H2O	-238.9	SIH2	289.0	PH2	142.2	H2S	-17.6
C2H	560.0	HCN	135.5	HNC	201.0	HCO	44.8	HCSI	.....
HCP	167.0	HCS	310.0	HNO	100.0	HNSI	162.8	O2H	13.4
HPO	.....	HS2	.....	C3	831.0	CCN	556.0	CCO	.....
SIC2	610.0	CCP	.....	C2S	.....	OCN	154.0	SINC	.....
CO2	-393.1	OCS	-142.0	N2O	85.5	NO2	36.0	SIO2	-281.2
SO2	-294.3	CH3	149.0	NH3	-38.9	SIH3	202.9	C2H2	228.6
H2O2	-130.0	H2S2	16.0	H2CN	189.0	H2CO	-104.7	SICH2	.....
H2CS	105.0	H2SIO	.....	C3H	602.5	SIC2H	.....	HCCP	.....
C4	1052.0	C3N	.....	C3O	.....	SIC3	.....	C3P	.....
C3S	.....	CH4	-66.8	SIH4	46.0	C2H3	262.2	CH2NH	.....
SICH3	.....	CH2PH	.....	H2C3	512.0	C3H2	.....	CH2CN	245.0
CH2CO	-44.6	SIC2H2	.....	CHOOH	-378.8	C4H	.....	HC3N	351.0
SIC3H	.....	C5	1081.0	SIC4	.....	C4P	.....	C4S	.....
C2H4	60.7	CH3OH	-190.7	C3H3	343.0	CH3CN	81.0	C4H2	440.0
C5H	.....	C6	1312.0	C5N	.....	C2H5	130.0	C3H4	195.1
CH3CHO	-155.0	H3C3N	184.0	C5H2	723.0	C6H	.....	HC5N	.....
C7	1325.0	C2H6	-69.1	HCOOCH3	-355.5	H3C4N	338.0	C6H2	652.0
C7H	.....	C8	1487.0	C7N	.....	CH3OCH3	-166.3	C2H5OH	-217.1
C5H4	425.0	C7H2	933.0	C8H	.....	HC7N	.....	C9	1554.0
C2H6CO	-217.2	H3C6N	.....	C8H2	864.0	C9H	.....	C9N	.....
C7H4	.....	C9H2	1142.0	HC9N	.....	H3C8N	.....	H-	143.2
C-	.....	O-	105.4	S-	75.0	OH-	-137.7	CN-	63.6
H+	1528.0	HE+	2372.0	C+	1797.6	N+	1873.1	O+	1560.7
NA+	603.4	MG+	884.2	SI+	1233.0	P+	1328.0	S+	1272.0
CL+	1371.0	FE+	1173.0	H2+	1488.3	HEH+	1352.0	CH+	1619.1
NH+	1678.1	OH+	1292.7	SIH+	1136.2	PH+	1219.0	HS+	1137.0
HCL+	1137.7	C2+	1992.0	CN+	1796.3	CO+	1238.3	SIC+	.....
CP+	1529.0	CS+	1356.0	CCL+	1243.0	N2+	1503.3	NO+	984.7
SIN+	.....	PN+	1249.0	NS+	1119.0	O2+	1164.7	SIO+	1001.2
PO+	778.0	SO+	1000.7	CLO+	1158.0	SIS+	.....	S2+	1031.0
H3+	1107.0	CH2+	1386.0	NH2+	1266.4	H2O+	977.9	SIH2+	1155.2
PH2+	1090.0	H2S+	991.0	H2CL+	867.0	C2H+	1689.0	HCN+	1448.0
HCO+	825.6	HOC+	963.0	HCSI+	.....	HCP+	1208.0	HCS+	1018.0
N2H+	1035.5	HNO+	1074.4	HNSI+	.....	HPN+	.....	HNS+	.....
O2H+	1108.5	SIOH+	.....	HPO+	.....	HSO+	.....	HSIS+	.....
S2H+	.....	C3+	2004.0	CCN+	1715.0	CNC+	1620.0	C2O+	.....
SIC2+	1594.0	CCP+	.....	C2S+	.....	NCO+	1289.0	SINC+	.....
CO2+	935.7	OCS+	936.0	NO2+	977.0	SO2+	894.0	CH3+	1098.0
NH3+	941.0	H3O+	597.0	SIH3+	992.0	PH3+	966.0	H3S+	797.0
C2H2+	1328.5	HCNH+	947.0	H2NC+	1109.0	H2CO+	944.5	SICH2+	.....
PCH2+	.....	H2CS+	1006.0	H2CCL+	962.1	H2NO+	939.7	SINH2+	889.9
PNH2+	.....	H2SIO+	.....	H2PO+	.....	H2S2+	913.0	C3H+	1593.0
CCNH+	1531.0	HC2O+	1096.0	C2HO+	.....	SIC2H+	.....	PC2H+	.....
HC2S+	.....	HNCO+	1015.0	SINCH+	.....	HCO2+	589.0	HOCS+	757.0
HSIO2+	.....	HSO2+	597.0	C4+	2187.0	C3N+	.....	C3O+	.....
SIC3+	.....	C3S+	.....	C2N2+	1594.8	CH4+	1140.0	NH4+	630.0
SIH4+	1170.0	C2H3+	1120.9	H3CO+	703.0	SICH3+	977.0	PCH3+	.....
H3CS+	901.0	PNH3+	.....	H3SIO+	.....	H3S2+	.....	C3H2+	1381.0
CH2CN+	1214.0	CH2CO+	882.7	SIC2H2+	.....	PC2H2+	.....	C4H+	1805.0

Table 2. continued

HC3N+	1474.0	HC3O+	971.0	SIC3H+	.....	PC3H+	.....	HC3S+	.....
C5+	2162.0	C4N+	.....	SIC4+	.....	C4P+	.....	C4S+	.....
CH5+	905.0	SiH5+	917.0	C2H4+	1074.0	CH4N+	745.0	CH2NH2+	.....
CH3OH+	856.2	SiCH4+	1015.0	PCH4+	.....	C3H3+	1075.0	H2C3H+	.....
CH3CN+	1258.0	CH3CO+	653.0	SIC2H3+	.....	PC2H3+	.....	CHOOH2+	403.0
C4H2+	1422.0	H2C3N+	1127.5	C3H2O+	1157.0	SIC3H2+	.....	C5H+	.....
HC4N+	.....	SIC4H+	.....	PC4H+	.....	HC4S+	.....	C6+	.....
C5N+	.....	C2H5+	914.0	CH3OH2+	567.0	C3H4+	1194.5	H4C2N+	817.0
CH3CHO+	831.9	PC2H4+	.....	C4H3+	1217.0	H3C3O+	751.0	C5H2+	.....
H2C4N+	.....	PC4H2+	.....	C6H+	.....	HC5N+	.....	C7+	2299.0
C2H6+	1043.0	C3H5+	969.0	C2H5O+	583.0	H5C2O+	.....	H4C3N+	817.0
COOCH4+	688.0	C5H3+	.....	H3C4N+	.....	C6H2+	1569.0	H2C5N+	.....
C7H+	.....	C8+	.....	C7N+	.....	C2H7+	856.4	C2H5OH+	793.1
C2H6O+	801.0	C4H5+	1076.0	H5C2O2+	386.0	C5H4+	1332.0	H4C4N+	.....
C6H3+	.....	H3C5N+	.....	C7H2+	.....	C8H+	.....	HC7N+	.....
C9+	2451.0	C2H6OH+	542.0	C2H7O+	507.0	C2H6CO+	719.7	C5H5+	1132.0
C6H4+	1400.0	C7H3+	.....	C8H2+	1741.0	H2C7N+	.....	C9H+	.....
C10+	.....	C9N+	.....	C3H6OH+	490.0	C6H5+	1141.3	C7H4+	.....
H4C6N+	.....	C8H3+	.....	H3C7N+	.....	C9H2+	.....	HC9N+	.....
C7H5+	.....	C8H4+	.....	C9H3+	.....	H2C9N+	.....	C8H5+	.....
C9H4+	.....	H4C8N+	.....	H3C9N+	.....	C9H5+	.....	ELECTR	.....

Notes: These data were compiled from the JANAF tables by H.-H. Lee (Ohio State University), with the exception of the heats of formation for the carbon chains C_n , $n = 2 - 7$, which come from Gingerich et al. (1994), and for the carbenes, H_2C_n , which come from Bettens et al. (1995).

- Reactions 395 - 3197. Ion-neutral reactions, including reactions of positive and negative ions.
- Reactions 3198 - 3634. Electron reactions, including radiative electron attachment of H, C, O and S, as well as radiative and dissociative recombination of positive ions.
- Reactions 3635 - 3645. Ionisation by cosmic-ray protons.
- Reactions 3646 - 3795. Photoreactions driven by the general interstellar ultraviolet radiation field.
- Reactions 3796 - 3864. Cosmic-ray-induced photoreactions.

3.2. The entry format

Each entry in Table 4 has the following form:

I, R1, R2, P1, P2, P3, P4, α , β , γ , Note

where I is the reaction number, R1 and R2 are reactants - R2 can be a cosmic-ray proton (CRP), an interstellar photon (PHOTON), or a cosmic-ray-induced photon (CR-PHOT) - and P1 to P4 are reaction products, with the entry format given by:

1X, A4, 1X, 4(1A7, 1X), A3, 1X, A3, 1PE8.2, 1X, 0PF5.2, 1X, F8.1, A9

For each reaction, α , β and γ are used to calculate the rate coefficient by:

$$k = \alpha(T/300)^\beta \exp(-\gamma/T) \quad \text{cm}^3 \text{ s}^{-1} \quad (1)$$

for two-body reactions, where T is the gas temperature,

$$k = \alpha \quad \text{s}^{-1} \quad (2)$$

for direct cosmic-ray ionisation (R2 = CRP),

$$k = \alpha \exp(-\gamma A_V) \quad \text{s}^{-1} \quad (3)$$

for interstellar photoreactions (R2 = PHOTON), where α represents the rate in the unshielded interstellar ultraviolet radiation field, A_V is the extinction at visible wavelengths caused by interstellar dust, γ is the parameter used to take into account the increased extinction of dust at ultraviolet wavelengths, and

$$k = \alpha \gamma / (1 - \omega) \quad \text{s}^{-1} \quad (4)$$

for cosmic-ray-induced photoreactions (R2 = CRPHOT), where ω is the grain albedo in the far ultraviolet, typically 0.6 at 150 nm, α the cosmic-ray ionisation rate and γ is the probability per cosmic-ray ionisation that the appropriate photoreaction takes place.

Grain surface reactions are not included in this database since there is, as yet, little consensus on the magnitude of the appropriate rate coefficients nor, indeed, on

Table 3. Permanent electric dipole moments in Debye of the neutral molecules

Species	μ_D	Species	μ_D	Species	μ_D
H2	0	CH	1.46	NH	1.3
OH	1.66	SiH	0.12	PH	0.64
HS	0.76	HCl	1.08	C2	0
CN	1.45	CO	0.112	SiC	1.7
CP	0.86	CS	1.96	CCl	< 0.65
N2	0	NO	0.153	SiN	~ 2.3
PN	2.75	NS	1.81	O2	0
SiO	3.1	PO	1.88	SO	1.55
ClO	1.24	SiS	1.73	S2	0
CH2	0.57	NH2	1.83	H2O	1.85
SiH2	0.18	PH2	....	H2S	0.97
C2H	0.8	HCN	2.98	HNC	2.7
HCO	~ 1.0	HCSi	....	HCP	0.3
HCS	....	HNO	1.67	HNSi	0.16
O2H	2.09	HPO	2.33	HS2	....
C3	0	CCN	0.6	CCO	1.3
SiC2	2.39	CCP	....	C2S	2.8
OCN	0.64	SiNC	2.03	CO2	0
OCS	0.71	N2O	0.16	NO2	0.32
SiO2	~ 0.5	SO2	1.63	CH3	0
NH3	1.47	SiH3	0	C2H2	0
H2O2	1.57	H2S2	1.2	H2CN	2.54
H2CO	2.33	SiCH2	....	H2CS	1.65
H2SiO	....	l-C3H	3.1	SiC2H	1.4
HCCP	0	C4	0	C3N	2.2
C3O	2.39	SiC3	....	C3P	....
C3S	3.7	CH4	0	SiH4	0
C2H3	~ 1.5	CH2NH	2.02	SiCH3	....
CH2PH	....	c-C3H2	3.4	CH2CN	1.62
CH2CO	1.42	SiC2H2	2.5	CHOOH	1.41
C4H	0.9	HC3N	3.6	SiC3H	....
C5	0	SiC4	6.3	C4P	....
C4S	~ 3.0	C2H4	0	CH3OH	1.7
C3H3	4.0	CH3CN	3.92	H2CCCC	4.5D
C5H	4.3	C6	0	C5N	~ 2.7
C2H5	....	C3H4 [CH3CCH]	0.78	CH3CHO	2.69
H3C3N [CH2CHCN]	3.89	C5H2	2.5	C6H	5.0
HC5N	4.33	C7	0	C2H6	0
HCOOCH3	1.77	H3C4N [CH3C3N]	4.91	C6H2	0
C7H	4.5	C8	0	C7N	3.0
CH3OCH3	1.3	C2H5OH	1.44	C5H4 [CH3C4H]	1.21
C7H2	2.5	C8H	5.0	HC7N	4.62
C9	0	C2H6CO	2.8	H3C6N [CH3C5N]	5.75
C8H2	0	C9H	4.7	C9N	3.3
C7H4 [CH3C6H]	1.5	C9H2	2.5	HC9N	4.84
H3C8N [CH3C7N]	5.47				

Notes: c-C3H = 2.4D; H2CCC = 4.1D; HCCCCH = 0D; H2C3H(propargyl) = 0.14D;
C3S from Suernam & Lovas (1994); CH3C3N and CH3C5N from Botschwina et al. (1994);
H2CCCC from Oswald & Botschwina (1995); H2C3H from Botschwina et al. (1995);
C5O from Botschwina, Flugge & Sebald 1995.

the mode of reaction. One important omission is the formation of H_2 which is known to take place on the surfaces of interstellar grains and for which a reasonable estimate of the rate can be deduced both from theory (Hollenbach & Salpeter 1972) and observation (Jura 1975a,b).

‘Note’ is a nine-column entry which gives information on the type and source of the data and has the form:-

- *Column 1:* An ‘M’ here means that the rate coefficient has been measured in the laboratory or, in the case of radiative association, has been deduced with the aid of an experiment on the analogous three-body association. For ion-neutral reactions, the rate coefficients are generally independent of temperature. An important exception are those reactions in which the neutral molecule has a large, say greater than 1 Debye, permanent electric dipole moment. In such cases, the rate coefficients generally increase at low temperatures (Adams et al. 1985). Table 3 gives electric dipole moments, where available, for the neutral species in the database.

Neutral-neutral reactions are usually studied experimentally at room temperature and above and therefore application of laboratory-determined rate coefficients to the low temperature environments of interstellar clouds is fraught with uncertainty. For example, it is possible that several reactions listed in the rate-file as not possessing an activation energy do, in fact, have small barriers (< 100 K) which are not evident in measurements done at room temperature and above.

- *Columns 2,3:* A two-letter symbol for the type of reaction. The symbols used are: AD, associative detachment; CD, collisional dissociation; CH, chemi-ionisation; CI, carbon insertion, involving a reaction between a carbon atom and a hydrocarbon ion; CP, cosmic-ray-induced photoreaction; CO, positive ion-neutral reaction in which H and/or H_2 are the only neutral products; CR, cosmic-ray ionisation; CT, charge transfer; DR, dissociative recombination with electrons; HA, hydrogen abstraction; MN, mutual neutralisation; NA, neutral radiative association; NE, neutral exchange; NI, negative ion-neutral; PD, photodissociation; PI, photoionisation; PM, photodetachment of electron; PN, positive ion-neutral; PT, proton transfer; RA, radiative association between a positive ion and a neutral molecule; RM, radiative electron (minus ion) attachment; RR, radiative recombination with electrons.
- *Column 4:* A label is used to denote the relevance of a reaction. In many instances the user will be interested in using only a subset of the reaction file, and may want, for ease of computation and analysis, to neglect unimportant reactions. Certain types of reaction may be excluded from a particular model. For example, reactions with large activation energy barriers, which are important in shocked gas, and photoreactions can be neglected in models of cold, dark clouds. In addition,

however, there are reactions whose neglect will not seriously compromise the results of most models. These are labelled with an ‘E’ in this column. This category is most used for ions, such as NH^+ and H_2O^+ , which have rapid reactions with H_2 . The low abundance of all other species X relative to H_2 in many astronomical regions, means that all ion-X reactions can be excluded. This criterion is only useful if H_2 is the dominant form of hydrogen. If a reaction should be included in any comprehensive model it is labelled with an ‘A’.

- *Column 5:* A digit is used to represent the accuracy of the data. We have used such labelling mainly for the ion-neutral and photoreactions, although sometimes the accuracy of the formula given may be restricted to a particular range of temperature. The following scheme has been used:
 - 1. Error $< 25\%$
 - 2. Error $< 50\%$
 - 3. Error to within a factor of 2
 - 4. Error within an order of magnitude
 - 5. Highly uncertain

We have not attempted to give the accuracy of the unmeasured reactions. The ion-neutral rate coefficients should be accurate to a factor of two, but it is possible that some of the reactions included here have different products or are unreactive.

- *Columns 6-9:* A label to the source of the data. Labels of the form ‘8010’ refer to the labelling scheme of Anicich & Huntress (1986) and Anicich (1993). Details of the letter codes, such as RJ91, are given in the footnote to Table 4. The label ‘NIST’, used for many of the neutral-neutral reactions, refers to the National Institute of Standards and Technology Chemical Kinetics Database - Ver. 6.0 (Mallard et al. 1994).

3.3. Alterations present in this release

Major changes to the original database include:-

- Recently measured reactions of neutral carbon with hydrocarbons (Clary et al. 1994), and low-temperature rate coefficients of CN with neutral molecules (Sims et al. 1992, 1993a,b).
- A more detailed chemistry of phosphorus (Millar 1991; Charnley & Millar 1994) with experimental data on ion-neutral reactions taken mainly from Adams et al. (1990). Among new phosphorus-bearing molecules included are the organo-phosphorus species HCP, CCP, HCCP, C_3P , C_4P and CH_2PH .
- The chemistry of complex hydrocarbons with neutral molecules containing up to nine carbon atoms, including the cyanopolyynes HC_7N and HC_9N . These reactions are taken from Herbst & Leung (1989).
- Separate reactions have been included for the linear and cyclic isomers of C_3H_2 . C_3H_2 and $C_3H_3^+$ denote the cyclic species and its proton and H_2C_3 denotes the

linear cumulene, H_2CCC , and $\text{H}_2\text{C}_3\text{H}^+$ its protonated form.

- The photoreactions caused by the ultraviolet photons induced by the cosmic-ray ionisation of H_2 , the so-called Prasad-Tarafdar mechanism (Prasad & Tarafdar 1983), with rates taken from Gredel et al. (1987, 1989).
- Specific reactions for the synthesis of some recently detected molecules, including CCO (Ohishi et al. 1991) and CH_2CN (Herbst & Leung 1990), and a more detailed chemistry for vinyl cyanide, CH_2CHCN , based on the laboratory work of Petrie et al. (1992).
- Photorates taken from the compilation of Roberge et al. (1991) and scaled to the Draine (1978) UV radiation field.
- The inclusion of chemistry appropriate for hot molecular cores, mostly taken from the work of Charnley et al. (1992).

It should be noted that while the reaction set is closed, i.e. all species have at least one formation and destruction reaction, several of the hot core species are probably formed by grain surface reactions since they do not have efficient gas-phase routes to their syntheses. As a result, the species C_2H_5 , C_2H_6 , and SiH_4 and their ions should not be included in a purely gas-phase scheme, since they have no gas-phase formation routes. In hot molecular core models, they are assumed to be present with some initial abundance determined by grain surface reactions.

3.4. Particular reactions

3.4.1. Neutral-neutral reactions (Nos. 1 - 394)

The original rate file (Millar et al. 1991b) was ordered slightly differently in that the first reaction block listed those reactions possessing activation energies. The rationale was that in a particular low-temperature application, this block of reactions could be edited out. However, it turns out that a number of reactions previously thought to possess activation energies do not and vice versa. In addition, the speed of modern computers means that it is not much more costly to compute a chemical model with all reactions in the rate file. We have therefore gathered all neutral-neutral reactions in the first block.

Additional reactions to this section include those associated with phosphorus chemistry, e.g. $\text{O} + \text{C}_n\text{P}$ ($n = 1 - 4$), taken from Millar (1991) and large carbon-chain chemistry, in particular reactions involving atomic oxygen (Herbst & Leung 1989) and atomic carbon (Haider & Husain 1993a,b; Clary et al. 1994), the chemistry of H_2CN (Marston et al. 1989), and low-temperature reactions of CN with several neutral molecules (Sims et al. 1992, 1993a,b). Several of the reactions involve non-conservation of spin and may have rate coefficients smaller than tabulated or possess activation energy barriers. In some systems, the presence of low-lying electronic states may alter the products and rate coefficients.

Much effort has gone in to evaluating the neutral-neutral rate coefficients and in trying to include as many experimental determinations as possible. We have therefore searched the National Institute of Standards and Technology (NIST) Chemical Kinetics Database - Version 6 (Mallard et al. 1994) and included what we believe to be the most appropriate form of the rate coefficient. It is important to remember that neutral-neutral reactions are usually studied at room temperature and above so that application of laboratory-determined rate coefficients to low-temperature interstellar cloud models is often insecure. For example, it is possible that several reactions listed as having no activation energy do, in fact, have small barriers (< 100 K) which are not evident in measurements performed at room temperature. In addition, some reactions in the NIST Database are best characterised by a negative activation energy barrier since their rate coefficients increase with decreasing temperature. In order to prevent a serious over-estimate of these rate coefficients at 10 K, we have generally preferred to adopt an alternative, although still accurate, form for the rate coefficients, for example, one involving a power-law dependence on temperature. Normally, the NIST Database contains such alternative formulations. Roughly one half of the neutral-neutral reactions have been studied in the laboratory.

Finally, it is important to note that rate coefficients for the collisional dissociation (CD) reactions are dependent on both density and temperature and reference to the appropriate values to use in particular circumstances should be made to the original papers (Roberge & Dalgarno 1982; Dove & Mandy 1986).

3.4.2. Ion-neutral reactions (Nos. 395 - 3197)

This block includes the reactions of some negative ions as well as the more usual positive ion-neutral reactions. Around one-third of the 2800 reactions have experimentally determined rate coefficients, with several tens of rate coefficients studied at temperatures less than 100 K. The accuracy of the remaining rate coefficients is fairly high since theoretical methods for determining these depend chiefly on long-range forces and are very reliable for exothermic systems. At temperatures less than about 50 K, the presence of a neutral having a large electric dipole increases the rate coefficient (Adams et al. 1985). As mentioned above, there are various approximations which can be used to derive the low-temperature rate coefficients for such systems.

There are some limitations on the data presented here. For example, the radiative association reactions are labelled ‘M’, for measured, although in fact it is their three-body analogues which have been studied experimentally. The association rate coefficients are derived theoretically from these rates and are parameterised in a form which is valid only for the 10 – 50 K temperature range in general. At higher temperatures, different values and different

temperature dependencies can apply. Furthermore, some important reactions, in particular the $\text{N}^+ - \text{H}_2$ and $\text{C}_2\text{H}_2 - \text{H}_2$ reactions, have rate coefficients not easily approximated by the format in Table 4. Such reactions are discussed in detail by Millar et al. (1991b).

3.4.3. Reactions involving electrons (Nos. 3198 - 3634)

This block includes electron attachment (of H, C, O and S) as well as radiative and dissociative recombination of positive ions. An increasing number of dissociative recombination reactions have been studied in the laboratory (Herd et al. 1990; Amano 1990; Adams et al. 1991; Mitchell 1990; Canosa et al. 1991) and reviews have been given by Adams (1992) and several in a conference proceedings (Rowe et al. 1993). Branching ratios still remain an area of uncertainty in most cases. The dissociative recombination rate coefficient of H_3^+ remains a matter of some debate (Amano 1990; Canosa et al. 1991; Smith & Spaniel 1993; Sundstrom et al. 1994) although there has been a significant narrowing of the differences between rate coefficients measured in several laboratories. In general, calculated molecular abundances are not very sensitive to the total dissociative recombination rate coefficient but are sensitive to the adopted branching ratios.

3.4.4. Photoprocesses (Nos. 3646 - 3795)

We have added a number of photoreactions taken from the compilation of Roberge et al. (1991), scaled to the interstellar radiation field determined by Draine (1978). Photorates should be used with care for a number of reasons. Some species, most importantly H_2 and CO, dissociate via absorption of line radiation and thus self-shield. This is not included in the rate file and approaches such as those discussed by van Dishoeck & Black (1988), Lee et al. (1996) and Warin et al. (1996) need to be incorporated into chemical models. In addition, the intensity of ultraviolet radiation at any point in a cloud is determined by the properties of the small interstellar dust grains which control the transfer of radiation. Both the pre-exponential (α) and the exponential (γ) factors can be different for different grain populations (see Roberge et al. 1991). In some cases, a bi-exponential formula is to be preferred (see van Dishoeck 1988 for a discussion of this point). Finally, the rates are given for the standard interstellar radiation field incident on a slab and need to be re-evaluated when the field in a particular application is not a simple scaling of the interstellar field (Spaans et al. 1995) or when the cloud structure is clumpy (Boissé 1991).

3.4.5. Cosmic-ray-induced photoreactions (Nos. 3796 - 3864)

The Prasad-Tarafdar mechanism generates an internal source of UV photons in interstellar clouds. This source

of photons becomes important in regions in which the extinction of the external field is large. We have taken the appropriate probabilities, (γ), of reaction per cosmic-ray ionisation from Gredel et al. (1987, 1989) and Rawlings (1992) who has calculated photoionisation rates for some metal ions. Note that the value of γ for CO is dependent on the details of the cloud model (temperature and line-width). The form adopted here is a fit to the temperature-dependent values listed by Gredel et al. (1987).

4. Model results

To facilitate the use of the rate file as a standard package, we have calculated the pseudo-time-dependent evolution of the 395 species in a dark cloud model in which $n(\text{H}_2) = 10^4 \text{ cm}^{-3}$, $T = 10 \text{ K}$, and $A_V = 10$ magnitudes. We have adopted the same initial elemental abundances as in our calculation with the 1990 version: $\text{H:He:C:N:O:Na:Mg:Si:P:S:Cl:Fe} = 1 : 0.14 : 7.310^{-5} : 2.1410^{-5} : 1.7610^{-4} : 2.010^{-9} : 3.010^{-9} : 3.010^{-9} : 3.010^{-9} : 2.010^{-8} : 4.010^{-9} : 3.010^{-9}$, and give both early-time ($3.162 \cdot 10^5 \text{ yrs}$) and steady-state (10^8 yrs) abundances in Table 5. In addition to the gas-phase reactions of Table 4, we have included the grain surface formation of H_2 with a rate coefficient of $9.5 \cdot 10^{-18} n(\text{H}) \text{ cm}^{-3} \text{ s}^{-1}$.

The calculated abundances show some significant differences with those published in Millar et al. (1991b). We discuss these noting those reactions which have caused the changes and indicating the most important of these reactions which can be studied further in the laboratory. We concentrate on the differences in steady-state results since it is more apparent which differences are caused by the new rate coefficients; at early time, differences can be caused by small changes in the time scale for chemical evolution.

4.1. Small molecules

The abundance of C atoms is an order of magnitude larger in this model. The major source of the increase in CI is due to the reaction $\text{C}^+ + \text{NO} \rightarrow \text{C} + \text{NO}^+$. Although the rate coefficient for this reaction is unchanged in this revision of the ratefile, the NO abundance is larger by ~ 100 due to an increase in the rate coefficient of the $\text{N} + \text{OH} \rightarrow \text{NO} + \text{H}$ reaction. The increase is due to an adoption of a different dependence on temperature, from $(T/300)^{0.5}$ to $(T/300)^{-0.25}$, an increase of ~ 13 at a temperature of 10 K. This behaviour also is an indication of some of the difficulties in tracing the origin of the changes in abundances; an alteration to one rate coefficient can propagate through to species other than those directly involved in the reaction concerned. In our analysis here, we have made use of software which tabulates, for all species, the relative weights of the various formation and destruction reactions.

The OH abundance is also an order of magnitude larger due to a decrease in the rate coefficient of the $\text{O} + \text{OH} \rightarrow$

Table 5. Fractional abundances with respect to H₂ at 3.16 10⁵ (early time) and 10⁸ (steady state) years

Species	Early time	Steady state	Species	Early time	Steady state	Species	Early time	Steady state
H	5.957e-04	1.018e-04	He	2.801e-01	2.800e-01	C	1.314e-05	1.842e-09
N	6.427e-06	1.813e-07	O	2.273e-04	2.818e-05	Na	1.306e-10	2.135e-10
Mg	4.030e-10	4.559e-10	Si	1.415e-09	2.264e-11	P	3.685e-09	2.791e-09
S	4.009e-09	2.174e-09	Cl	7.444e-09	5.904e-09	Fe	1.814e-10	2.709e-10
H ₂	1.000e+00	1.000e+00	CH	1.266e-08	2.857e-10	NH	6.779e-11	4.560e-10
OH	2.102e-07	9.601e-07	SiH	2.787e-13	5.825e-14	PH	3.335e-12	2.324e-11
HS	9.569e-13	1.547e-11	HCl	5.585e-10	2.096e-09	C ₂	1.049e-08	3.295e-10
CN	8.252e-08	1.007e-10	CO	1.147e-04	1.426e-04	SiC	2.624e-11	6.969e-13
CP	1.752e-12	8.334e-14	CS	3.302e-08	2.730e-09	CCl	1.532e-14	4.466e-15
N ₂	1.783e-05	1.960e-05	NO	2.189e-07	3.267e-06	SiN	7.111e-13	3.104e-12
PN	1.987e-09	2.844e-10	NS	9.514e-15	4.543e-14	O ₂	1.082e-06	8.424e-05
SiO	4.441e-09	5.512e-09	PO	3.175e-10	2.898e-09	SO	3.258e-11	5.223e-09
ClO	0.000e+00	0.000e+00	SiS	1.020e-17	3.998e-18	S ₂	2.707e-18	8.083e-17
CH ₂	9.250e-10	8.366e-12	NH ₂	6.170e-10	3.653e-09	H ₂ O	5.927e-06	2.317e-06
SiH ₂	3.477e-15	6.068e-15	PH ₂	1.863e-14	3.641e-13	H ₂ S	4.446e-12	2.857e-11
C ₂ H	2.655e-09	9.229e-12	HCN	6.780e-08	3.971e-09	HNC	3.331e-08	6.849e-09
HCO	2.699e-10	2.856e-11	HCSi	5.583e-14	1.258e-14	HCP	1.403e-12	5.524e-14
HCS	8.245e-13	4.558e-14	HNO	7.483e-10	4.133e-09	HNSi	1.369e-11	1.633e-11
O ₂ H	5.277e-13	1.853e-12	HPO	2.308e-14	3.018e-13	HS ₂	3.349e-16	5.069e-15
C ₃	8.383e-09	2.151e-10	CCN	1.127e-07	5.558e-11	CCO	1.913e-10	1.585e-11
SiC ₂	4.566e-12	1.803e-13	CCP	1.460e-13	3.121e-14	C ₂ S	1.280e-09	5.512e-11
OCN	3.227e-09	2.366e-09	SiNC	8.539e-16	1.842e-17	CO ₂	9.977e-08	3.026e-06
OCS	5.170e-11	3.667e-11	N ₂ O	2.926e-11	2.757e-11	NO ₂	2.072e-11	1.156e-10
SiO ₂	3.458e-11	4.310e-10	SO ₂	8.096e-12	2.968e-08	CH ₃	2.182e-09	2.818e-10
NH ₃	4.941e-08	1.379e-07	SiH ₃	1.884e-19	8.399e-19	C ₂ H ₂	2.333e-08	6.225e-08
H ₂ O ₂	0.000e+00	0.000e+00	H ₂ S ₂	1.121e-16	1.686e-15	H ₂ CN	1.699e-11	3.613e-13
H ₂ CO	9.860e-07	1.386e-08	SiCH ₂	1.211e-11	7.527e-15	H ₂ CS	9.818e-10	1.838e-11
H ₂ SiO	7.792e-18	2.226e-16	C ₃ H	1.142e-06	2.181e-09	SiC ₂ H	6.339e-12	6.101e-13
HCCP	2.768e-14	1.516e-14	C ₄	5.404e-09	2.865e-11	C ₃ N	3.032e-08	9.443e-12
C ₃ O	1.619e-10	1.346e-10	SiC ₃	1.414e-12	6.108e-14	C ₃ P	7.319e-14	4.053e-15
C ₃ S	5.478e-10	8.591e-12	CH ₄	7.289e-06	1.294e-07	SiH ₄	5.988e-18	6.674e-18
C ₂ H ₃	1.967e-11	1.534e-13	CH ₂ NH	1.908e-18	3.668e-22	SiCH ₃	4.115e-12	2.392e-15
CH ₂ PH	7.341e-15	1.219e-15	H ₂ C ₃	2.612e-10	2.431e-10	C ₃ H ₂	9.579e-09	5.717e-09
CH ₂ CN	5.246e-08	7.546e-11	CH ₂ CO	1.015e-07	3.899e-10	SiC ₂ H ₂	3.076e-12	3.583e-13
CHOOH	2.575e-08	2.583e-08	C ₄ H	8.634e-07	7.133e-09	HC ₃ N	3.849e-08	1.719e-10
SiC ₃ H	7.301e-12	6.889e-15	C ₅	4.235e-09	3.164e-11	SiC ₄	6.166e-15	8.828e-18
C ₄ P	3.893e-14	2.976e-15	C ₄ S	1.254e-11	1.548e-13	C ₂ H ₄	4.487e-10	1.190e-11
CH ₃ OH	1.544e-07	7.024e-10	C ₃ H ₃	1.845e-08	1.499e-11	CH ₃ CN	1.859e-08	8.902e-12
C ₄ H ₂	4.029e-11	2.874e-11	C ₅ H	2.435e-08	3.980e-11	C ₆	2.524e-09	6.535e-12
C ₅ N	8.448e-10	4.236e-13	C ₂ H ₅	6.596e-16	3.240e-17	C ₃ H ₄	2.904e-11	8.753e-12
CH ₃ CHO	2.622e-10	3.961e-10	H ₃ C ₃ N	1.305e-10	1.005e-14	C ₅ H ₂	1.331e-10	2.915e-11
C ₆ H	1.545e-07	4.490e-11	HC ₅ N	1.433e-09	4.408e-13	C ₇	1.075e-09	1.652e-12
C ₂ H ₆	4.955e-20	4.299e-20	HCOOCH ₃	3.324e-11	2.943e-15	H ₃ C ₄ N	3.651e-10	3.805e-14
C ₆ H ₂	9.583e-11	1.472e-11	C ₇ H	2.276e-08	5.968e-12	C ₈	5.126e-10	3.882e-13
C ₇ N	1.077e-10	5.256e-14	CH ₃ OCH ₃	4.353e-09	1.921e-13	C ₂ H ₅ OH	3.743e-12	6.971e-14
C ₅ H ₄	4.834e-11	2.398e-12	C ₇ H ₂	1.401e-11	2.681e-12	C ₈ H	2.060e-08	2.338e-12
HC ₇ N	7.085e-10	6.667e-14	C ₉	1.408e-10	2.857e-14	C ₂ H ₆ CO	1.710e-13	2.331e-15
H ₃ C ₆ N	3.030e-11	7.363e-17	C ₈ H ₂	9.670e-12	1.089e-13	C ₉ H	2.850e-09	6.051e-14
C ₉ N	7.549e-12	1.633e-16	C ₇ H ₄	1.012e-11	2.745e-14	C ₉ H ₂	5.902e-10	2.959e-14
HC ₉ N	6.258e-11	2.065e-16	H ₃ C ₈ N	1.074e-11	1.062e-17	H ⁻	5.453e-13	1.404e-12
C ⁻	3.206e-15	1.013e-18	O ⁻	2.134e-17	2.531e-18	S ⁻	5.883e-18	5.418e-18
OH ⁻	1.526e-14	8.378e-14	CN ⁻	1.841e-16	1.562e-16	H ⁺	5.968e-10	2.241e-10
He ⁺	1.443e-09	9.921e-10	C ⁺	7.240e-09	2.313e-09	N ⁺	7.385e-11	5.725e-11
O ⁺	4.938e-15	1.216e-13	Na ⁺	3.871e-09	3.787e-09	Mg ⁺	5.599e-09	5.544e-09
Si ⁺	2.797e-11	1.058e-11	P ⁺	3.189e-12	2.604e-13	S ⁺	2.412e-11	1.720e-11
Cl ⁺	2.718e-18	6.907e-18	Fe ⁺	5.821e-09	5.729e-09	H ₂ ⁺	1.139e-12	1.137e-12
HeH ⁺	2.763e-14	2.759e-14	CH ⁺	2.053e-13	1.150e-16	NH ⁺	1.002e-14	7.759e-15
OH ⁺	8.706e-13	3.686e-13	SiH ⁺	4.106e-14	4.610e-15	PH ⁺	1.939e-13	5.856e-13
HS ⁺	2.498e-13	6.406e-13	HCl ⁺	2.948e-17	3.854e-17	C ₂ ⁺	3.435e-16	7.171e-17
CN ⁺	2.208e-16	1.703e-17	CO ⁺	9.220e-15	5.227e-14	SiC ⁺	5.752e-19	9.203e-21

Table 5. continued

Species	Early time	Steady state	Species	Early time	Steady state	Species	Early time	Steady state
CP ⁺	1.438e-20	2.726e-22	CS ⁺	2.144e-16	1.330e-17	CCl ⁺	5.920e-14	7.417e-14
N ₂ ⁺	8.237e-15	6.228e-15	NO ⁺	3.808e-11	1.503e-10	SiN ⁺	1.450e-15	7.587e-16
PN ⁺	1.143e-14	1.307e-15	NS ⁺	7.704e-15	2.294e-15	O ₂ ⁺	1.332e-11	4.472e-10
SiO ⁺	5.158e-17	3.322e-17	PO ⁺	1.118e-12	1.461e-12	SO ⁺	4.360e-13	6.279e-12
ClO ⁺	0.000e+00	0.000e+00	SiS ⁺	1.104e-18	1.449e-18	S ₂ ⁺	1.409e-18	1.073e-17
H ₃ ⁺	4.686e-09	7.142e-09	CH ₂ ⁺	1.761e-13	1.369e-15	NH ₂ ⁺	4.793e-14	3.772e-14
H ₂ O ⁺	1.094e-12	4.745e-13	SiH ₂ ⁺	3.159e-16	2.392e-16	PH ₂ ⁺	2.369e-14	1.003e-14
H ₂ S ⁺	2.453e-14	1.020e-14	H ₂ Cl ⁺	2.735e-13	5.698e-13	C ₂ H ⁺	5.704e-15	1.362e-16
HCN ⁺	1.674e-15	6.732e-17	HCO ⁺	6.991e-09	1.329e-08	HOC ⁺	7.057e-14	2.856e-14
HCSi ⁺	1.486e-18	3.693e-20	HCP ⁺	4.919e-20	2.252e-21	HCS ⁺	3.138e-11	3.958e-12
N ₂ H ⁺	4.921e-10	8.862e-10	HNO ⁺	9.867e-12	2.700e-10	HNSi ⁺	1.925e-20	4.981e-20
HPN ⁺	4.360e-13	9.035e-14	HNS ⁺	3.762e-18	2.238e-17	O ₂ H ⁺	3.671e-18	2.859e-16
SiOH ⁺	2.177e-12	2.495e-12	HPO ⁺	2.107e-13	6.477e-13	HSO ⁺	9.224e-15	2.565e-12
HSiS ⁺	2.721e-20	1.386e-20	S ₂ H ⁺	6.126e-20	3.089e-19	C ₃ ⁺	1.601e-14	2.075e-17
CCN ⁺	1.563e-11	6.812e-13	CNC ⁺	2.025e-11	3.960e-13	C ₂ O ⁺	1.996e-14	5.594e-16
SiC ₂ ⁺	1.781e-19	1.374e-21	CCP ⁺	7.750e-17	1.752e-18	C ₂ S ⁺	5.488e-18	7.642e-20
NCO ⁺	8.245e-15	8.299e-15	SiNC ⁺	1.273e-14	1.986e-15	CO ₂ ⁺	2.415e-17	5.193e-16
OCS ⁺	4.778e-13	8.502e-15	NO ₂ ⁺	1.494e-17	5.135e-17	SO ₂ ⁺	1.927e-18	2.984e-15
CH ₃ ⁺	4.771e-10	4.610e-12	NH ₃ ⁺	6.331e-12	5.130e-12	H ₃ O ⁺	4.811e-09	2.404e-09
SiH ₃ ⁺	2.180e-16	5.304e-17	PH ₃ ⁺	7.234e-15	2.289e-14	H ₃ S ⁺	8.269e-15	4.029e-14
C ₂ H ₂ ⁺	6.201e-12	7.846e-14	HCNH ⁺	1.096e-10	1.471e-11	H ₂ NC ⁺	1.686e-11	1.176e-11
H ₂ CO ⁺	7.810e-11	4.457e-13	SiCH ₂ ⁺	7.236e-15	4.053e-16	PCH ₂ ⁺	3.215e-13	6.782e-16
H ₂ C ⁺	1.838e-14	1.400e-16	H ₂ CCl ⁺	4.614e-15	1.747e-16	H ₂ NO ⁺	9.342e-14	8.265e-13
SiNH ₂ ⁺	1.743e-14	2.406e-14	PNH ₂ ⁺	9.396e-16	5.462e-16	H ₂ SiO ⁺	1.319e-16	4.174e-18
H ₂ PO ⁺	3.681e-15	3.977e-15	H ₂ S ₂ ⁺	5.906e-19	4.455e-18	C ₃ H ⁺	1.286e-13	3.400e-15
CCNH ⁺	6.970e-11	6.687e-14	HC ₂ O ⁺	1.496e-10	1.620e-12	C ₂ HO ⁺	1.596e-12	2.631e-15
SiC ₂ H ⁺	9.784e-15	2.191e-15	PC ₂ H ⁺	1.564e-15	2.925e-16	HC ₂ S ⁺	3.297e-13	3.368e-14
HNCO ⁺	1.115e-17	3.513e-19	SiNCH ⁺	2.058e-16	6.024e-19	HCO ₂ ⁺	5.703e-12	2.613e-10
HOCS ⁺	8.710e-15	1.102e-14	HSiO ₂ ⁺	1.074e-14	2.450e-13	HSO ₂ ⁺	7.265e-16	3.229e-12
C ₄ ⁺	4.432e-14	9.769e-17	C ₃ N ⁺	3.300e-16	3.298e-19	C ₃ O ⁺	6.483e-15	1.862e-15
SiC ₃ ⁺	4.277e-13	3.454e-16	C ₃ S ⁺	4.551e-13	6.878e-16	C ₂ N ₂ ⁺	6.276e-20	2.964e-22
CH ₄ ⁺	4.963e-13	2.518e-15	NH ₄ ⁺	3.113e-11	3.947e-11	SiH ₄ ⁺	7.124e-27	1.424e-26
C ₂ H ₃ ⁺	3.294e-10	2.742e-11	H ₃ CO ⁺	4.959e-10	9.645e-12	SiCH ₃ ⁺	6.055e-15	4.954e-18
PCH ₃ ⁺	1.035e-14	5.800e-16	H ₃ CS ⁺	5.868e-13	1.059e-14	PNH ₃ ⁺	8.259e-17	6.332e-16
H ₃ SiO ⁺	1.605e-20	3.220e-19	H ₃ S ₂ ⁺	2.937e-19	2.360e-18	C ₃ H ₂ ⁺	2.019e-10	7.044e-13
CH ₂ CN ⁺	1.331e-11	6.345e-15	CH ₂ CO ⁺	9.790e-12	1.288e-14	SiC ₂ H ₂ ⁺	5.116e-15	4.189e-16
PC ₂ H ₂ ⁺	1.768e-16	6.898e-16	C ₄ H ⁺	2.824e-14	6.819e-17	HC ₃ N ⁺	4.294e-13	2.489e-16
HC ₃ O ⁺	6.094e-14	8.105e-14	SiC ₃ H ⁺	6.119e-15	9.370e-16	PC ₃ H ⁺	9.918e-15	2.864e-17
HC ₃ S ⁺	1.428e-13	5.049e-15	C ₅ ⁺	1.153e-14	2.290e-17	C ₄ N ⁺	1.514e-14	2.161e-17
SiC ₄ ⁺	3.244e-13	1.051e-15	C ₄ P ⁺	3.093e-19	9.275e-21	C ₄ S ⁺	2.780e-13	1.710e-15
CH ₅ ⁺	7.992e-10	1.438e-11	SiH ₅ ⁺	1.171e-20	6.608e-21	C ₂ H ₄ ⁺	1.571e-10	3.871e-12
CH ₄ N ⁺	3.434e-13	9.784e-15	CH ₂ NH ₂ ⁺	1.727e-17	3.470e-21	CH ₃ OH ⁺	2.038e-13	2.879e-15
SiCH ₄ ⁺	4.830e-15	3.678e-18	PCH ₄ ⁺	1.783e-15	3.913e-17	C ₃ H ₃ ⁺	7.634e-11	2.265e-11
H ₂ C ₃ H ⁺	8.520e-11	6.167e-12	CH ₃ CN ⁺	3.318e-12	5.781e-15	CH ₃ CO ⁺	4.877e-11	2.478e-13
SiC ₂ H ₃ ⁺	2.954e-15	4.800e-16	PC ₂ H ₃ ⁺	2.274e-18	1.158e-17	CHOOH ₂ ⁺	2.490e-11	2.425e-11
C ₄ H ₂ ⁺	3.063e-10	3.880e-12	H ₂ C ₃ N ⁺	3.875e-11	1.653e-13	C ₃ H ₂ O ⁺	9.380e-15	1.541e-16
SiC ₃ H ₂ ⁺	9.533e-15	9.229e-18	C ₅ H ⁺	4.093e-11	9.152e-14	HC ₄ N ⁺	7.294e-20	8.481e-21
SiC ₄ H ⁺	1.490e-15	2.875e-19	PC ₄ H ⁺	1.890e-14	1.905e-16	HC ₄ S ⁺	1.914e-14	1.703e-16
C ₆ ⁺	2.422e-14	7.605e-18	C ₅ N ⁺	3.507e-17	2.212e-21	C ₂ H ₅ ⁺	2.096e-11	5.692e-15
CH ₃ OH ₂ ⁺	1.553e-10	8.935e-13	C ₃ H ₄ ⁺	3.161e-12	5.739e-15	H ₄ C ₂ N ⁺	3.902e-11	2.337e-14
CH ₃ CHO ⁺	4.539e-14	2.356e-14	PC ₂ H ₄ ⁺	1.556e-19	1.826e-21	C ₄ H ₃ ⁺	5.794e-13	1.612e-14
H ₃ C ₃ O ⁺	4.960e-12	5.363e-13	C ₅ H ₂ ⁺	1.575e-11	3.720e-14	H ₂ C ₄ N ⁺	1.197e-18	8.508e-21
PC ₄ H ₂ ⁺	4.415e-19	2.305e-19	C ₆ H ⁺	1.752e-12	7.330e-16	HC ₅ N ⁺	1.257e-16	4.615e-20
C ₇ ⁺	2.575e-15	5.115e-19	C ₂ H ₆ ⁺	1.163e-19	1.173e-20	C ₃ H ₅ ⁺	3.688e-12	1.241e-14
C ₂ H ₅ O ⁺	9.823e-13	1.403e-12	H ₅ C ₂ O ⁺	5.249e-14	3.618e-18	H ₄ C ₃ N ⁺	1.021e-13	1.135e-17
COOCH ₄ ⁺	1.040e-14	3.116e-19	C ₅ H ₃ ⁺	2.892e-12	4.345e-14	H ₃ C ₄ N ⁺	1.197e-18	8.507e-21
C ₆ H ₂ ⁺	2.083e-11	1.161e-14	H ₂ C ₅ N ⁺	3.481e-12	1.655e-15	C ₇ H ⁺	2.635e-12	8.220e-16
C ₈ ⁺	1.316e-13	1.167e-17	C ₇ N ⁺	2.258e-18	1.987e-23	C ₂ H ₇ ⁺	5.625e-24	2.977e-24
C ₂ H ₅ OH ⁺	6.301e-16	4.016e-18	C ₂ H ₆ O ⁺	9.080e-13	1.356e-17	C ₄ H ₅ ⁺	4.711e-13	3.534e-16
H ₅ C ₂ O ₂ ⁺	6.440e-14	6.368e-18	C ₅ H ₄ ⁺	2.235e-12	9.805e-16	H ₄ C ₄ N ⁺	9.848e-13	1.084e-16

Table 5. continued

Species	Early time	Steady state	Species	Early time	Steady state	Species	Early time	Steady state
$C_6H_3^+$	1.274e-12	3.407e-15	$H_3C_5N^+$	8.009e-14	7.655e-19	$C_7H_2^+$	6.734e-12	2.375e-15
C_8H^+	7.079e-16	7.630e-20	HC_7N^+	3.911e-15	7.367e-19	C_9^+	6.425e-15	2.188e-19
$C_2H_6OH^+$	8.073e-12	2.981e-16	$C_2H_7O^+$	1.087e-14	1.655e-16	$C_2H_6CO^+$	5.486e-17	2.540e-19
$C_5H_5^+$	5.572e-12	1.922e-15	$C_6H_4^+$	3.058e-13	1.739e-15	$C_7H_3^+$	3.965e-13	1.434e-15
$C_8H_2^+$	5.335e-12	8.817e-16	$H_2C_7N^+$	2.750e-13	4.765e-17	C_9H^+	1.047e-12	4.157e-17
C_{10}^+	4.670e-13	3.256e-18	C_9N^+	8.971e-19	1.005e-24	$C_3H_6OH^+$	4.695e-16	7.619e-18
$C_6H_5^+$	3.793e-13	2.386e-17	$C_7H_4^+$	1.747e-13	5.583e-18	$H_4C_6N^+$	3.466e-14	1.216e-19
$C_8H_3^+$	1.053e-13	2.995e-17	$H_3C_7N^+$	4.620e-13	2.710e-17	$C_9H_2^+$	8.292e-13	2.493e-17
HC_9N^+	5.872e-16	2.679e-21	$C_7H_5^+$	4.788e-13	1.190e-17	$C_8H_4^+$	2.203e-13	8.548e-18
$C_9H_3^+$	1.543e-13	1.487e-17	$H_2C_9N^+$	3.082e-14	1.634e-19	$C_8H_5^+$	1.531e-19	3.177e-21
$C_9H_4^+$	1.645e-13	8.081e-19	$H_4C_8N^+$	1.576e-14	1.819e-20	$H_3C_9N^+$	1.846e-14	6.975e-20
$C_9H_5^+$	7.636e-19	8.565e-21	e^-	4.571e-8	4.375e-8			

$O_2 + H$ reaction. The O_2 abundance is unchanged by this change to the rate coefficient because the ‘throughput’, which depends on the product $kn(O)n(OH)$ is unchanged. This can only occur when the reaction is the major route to formation. At steady state the reaction contributes 83% to the loss rate of OH.

The increased C and NO abundances have a minor effect on the abundance of CN since they form this molecule at the 30% level. The major route to CN is the dissociative recombination of $HCNH^+$ with electrons, although the branching ratio to CN (and those to HCN and HNC) are only estimated theoretically. An experimental determination of these ratios is needed. The rate of formation of CN is increased by about a factor of 1.5 but the CN abundance falls by about 30 because the reaction $CN + O_2 \rightarrow CO + NO$ is about 70 times faster in RATE95 than in RATE90. This reaction has, through altering the abundance of CN, an affect on the abundance of other species. Note that the $CN + O_2$ reaction rate coefficient has been measured down to 13 K.

The increased abundances of NO and OH also cause the N atom abundance to decrease by about 40 because the reactions of N with NO and OH are very efficient at converting atomic nitrogen into nitrogen-bearing molecules.

Other molecules, particularly oxides, are affected by the increased OH abundance. They include CO_2 , which is a factor of 10 larger, and which is formed by the $CO + OH$ reaction. CO_2 is unobservable from the ground, except indirectly via its protonated form, $HOCO^+$, but should be detectable at IR wavelengths by the *ISO* mission. The only phosphorus molecule yet detected in interstellar clouds, PN, decreases by an order of magnitude due to the indirect effects of OH.

The uncertainty attached to the calculated abundance of OCN in this model calculation is difficult to quantify as it is uncertain how this species forms in interstellar clouds. In the ratefile, it is formed in the reaction of CN with O_2 , which is less efficient due to the decrease in the CN

abundance. The OCN abundance is a factor of 20 lower in this model.

Finally, the abundance of HPO decreases by about 30 due to the inclusion of the reaction $O + HPO \rightarrow PO + OH$, which was not included in RATE90.

4.2. Carbon-chain species

The C_2H abundance is a factor of around 100 less because of more rapid loss with O and O_2 . These reactions, which were assumed to have activation energy barriers of 250 K and 3500 K, respectively, are now taken to be activationless. The C_4H_2 molecule, which in RATE90 was produced primarily by the $C_2H + C_2H_2 \rightarrow C_4H_2 + H$ reaction, falls by an order of magnitude as the C_2H abundance is lower. HC_3N also falls by an order of magnitude. Although the formation reaction $CN + C_2H_2 \rightarrow HC_3N + H$ has a larger rate coefficient in RATE95, the decrease in the CN abundance by a factor of 30 more than offsets this. The C_5 abundance falls by $\sim 10^3$ due to the inclusion of a new rapid destruction channel, reaction with O atoms, which dominates over the loss reactions of C_5 with ions. However, since the products of this reaction are assumed to be C_4 and CO, the C_4 abundance increases by ~ 200 . Rapid destruction of C_4 with O atoms is included in both RATE90 and RATE95.

The formation of CH_3CHO increases by around 100 due to a large increase in the rate coefficient of the radiative association $H_3O^+ + C_2H_2 \rightarrow C_2H_5O^+ + h\nu$, from which CH_3CHO forms by dissociative recombination.

The heavy molecule CH_3C_3N decreases in abundance by ~ 1000 due to the inclusion of an additional channel in the products of the dissociative recombination of $H_4C_4N^+$, protonated CH_3C_3N . In RATE90, the only products of the recombination are $CH_3C_3N + H$. Thus, proton transfer, followed by dissociative recombination, simply recycles the neutral molecule and its effective destruction is small. In RATE95, we include, with an equal branching ratio, a channel to $CH_3 + HC_3N$, which breaks the recycling

process and leads to a much larger destruction rate for $\text{CH}_3\text{C}_3\text{N}$.

Because the results of the calculation shown in Table 5 are for physical parameters similar to those in the dark dust cloud TMC-1, we show in Table 6 a comparison between the calculated abundances at early time (3.16×10^5 yr) and steady-state (10^8 yr) and those observed toward TMC-1. This calculation has not been optimised in the sense of searching for the best-fit through looking for the best time, varying elemental abundances, cosmic ray ionisation rate, etc., but it does show that the chemistry is particularly suited to this type of source. In general, around one-half of the molecules agree to within a factor of 5 at early time, although there are some notable exceptions. SO and SO_2 both increase in abundance rapidly at late times and agree with the observations around steady-state, although the SO_2 abundance is too large at this time. Some molecules, C_nH ($n = 3 - 6$) for example, are much too large at early time. This may indicate that they have faster loss reactions with O atoms than adopted in the rate file, where we have assumed an activation energy barrier of 250 K. H_2S is too low at all times and this might indicate that the radiative association rate coefficient for the $\text{S}^+ - \text{H}_2$ reaction has been underestimated (see Millar & Herbst 1990 for a discussion). The abundances of HCS^+ and HCNH^+ are roughly an order of magnitude below the observations. This difference can be resolved by the adoption of ion-dipolar rate coefficients for the proton transfer reactions of CS and HCN . Finally, we note that contrary to many statements in the literature, the NH_3 abundance agrees with the observations at early times and does not need a special chemistry to be invoked.

5. On-line access to the database

The database is up-dated on a regular, usually annual, basis. The current version is kept on-line and can be accessed via the World Wide Web at URL <http://saturn.phy.umist.ac.uk:8000/~tjm/rate/rate.html>, which contains a short article describing the data and links to the files containing the species set (Table 2), the dipole moments (Table 3), the heats of formation (Table 2) and the rate coefficients (Table 4). A link can also be found here to a FORTRAN program, DELOAD, originally written by Dr. L.A.M. Nejad, which reads the species set and reaction file and writes output in the form of a FORTRAN subroutine.

Keeping a database such as this up-to-date is a difficult and time-consuming task. Any additions, corrections, suggestions for improvement or other comments on this database will be gratefully received by T.J. Millar (e-mail address: tjm@ast.phy.umist.ac.uk).

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Table 6. Comparison of observations toward TMC-1 (Ohishi et al. 1992) with fractional abundances with respect to H₂ at 3.16 10⁵ (early time) and 10⁸ (steady state) years

Species	Early time	Steady state	Observed	Species	Early time	Steady state	Observed
C	1.3e-05	1.8e-09	1.0e-04	CH	1.3e-08	2.9e-10	2.0e-08
C ₂	1.0e-08	3.3e-10	5.0e-08	CN	8.3e-08	1.0e-10	3.0e-08
CO	1.1e-04	1.4e-04	8.0e-05	CS	3.3e-08	2.7e-09	1.0e-08
OH	2.1e-07	9.6e-07	3.0e-07	NO	2.2e-07	3.3e-06	<3.0e-08
SO	3.3e-11	5.2e-09	5.0e-09	C ₂ H	2.7e-09	9.2e-12	5.0e-08
CCO	1.9e-10	1.6e-11	6.0e-10	C ₂ S	1.3e-09	5.5e-11	8.0e-09
HCN	6.8e-08	4.0e-09	2.0e-08	HNC	3.3e-08	6.8e-09	2.0e-08
OCS	5.2e-11	3.7e-11	2.0e-09	H ₂ S	4.4e-12	2.9e-11	<5.0e-10
SO ₂	8.1e-12	3.0e-08	<1.0e-09	C ₃ H	1.1e-06	2.2e-09	1.1e-09
C ₃ N	3.0e-08	9.4e-12	1.0e-09	C ₃ O	1.6e-10	1.3e-10	1.0e-10
C ₃ S	5.5e-10	8.6e-12	1.0e-09	H ₂ CO	9.9e-07	1.4e-08	2.0e-08
H ₂ CS	9.8e-10	1.8e-11	3.0e-09	NH ₃	4.9e-08	1.4e-07	2.0e-08
C ₄ H	8.6e-07	7.1e-09	2.0e-08	C ₃ H ₂	9.6e-09	5.7e-09	1.0e-08
HC ₃ N	3.8e-08	1.7e-10	6.0e-09	CH ₂ CN	5.2e-08	7.5e-11	5.0e-09
CH ₂ CO	1.0e-07	4.0e-10	1.0e-09	CHOOH	2.6e-08	2.6e-08	<2.0e-10
C ₅ H	2.4e-08	4.0e-11	3.0e-10	C ₄ H ₂	4.0e-11	2.9e-11	8.0e-10
CH ₃ CN	1.9e-08	8.9e-12	1.0e-09	CH ₃ OH	1.5e-07	7.0e-10	2.0e-09
C ₆ H	1.5e-07	4.5e-11	1.0e-10	HC ₅ N	1.4e-09	4.4e-13	3.0e-09
C ₃ H ₄	2.9e-11	8.8e-12	6.0e-09	H ₃ C ₃ N	1.3e-10	1.0e-14	2.0e-10
CH ₃ CHO	2.6e-10	4.0e-10	6.0e-10	H ₃ C ₄ N	3.7e-10	3.8e-14	5.0e-10
HC ₇ N	7.1e-10	6.7e-14	1.0e-09	C ₅ H ₄	4.8e-11	2.4e-12	2.0e-10
HC ₉ N	6.3e-11	2.1e-16	3.0e-10	HCO ⁺	7.0e-09	1.3e-08	8.0e-09
HCS ⁺	3.1e-11	4.0e-12	6.0e-10	N ₂ H ⁺	4.9e-10	8.9e-10	5.0e-10
HCNH ⁺	1.1e-10	1.5e-11	1.9e-09				

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Table 4. Reactions and their rate coefficients

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
1	H	H2	H	H	H		4.67E-07	-1.00	35000.0	CDA
2	H	C	CH	PHOTON			1.00E-17	0.00	0.0	NAA PH80
3	H	CH	C	H2			4.98E-11	0.00	0.0	MNEA NIST
4	H	CH	C	H	H		6.00E-09	0.00	40200.0	CDA
5	H	CH2	CH	H2			2.70E-10	0.03	0.0	MNEA NIST
6	H	NH	N	H2			1.73E-11	0.53	2400.0	NEA
7	H	CH3	CH2	H2			1.00E-10	0.00	7600.0	MNEA NIST
8	H	O	OH	PHOTON			9.90E-19	-0.38	0.0	NAA
9	H	NH2	NH	H2			5.25E-12	0.79	2200.0	NEA
10	H	CH4	H2	CH3			5.82E-13	3.00	4048.0	MNEA NIST
11	H	CH4	H2	O			7.00E-14	2.80	1950.0	MNEA NIST
12	H	OH	O	H	H		6.00E-09	0.00	50900.0	CDA
13	H	NH3	NH2	H2			7.80E-13	2.40	4990.0	MNEA NIST
14	H	H2O	OH	H2			6.83E-12	1.60	9720.0	MNEA NIST
15	H	H2O	OH	H	H		5.80E-09	0.00	52900.0	CDA
16	H	O2	CH	C			4.67E-10	0.50	30450.0	NEA
17	H	CO	C	OH			1.10E-10	0.50	77700.0	NEA
18	H	HCN	C2H2	H2			2.00E-11	0.00	0.0	MNEA NIST
19	H	HCN	CN	H2			6.31E-10	0.00	12400.0	MNEA NIST
20	H	H2CN	HCN	H2			1.00E-10	0.50	0.0	MNEA NIST
21	H	HCO	CO	H2			1.50E-10	0.00	0.0	MNEA NIST
22	H	NO	NH	O			9.29E-10	-0.10	35220.0	CDA
23	H	NO	OH	N			2.82E-10	0.00	24560.0	MNEA NIST
24	H	H2CO	HCO	H2			1.50E-11	1.05	1650.0	MNEA NIST
25	H	HNO	OH	NH			2.41E-09	-0.50	9010.0	MNEA NIST
26	H	HNO	NO	H2			1.50E-11	0.00	1500.0	NEA
27	H	O2	OH	O			3.30E-10	0.00	8460.0	MNEA NIST
28	H	O2	O	O			6.00E-09	0.00	52300.0	CDA
29	H	HS	S	H2			2.50E-11	0.00	0.0	MNEA NIST
30	H	O2H	H2O	O			5.00E-11	0.00	866.0	MNEA NIST
31	H	O2H	H2	O2			7.10E-11	0.00	710.0	MNEA NIST
32	H	O2H	OH	OH			2.80E-10	0.00	440.0	MNEA NIST
33	H	H2S	HS	H2			3.08E-12	2.10	352.0	MNEA NIST
34	H	H2O2	O2H	H2			2.80E-12	0.00	1890.0	MNEA NIST
35	H	CO2	OH	CO			2.50E-10	0.00	13900.0	MNEA NIST
36	H	N2O	NH	NO			2.94E-12	0.50	15100.0	NEA
37	H	N2O	OH	N2			1.26E-10	0.00	7630.0	MNEA NIST
38	H	NS	HS	N			7.27E-11	0.50	15700.0	NEA MB84
39	H	NS	NH	S			7.27E-11	0.50	20735.0	NEA MB84
40	H	NO2	OH	NO			1.40E-10	0.00	740.0	MNEA NIST
41	H	SO	HS	O			1.73E-11	0.50	19930.0	NEA MB84
42	H	SO	OH	S			5.90E-10	-0.31	11100.0	NEA LG88
43	H	OCS	CO	HS			9.06E-12	0.00	1997.0	MNEA NIST
44	H	S2	HS	S			2.25E-10	0.50	8355.0	NEA MB84
45	H2	ELECTR	H	ELECTR	H		3.32E-09	0.35	102000.0	CDA
46	H2	H2	H	H	H2		1.00E-08	0.00	84100.0	CDA
47	H2	C	CH2	PHOTON			1.00E-17	0.00	0.0	NAA PH80
48	H2	CH	CH2	H			2.38E-10	0.00	1760.0	MNEA NIST
49	H2	CH	C	H	H2		6.00E-09	0.00	40200.0	CDA
50	H2	CH2	CH3	H			5.18E-11	0.17	8400.0	MNEA NIST
51	H2	NH	NH2	H			5.96E-11	0.00	7782.0	MNEA NIST
52	H2	CH3	CH4	H			6.86E-14	2.74	4740.0	MNEA NIST
53	H2	NH2	NH3	H			2.09E-12	0.00	4277.0	MNEA NIST
54	H2	OH	H2O	H			1.55E-12	1.60	1660.0	MNEA NIST
55	H2	OH	O	H	H2		6.00E-09	0.00	50900.0	CDA
56	H2	H2O	HCN	H	H2		5.80E-09	0.00	52900.0	CDA
57	H2	CN	HCN	H			3.53E-13	3.31	755.0	MNEA NIST
58	H2	O2	O2H	H			2.40E-10	0.00	28500.0	MNEA NIST
59	H2	O2	OH	OH			3.16E-10	0.00	21890.0	MNEA NIST
60	H2	O2	O	O	H2		6.00E-09	0.00	52300.0	CDA
61	H2	HS	H2S	H			6.52E-12	0.09	8050.0	NEA LG88
62	H2	O2H	H2O2	H			1.20E-12	0.00	9400.0	MNEA NIST
63	H2	CO2	H2O	CO			2.94E-14	0.50	7550.0	NEA
64	C	H2	CH	H			6.64E-10	0.00	11700.0	MNEA NIST
65	C	C	C2	PHOTON			1.00E-17	0.00	0.0	NAA PH80
66	C	CH	C2	H			1.73E-11	0.50	0.0	NEA
67	C	N	CN	PHOTON			1.00E-17	0.00	0.0	NAA PH80
68	C	CH2	C2H	H			5.00E-11	0.50	4000.0	NEA LH84
69	C	NH	CH	N			1.73E-11	0.50	0.0	NEA
70	C	NH	CN	H			1.10E-10	0.50	0.0	NEA
71	C	O	CO	PHOTON			2.10E-19	0.00	0.0	NAA DD90
72	C	NH2	HNC	H			2.00E-11	0.50	0.0	NEA PR90
73	C	OH	CO	H			1.10E-10	0.50	0.0	NEA
74	C	OH	CH	O			2.25E-11	0.50	14800.0	NEA
75	C	C2H2	C3H	H			2.00E-10	0.00	0.0	MNEA NIST
76	C	CN	C2	N			4.98E-10	0.00	18116.0	MNEA NIST
77	C	CO	C2	O			2.94E-11	0.50	58025.0	NEA
78	C	N2	C3H	N			1.03E-10	0.00	23160.0	MNEA NIST
79	C	C2H4	C3H3	H			2.00E-10	0.00	0.0	MNEA NIST
80	C	SH	SIC	H			5.00E-11	0.50	0.0	MNEA NIST
81	C	HCO	CH	CO			1.00E-11	0.00	0.0	NEA
82	C	NO	CN	O			4.80E-11	0.00	0.0	MNEA NIST
83	C	NO	CO	N			1.73E-11	0.50	4000.0	NEA
84	C	SH2	HCN	H			5.00E-11	0.50	0.0	NEA HM89
85	C	SH3	SIC2	H			5.00E-11	0.50	0.0	NEA HM89
86	C	PH	CP	H			4.00E-11	0.00	0.0	NEA M91
87	C	O2	CO	O			3.30E-11	0.00	0.0	MNEA NIST
88	C	HS	CS	H			2.00E-11	0.00	0.0	NEA LG88
89	C	HS	CH	S			1.20E-11	0.58	5880.0	NEA LG88
90	C	H2C3	C4H	H			2.00E-10	0.00	0.0	NEA
91	C	C3H4	C4H2	H2			4.00E-10	0.00	0.0	MNEAHH83
92	C	OCN	CO	CN			4.00E-11	0.50	0.0	NEA
93	C	CS	C2	S			1.44E-11	0.50	20435.0	NEA MB84
94	C	NS	CN	S			2.00E-11	0.50	0.0	NEA MB84
95	C	NS	CS	N			1.73E-11	0.50	4000.0	NEA LG88
96	C	SO	CO	S			1.70E-10	0.00	0.0	NEA LG88
97	C	SO	CS	O			4.00E-11	0.00	0.0	NEA M91
98	C	HFO	PH	CO			6.50E-10	0.00	0.0	MNEAHH83
99	C	C4H2	C3H	H			1.73E-11	0.50	0.0	NEA MB84
100	C	S2	S	CS			6.50E-10	0.00	0.0	MNEAHH83
101	C	C5H2	C6H	H			6.50E-10	0.00	0.0	MNEAHH83
102	C	C5H4	C6H2	H2			6.50E-10	0.00	0.0	MNEAHH83
103	C	C6H2	C7H	H			5.30E-10	0.00	0.0	MNEAHH83
104	C	C7H2	C8H	H			7.40E-10	0.00	0.0	MNEAHH83
105	C	C7H4	C8H2	H2			8.00E-10	0.17	0.0	MNEAHH83
106	C	C8H2	C9H	H			8.40E-10	0.00	0.0	MNEAHH83
107	CH	CH4	CH2	CH3			2.28E-11	0.70	3000.0	NEA
108	CH	OH	HCO	H			1.44E-11	0.50	5000.0	NEA
109	CH	N2	HCN	N			1.00E-12	0.00	7000.0	MNEA NIST
110	CH	HCO	CH2	CO			2.87E-12	0.70	500.0	NEA
111	CH	NO	HCO	N			2.70E-11	0.00	5000.0	NEA
112	CH	NO	HCN	O			1.66E-10	0.00	0.0	MNEA NIST
113	CH	H2CO	CH2	HCO			9.21E-12	0.70	2000.0	NEA
114	CH	HNO	NO	CH2			1.73E-11	0.50	0.0	NEA
115	CH	O2	HCO	O			1.44E-11	0.50	3000.0	NEA
116	CH	O2H	CH2	O2			2.94E-13	0.50	7550.0	NEA
117	CH	O2H	HCO	OH			1.44E-11	0.50	3000.0	NEA
118	CH	CO2	HCO	CO			2.94E-13	0.50	3000.0	NEA
119	N	H2	NH	H			4.65E-10	0.50	16606.0	MNEA NIST
120	N	CH	CN	H			2.10E-11	0.50	0.0	MNEA ST88

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
121	N	CH2	HCN	H			2.00E-11	0.50	0.0	NEA PH80
122	N	CH	NH	C			2.94E-11	0.50	6995.0	NEA
123	N	CH2	NH	CH			1.00E-12	0.00	20400.0	MNEA NIST
124	N	NH	N2	H			4.98E-11	0.00	0.0	MNEA NIST
125	N	CH3	H2CN	H			7.20E-11	0.50	0.0	MNEA2MN89
126	N	CH3	HCN	H2			1.30E-11	0.50	0.0	MNEA2MN89
127	N	OH	NO	II			5.32E-11	-0.25	0.0	MNEA NIST
128	N	OH	NH	O			1.88E-11	0.10	10700.0	MNEA NIST
129	N	C2	CN	C			5.00E-11	0.50	0.0	NEA MD83
130	N	CN	N2	C			3.00E-10	0.00	0.0	MNEA NIST
131	N	H2CN	NH	HCN			1.00E-10	0.00	200.0	MNEA NIST
132	N	SiH	SIN	H			5.00E-11	0.50	0.0	NEA HM89
133	N	HCO	NH	CO			5.71E-12	0.50	1000.0	NEA
134	N	HCO	HCN	O			1.70E-10	0.00	0.0	NEA
135	N	NO	N2	O			3.10E-11	0.00	0.0	MNEA NIST
136	N	SiH2	HNSI	H			5.00E-11	0.50	0.0	NEA HM89
137	N	HNO	N2O	H			1.43E-12	0.50	1500.0	NEA
138	N	HNO	NH	NO			2.94E-12	0.50	1000.0	NEA
139	N	SiH3	HNSI	H2			5.00E-11	0.50	0.0	NEA HM89
140	N	PH	PN	H			4.00E-11	0.00	0.0	NEA MB87
141	N	O2	NO	O			1.50E-11	0.00	3570.0	MNEA NIST
142	N	HS	NH	S			1.73E-11	0.50	9060.0	NEA MB84
143	N	HS	NS	H			1.73E-11	0.50	0.0	NEA MB84
144	N	O2H	NH	O2			1.70E-13	0.00	0.0	NEA
145	N	C3H	C3N	H			2.00E-11	0.50	0.0	NEA MN85
146	N	C3H2	HC3N	H			2.00E-11	0.50	0.0	NEA MN85
147	N	C3H3	HC3N	H2			2.00E-11	0.50	0.0	NEA MN85
148	N	SIC	SIN	C			2.50E-11	0.50	0.0	NEA HM89
149	N	SIC	CN	SI			2.50E-11	0.50	0.0	NEA HM89
150	N	CS	CN	S			3.80E-11	0.50	1160.0	NEA MB84
151	N	CO2	NO	CO			3.20E-13	0.00	1700.0	MNEA NIST
152	N	PN	P	N2			1.00E-18	0.00	0.0	NEA MB87
153	N	HCS	HCN	S			2.00E-11	0.50	0.0	NEA PH82
154	N	NS	N2	S			1.73E-11	0.50	0.0	NEA MB84
155	N	NO2	N2	O2			1.70E-12	0.00	0.0	NEA
156	N	NO2	N2O	NO			6.00E-12	0.00	0.0	NEA
157	N	NO2	N2O	O			3.00E-12	0.00	0.0	MNEA NIST
158	N	PO	PN	O			8.50E-12	0.00	0.0	NEA MB87
159	N	PO	P	NO			2.55E-12	0.00	0.0	NEA MB87
160	N	SO	NO	S			1.73E-11	0.50	750.0	NEA MB84
161	N	SO	NS	O			4.68E-11	0.50	8254.0	NEA
162	N	C5H	C5N	H			2.00E-11	0.50	0.0	NEA
163	N	C5H2	HC5N	H			2.00E-11	0.50	0.0	NEA MN85
164	N	S2	S	NS			1.73E-11	0.50	4000.0	NEA MB84
165	CH2	CH2	C2H2	H			2.00E-10	0.00	400.0	MNEA NIST
166	CH2	CH2	CH	CH3			4.00E-10	0.00	5000.0	MNEA NIST
167	CH2	CH4	CH3	CH3			7.13E-12	0.00	5050.0	MNEA NIST
168	CH2	HCO	CH3	CO			3.00E-11	0.00	0.0	MNEA NIST
169	CH2	H2CO	CH3	HCO			3.30E-13	0.00	3270.0	MNEA NIST
170	CH2	HNO	NO	CH3			1.73E-11	0.50	0.0	NEA
171	NH	NH	H2	N2			1.70E-11	0.00	0.0	NEA
172	NH	OH	H2O	N			3.09E-12	1.20	0.0	MNEA NIST
173	NH	OH	NH2	O			2.93E-12	0.10	5800.0	MNEA NIST
174	NH	OH	HNO	H			3.32E-11	0.00	0.0	MNEA NIST
175	NH	H2O	NH2	OH			1.81E-12	1.60	14090.0	MNEA NIST
176	NH	CN	HCN	N			2.94E-12	0.50	1000.0	NEA
177	NH	NO	N2	O			5.00E-11	0.00	0.0	MNEA NIST
178	NH	NO2	NO	HNO			5.72E-12	0.50	2500.0	NEA
179	CH3	CH3	C2H4	H2			1.66E-08	0.00	16556.0	MNEA NIST
180	CH3	CH3	C2H5	H			5.00E-11	0.00	6800.0	MNEA NIST
181	CH3	NH3	CH4	CH4			9.55E-14	0.00	4890.0	MNEA NIST
182	CH3	H2O	CH4	OH			1.20E-14	2.90	7480.0	MNEA NIST
183	CH3	CN	CH3CN	PHOTON			1.00E-16	0.00	0.0	NAA PH80
184	CH3	HCO	CH4	CO			2.00E-10	0.00	0.0	MNEA NIST
185	CH3	H2CO	CH4	HCO			6.80E-12	0.00	4150.0	MNEA NIST
186	CH3	HNO	CH4	NO			1.44E-11	0.50	0.0	NEA
187	CH3	H2S	HS	CH4			3.30E-13	0.00	1105.0	MNEA NIST
188	O	H2	OH	H			3.43E-13	2.67	3160.0	MNEA NIST
189	O	CH	CO	H			6.60E-11	0.00	0.0	MNEA NIST
190	O	CH	HCO+	ELECTR			2.00E-11	0.44	0.0	CIA MD83
191	O	CH	HO	C			2.52E-11	0.00	2381.0	MNEA NIST
192	O	CH2	CH	OH			4.98E-10	0.00	6000.0	MNEA NIST
193	O	CH2	HCO	H			1.44E-11	0.50	2000.0	NEA
194	O	CH2	CO	H			2.00E-10	0.00	0.0	MNEA NIST
195	O	NH	NO	H			1.16E-10	0.00	0.0	MNEA NIST
196	O	NH	OH	H			1.16E-11	0.00	0.0	MNEA NIST
197	O	CH3	H2CO	H			1.40E-10	0.00	0.0	MNEA NIST
198	O	O	O2	PHOTON			4.90E-20	1.58	0.0	NAA PH80
199	O	NH2	HNO	H			7.47E-11	0.00	0.0	MNEA NIST
200	O	NH2	NH	OH			1.16E-11	0.00	0.0	MNEA NIST
201	O	CH4	CH3	OH			8.32E-12	1.56	4270.0	MNEA NIST
202	O	OH	O2	H			4.34E-11	-0.50	30.0	MNEA NIST
203	O	NH3	OH	NH2			1.60E-11	0.00	3670.0	MNEA NIST
204	O	H2O	OH	OH			1.85E-11	0.95	8571.0	MNEA NIST
205	O	C2	CO	C			5.00E-11	0.50	0.0	NEA MD83
206	O	C2H	CO	CH			1.70E-11	0.00	0.0	MNEA NIST
207	O	CN	CO	N			1.70E-11	0.00	50.0	MNEA NIST
208	O	CN	NO	C			3.81E-11	0.50	14545.0	NEA
209	O	C2H2	C2H	OH			5.30E-09	0.00	8520.0	NEA
210	O	C2H2	CH2	CO			3.49E-12	1.50	850.0	MNEA NIST
211	O	C2H3	CH2CO	H			1.60E-10	0.00	0.0	MNEA NIST
212	O	HCN	OH	CN			3.65E-11	1.58	13386.0	MNEA NIST
213	O	C2H4	NO	N			1.88E-12	1.00	20390.0	MNEA NIST
214	O	C2H4	ClH3	HCO			1.50E-12	1.55	215.0	MNEA NIST
215	O	C2H4	H2CO	CH2			4.20E-11	0.00	2520.0	MNEA NIST
216	O	C2H5	H2CO	CH3			2.67E-11	0.00	0.0	MNEA NIST
217	O	C2H5	CH3CHO	H			1.33E-10	0.00	0.0	MNEA NIST
218	O	SiH	SiO	H			4.00E-11	0.50	0.0	NEA PH80
219	O	HCO	CO2	H			5.00E-11	0.00	0.0	MNEA NIST
220	O	HCO	OH	CO			5.00E-11	0.00	0.0	MNEA NIST
221	O	NO	N	O2			1.88E-12	1.00	20320.0	MNEA NIST
222	O	SiH2	SiO	H			5.00E-11	0.50	0.0	NEA HM89
223	O	HNO	HCO	OH			1.78E-11	0.57	1390.0	MNEA NIST
224	O	HNO	NH	O2			2.94E-12	0.50	3500.0	NEA
225	O	HNO	OH	NO			6.00E-11	0.00	0.0	MNEA NIST
226	O	HNO	NO2	H			1.44E-12	0.50	0.0	NEA
227	O	SiH3	H2SiO	H			5.00E-11	0.50	0.0	NEA HM89
228	O	PH	PO	H			4.00E-11	0.00	0.0	MNEA NIST
229	O	HS	SO	H			2.32E-10	0.00	0.0	MNEA NIST
230	O	HS	OH	S			1.00E-12	0.00	4000.0	NEA MB84
231	O	PH2	PO	H2			4.00E-11	0.00	0.0	NEA MB87
232	O	PH2	PH	OH			2.00E-11	0.00	0.0	NEA MB81
233	O	PH2	HPO	H			2.00E-11	0.00	0.0	NEA
234	O	O2H	OH	O2			5.40E-11	0.00	0.0	MNEA NIST
235	O	H2S	HS	OH			1.40E-11	0.00	1920.0	MNEA NIST
236	O	H2O2	O2H	OH			1.40E-12	0.00	2000.0	MNEA NIST
237	O	C3	CO	C2			5.00E-11	0.50	0.0	NEA MN85
238	O	C3H	CO	C3H			1.00E-11	0.00	250.0	NEA HL89
239	O	H2C3	C2H2	CO			5.00E-11	0.50	0.0	NEA
240	O	CCN	CN	CO			6.00E-12	0.50	0.0	MNEA NIST

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
241	O	OCO	CO	CO			8.60E-11	0.00	0.0	MNEA NIST
242	O	SIC	SIO	C			2.50E-11	0.50	0.0	NEA HM89
243	O	SIC	CO	SI			2.50E-11	0.50	0.0	NEA HM89
244	O	HCSI	SIO	CH			4.00E-11	0.00	0.0	NEA HM89
245	O	SIN	SIO	N			2.50E-11	0.50	0.0	NEA HM89
246	O	SIN	NO	SI			2.50E-11	0.50	0.0	NEA HM89
247	O	OCN	NO	CO			1.50E-11	0.00	0.0	MNEA NIST
248	O	CP	P	CO			4.00E-11	0.00	0.0	NEA M91
249	O	CS	CO	S			2.70E-10	0.00	760.0	MNEA NIST
250	O	CS	SO	C			4.63E-11	0.50	28940.0	NEA MB84
251	O	CO2	CO	O2			2.80E-11	0.00	26500.0	MNEA NIST
252	O	N2O	O2	N2			1.66E-10	0.00	14100.0	MNEA NIST
253	O	N2O	NO	NO			1.13E-10	0.00	13400.0	MNEA NIST
254	O	NO2	NO	O2			9.12E-12	0.00	0.0	MNEA NIST
255	O	HCP	CO	PH			4.00E-11	0.00	0.0	NEA M91
256	O	HCS	OCs	H			4.00E-11	0.50	0.0	NEA PH82
257	O	NS	NO	S			5.00E-11	0.50	0.0	NEA MB84
258	O	NS	SO	N			1.73E-11	0.50	4000.0	NEA MB84
259	O	CH2PH	PH2	CO			4.00E-11	0.00	0.0	NEA M91
260	O	CCL	CL	CO			9.96E-11	0.00	0.0	MNEA NIST
261	O	CCL	C	CLO			1.38E-10	0.00	16050.0	MNEA NIST
262	O	SO	SO2	O2			3.20E-16	-1.50	0.0	NAA MH90
263	O	SO	S	O2			6.00E-13	0.00	2760.0	NEA LG88
264	O	HPO	PO	OH			4.00E-11	0.00	0.0	NEA M91
265	O	C4	CO	C3			5.00E-11	0.50	0.0	NEA MN85
266	O	CAH	CO	C3H			1.00E-10	0.00	250.0	NEA HL89
267	O	C3N	CCN	CO			2.00E-11	0.50	0.0	NEA MN85
268	O	GLO	GL	O2			3.80E-11	0.00	0.0	MNEA NIST
269	O	SIC2	SIC	CO			4.00E-11	0.00	0.0	NEA HM89
270	O	C3O	C3	O2			1.00E-11	0.00	0.0	NEA MN85
271	O	SINC	SIN	CO			4.00E-11	0.00	0.0	NEA HM89
272	O	CCP	CP	CO			4.00E-11	0.00	0.0	NEA M91
273	O	HCCTP	HCP	CO			4.00E-11	0.00	0.0	NEA M91
274	O	C5	CO	C4			5.00E-11	0.50	0.0	NEA HL89
275	O	OCs	CO	SO			1.60E-11	0.00	2150.0	MNEA NIST
276	O	C3H	CO	C4H			1.00E-10	0.00	250.0	NEA HL89
277	O	S2	SO	S			1.73E-11	0.50	0.0	MNEA NIST
278	O	SO2	SO	O2			8.30E-12	0.00	9800.0	MNEA NIST
279	O	SIC3	SIC2	CO			4.00E-11	0.00	0.0	NEA HM89
280	O	C3P	CCP	CO			4.00E-11	0.00	0.0	NEA M91
281	O	C6	CO	C5			5.00E-11	0.50	0.0	NEA HL89
282	O	C6H	CO	C5H			1.00E-10	0.00	250.0	NEA HL89
283	O	C3N	CCN	C4			2.00E-11	0.50	0.0	NEA HL89
284	O	SIC4	SIC3	CO			4.00E-11	0.00	0.0	NEA M91
285	O	C4P	CCP	CO			4.00E-11	0.00	0.0	NEA M91
286	O	C7	CO	C6			5.00E-11	0.50	0.0	NEA HL89
287	O	C7H	CO	C6H			1.00E-10	0.00	250.0	NEA HL89
288	O	C8	CO	C7			5.00E-11	0.50	0.0	NEA HL89
289	O	C8H	CO	C7H			1.00E-10	0.00	250.0	NEA HL89
290	O	C7N	CCN	C6			2.00E-11	0.50	0.0	NEA HL89
291	O	C9	CO	C8			5.00E-11	0.50	0.0	NEA HL89
292	O	C9H	CO	C8H			1.00E-10	0.00	250.0	NEA HL89
293	O	C9N	CCN	C8			2.00E-11	0.50	0.0	NEA HL89
294	NH2	NO	N2	H2O			1.70E-11	0.00	0.0	MNEA NIST
295	OH	CH2	CH3	O			1.44E-11	0.50	3000.0	NEA
296	OH	CH2	H2O	CH			1.44E-11	0.50	3000.0	NEA
297	OH	CH2	H2O	H			3.00E-11	0.00	0.0	MNEA NIST
298	OH	CH3	H2O	CH2			5.42E-11	0.70	1000.0	NEA
299	OH	CH3	CH4	O			3.22E-14	2.20	2240.0	MNEA NIST
300	OH	NH2	NH	HO			1.00E-11	0.00	0.0	MNEA NIST
301	OH	NH3					3.31E-13	0.41	250.0	MNEA NIST
302	OH	CH4	H2O	CH3			8.87E-13	1.83	1400.0	MNEA NIST
303	OH	OH	H2O	O			1.65E-12	1.14	50.0	MNEA NIST
304	OH	NH3	NH2	H2O			7.55E-13	1.60	480.0	MNEA NIST
305	OH	CN	HCN	O			5.30E-12	0.00	1500.0	NEA
306	OH	C2H2	H2O	C2H			1.30E-13	2.68	6060.0	MNEA NIST
307	OH	C2H3	CH3CHO	PHOTON			5.00E-21	0.00	0.0	MNEA NIST
308	OH	C2H3	C2H2	H2O			5.00E-11	0.00	0.0	MNEA NIST
309	OH	HCN	H2O	CN			1.50E-11	0.00	5400.0	MNEA NIST
310	OH	CO	CO2	H			1.00E-13	0.00	0.0	MNEA F591
311	OH	C2H5	C2H4	H2O			4.00E-11	0.00	0.0	MNEA F591
312	OH	HCO	H2O	CO			1.70E-10	0.00	0.0	MNEA NIST
313	OH	NO2	NO2	H			5.20E-12	0.00	15100.0	NEA
314	OH	HCN	H2O	HCO			4.95E-11	1.00	601.0	MNEA NIST
315	OH	HNO	H2O	NO			8.00E-11	0.00	500.0	MNEA NIST
316	OH	O2H	H2O	O2			4.00E-11	0.00	0.0	MNEA NIST
317	OH	H2S	H2O	HS			6.30E-12	0.00	80.0	MNEA NIST
318	OH	H2O2	H2O	O2H			1.30E-11	0.00	670.0	MNEA NIST
319	OH	SIO	SIO2	H			1.00E-11	0.50	0.0	NEA HM89
320	OH	CS	OCs	H			9.39E-14	1.12	800.0	NEA LG88
321	OH	NO2	O2H	N2			1.05E-12	0.00	5000.0	MNEA NIST
322	OH	SO	SO2	H			8.60E-11	0.00	0.0	MNEA NIST
323	C2H	C2H2	C4H2	H			5.00E-11	0.00	0.0	MNEA NIST
324	C2H	HCN	HC3N	PHOTON			1.00E-16	0.00	0.0	NAA PH80
325	C2H	HCN	HC3N	H			2.20E-12	0.00	0.0	MNEA BH83
326	CN	CH2	CH	HCN			5.30E-12	0.00	2500.0	NEA
327	CN	CH3	HCN	CH2			9.21E-12	0.70	1500.0	NEA
328	CN	CH4	HCN	CH3			3.14E-12	1.53	504.0	MNEA NIST
329	CN	NH3	HCN	NH2			2.60E-11	-1.10	0.0	MNEA SA93
330	CN	C2H2	H3C3N	H			2.90E-10	-0.53	0.0	MNEA NIST
331	CN	C2H4	H3C3N	H			1.25E-10	0.70	30.0	MPNAINIST
332	CN	C2H4	C2H3	HCN			1.23E-10	0.70	30.0	MPNAINIST
333	CN	HCO	HCN	CO			5.72E-12	0.50	0.0	NEA
334	CN	NO	N2	GO			1.79E-10	0.00	4040.0	MNEA NIST
335	CN	H2CO	HCO	HCN			1.19E-11	0.70	1500.0	NEA
336	CN	HNO	NO	HCN			1.14E-11	0.50	0.0	NEA
337	CN	O2	OCN	O			2.50E-11	-0.76	10.0	MNEA NIST
338	CN	O2	CO	NO			5.30E-13	0.00	0.0	NEA
339	CN	C4H2	HC3N	H			2.00E-10	0.00	0.0	NEA HL90
340	CN	C6H2	HC7N	II			2.00E-10	0.00	0.0	NEA HL90
341	CN	C8H2	HC9N	H			2.00E-10	0.00	0.0	NEA HL90
342	SI	CH2	HC3N	H			4.00E-11	0.50	0.0	NEA HM89
343	SI	CH3	SIC2	H			4.00E-11	0.50	0.0	NEA HM89
344	SI	OH	SIO	H			2.00E-11	0.50	0.0	NEA HM89
345	SI	O2	SIO	O			2.70E-10	0.50	0.0	MNEA HN79
346	CO	HNO	NH	CO2			2.94E-12	0.50	0.0	NEA
347	CO	O2	CO2	O			4.20E-12	0.00	24000.0	MNEA NIST
348	CO	O2H	CO2	OH			2.50E-10	0.00	11900.0	MNEA NIST
349	CO	N2O	N2	CO2			1.62E-13	0.00	8780.0	MNEA NIST
350	CO	NO2	NO	CO2			1.48E-10	0.00	17000.0	MNEA NIST
351	N2	O2	N2O	O			1.00E-10	0.00	55200.0	NEA
352	HCO	HCO	H2CO	CO			5.00E-11	0.00	0.0	MNEA NIST
353	HCO	HNO	H2CO	NO			1.00E-12	0.00	1000.0	MNEA NIST
354	NO	CH2	H2CO	N			2.70E-12	0.00	3500.0	NEA
355	NO	HCO	HNO	CO			1.20E-11	0.00	0.0	MNEA NIST
356	NO	NO	N2	O2			5.10E-12	0.50	30455.0	MNEA NIST
357	NO	HNO	N2O	OH			3.30E-12	0.00	13000.0	MNEA NIST
358	NO	O2	N2O	O			2.80E-12	0.00	23400.0	NEA
359	NO	N2O	NO2	N2			4.56E-10	0.00	25160.0	MNEA NIST
360	P	O2	PO	O			1.00E-13	0.00	0.0	MNEA NIST

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
361	S	H2	HS	H			1.03E-10	0.13	9620.0	NEA LG88
362	S	CH	CS	C			1.73E-11	0.50	4000.0	NEA MB84
363	S	CH	CS	H			1.10E-12	0.00	0.0	NEA LG88
364	S	CH2	HCS	H			3.98E-11	0.50	0.0	NEA PH82
365	S	NH	HS	N			1.73E-11	0.50	4000.0	NEA MB84
366	S	NH	NS	H			1.73E-11	0.50	0.0	NEA MB84
367	S	CH3	H2CS	H			2.00E-11	0.50	0.0	NEA MB84
368	S	OH	SO	H			6.60E-11	0.00	0.0	MNEA NIST
369	S	OH	HS	O			6.60E-11	0.00	0.0	NEA
370	S	C2	CS	C			1.73E-11	0.50	0.0	NEA MB84
371	S	CN	CS	N			1.73E-11	0.50	0.0	NEA MB84
372	S	CN	NS	C			5.71E-11	0.50	3200.0	NEA MB84
373	S	CO	OCs	PHOTON			1.60E-17	-1.50	0.0	NAAIMH90
374	S	NO	NS	O			2.94E-11	0.50	17465.0	NEA MB84
375	S	NO	SO	N			1.14E-11	0.50	17260.0	NEA MB84
376	S	O2	SO	O			2.28E-12	0.52	0.0	MNEA NIST
377	S	SO	O	S2			1.73E-11	0.50	11500.0	NEA MB84
378	O2	CH2	HCO	OH			4.10E-11	0.00	750.0	MNEA NIST
379	O2	CH2	H2CO	O			1.44E-11	0.50	3500.0	NEA
380	O2	CH3	O2H	CH2			5.30E-12	0.00	34975.0	NEA
381	O2	CH3	H2CO	OH			5.50E-13	0.00	4500.0	MNEA NIST
382	O2	CH4	CH3	O2H			6.60E-11	0.00	28630.0	MNEA NIST
383	O2	C2H	HCO	CO			4.00E-12	0.00	0.0	MNEA NIST
384	O2	C2H3	H2CO	HCO			9.00E-12	0.00	0.0	MNEA NIST
385	O2	HCO	O2H	CO			8.50E-11	0.00	830.0	MNEA NIST
386	O2	OCN	NO2	CO			8.10E-11	0.00	773.0	NEA
387	O2	SO	SO2	O			1.40E-13	0.00	2280.0	MNEA NIST
388	HS	HS	H2S	S			1.30E-11	0.00	0.0	MNEA NIST
389	HS	CO	OCs	II			5.95E-14	1.12	8330.0	NEA LG88
390	O2H	CH3	CH4	O2			6.00E-12	0.00	0.0	MNEA NIST
391	O2H	H2O	H2O2	OH			4.60E-11	0.00	16500.0	MNEA NIST
392	O2H	HCO	H2CO	O2			5.00E-11	0.00	0.0	MNEA NIST
393	O2H	H2CO	H2O2	HCO			3.30E-12	0.00	3870.0	MNEA NIST
394	O2H	O2H	H2O2	O2			3.10E-12	0.00	775.0	MNEA NIST
395	H+	H	H2+	PHOTON			2.00E-20	1.00	0.0	RAA
396	H+	NA	NA+	H			1.20E-09	0.00	0.0	CTA
397	H+	MG	MG+	H			1.10E-09	0.00	0.0	CTA
398	H+	SI	SI+	H			9.90E-10	0.00	0.0	CTA TA84
399	H+	P	P+	H			1.00E-09	0.00	0.0	CTA
400	H+	S	S+	H			1.30E-09	0.00	0.0	CTA
401	H+	FE	FE+	H			7.40E-09	0.00	0.0	CTA
402	H+	H-	H	H			2.30E-07	-0.50	0.0	MNA
403	H+	H-	H2+	H			1.00E-10	0.00	21200.0	CTA MD83
404	H+	C-	H	C			2.30E-07	-0.50	0.0	MNA
405	H+	CH	CH+	H			1.90E-09	0.00	0.0	CTA
406	II+	CH2	CH+	H2			1.40E-09	0.00	0.0	PNA
407	H+	CH2	CH2+	H			1.40E-09	0.00	0.0	CTA
408	H+	NH	NH+	H			2.10E-09	0.00	0.0	CTA
409	H+	CH3	CH3+	H			3.40E-09	0.00	0.0	CTA
410	H+	O	O+	H			7.00E-10	0.00	232.0	CTA MD83
411	H+	NH2	NH2+	H			2.90E-09	0.00	0.0	CTA
412	H+	CH4	CH3+	H2			2.30E-09	0.00	0.0	MPNAI7401
413	H+	CH4	CH4+	H			1.50E-09	0.00	0.0	MCTAI7401
414	H+	OH	OH+	H			2.10E-09	0.00	0.0	CTA
415	H+	NH3	NH3+	H			1.10E-09	0.00	0.0	MCTAIDS92
416	H+	H2O	H2O+	H			6.90E-09	0.00	0.0	MCTAIDS92
417	H+	C2	C2+	H			3.10E-09	0.00	0.0	CTA
418	H+	C2H	C2H+	H			1.50E-09	0.00	0.0	PNA
419	H+	C2H	C2+	H2			1.50E-09	0.00	0.0	CTA
420	H+	C2H2	C2H+	H2			4.30E-09	0.00	0.0	PNA
421	H	C2H2+	C2H2+	H			2.00E-09	0.00	0.0	CTA HL89
422	H	HCN+	HCN+	H			1.10E-08	0.00	0.0	MCTA18512
423	H	HNC	H+	HCN			1.00E-09	0.00	0.0	PNA
424	H+	C2H2+	C2H2+	H2			2.00E-09	0.00	0.0	PNA
425	H+	C2H3	C2H3+	H			2.00E-09	0.00	0.0	CTA
426	H+	C2H4	C2H4+	H			1.00E-09	0.00	0.0	MCTA18594
427	H2	C2H3+	C2H3+	H2			3.00E-09	0.00	0.0	MPNA18594
428	H2	C2H2+	C2H2+	H2			1.00E-09	0.00	0.0	MPNA18594
429	H	SiH+	SiH+	H			1.70E-09	0.00	0.0	CTA HL89
430	H2	Si+	Si+	H2			1.70E-09	0.00	0.0	PNA HL89
431	II2	CO+	CO+	II2			9.40E-10	0.00	0.0	PNA
432	CO	II2+	II2+	CO			9.40E-10	0.00	0.0	HAA
433	H	HCO+	HCO+	H			9.40E-10	0.00	0.0	CTA
434	NH2	CH2+	CH2+	NH2			1.00E-09	0.00	0.0	PNA
435	CH2	NH2+	NH2+	CH2			1.00E-09	0.00	0.0	PNA
436	H	C2H5+	C2H5+	H			2.00E-09	0.00	0.0	CTA
437	H2	C2H4+	C2H4+	H2			2.00E-09	0.00	0.0	PNA
438	H2	C2H3+	C2H3+	H2			2.80E-09	0.00	0.0	MCOA18594
439	H2	C2H4+	C2H4+	H2			1.40E-09	0.00	0.0	MCOA18594
440	H	NO+	NO+	H			2.90E-09	0.00	0.0	MCTAIDS92
441	H	SiH2+	SiH2+	H			1.50E-09	0.00	0.0	CTA HL89
442	H2	SiH+	SiH+	H2			1.50E-09	0.00	0.0	PNA HL89
443	II	H2CO	H2CO+	II			2.96E-09	0.00	0.0	MCTA18592
444	II2	H2CO	HCO+	II2			3.57E-09	0.00	0.0	MPNA18592
445	H2	H2CO	CO+	H2			1.06E-09	0.00	0.0	MPNA18592
446	H2	HNO	NO+	H2			4.00E-09	0.00	0.0	HAA
447	H	SiH3	SiH3+	H			1.50E-09	0.00	0.0	CTA HL89
448	H2	SiH2+	SiH2+	H2			1.50E-09	0.00	0.0	PNA HL89
449	H	O2+	O2+	H			2.00E-09	0.00	0.0	MCTAIDS92
450	H	PH+	PH+	H			1.00E-09	0.00	0.0	CTA
451	H	SiH4+	SiH4+	H			1.50E-09	0.00	0.0	CTA HL89
452	H2	SiH3+	SiH3+	H2			1.50E-09	0.00	0.0	PNA HL89
453	H	S-	H	S			2.30E-07	-0.50	0.0	MNA
454	H	HS	HS+	H			1.60E-09	0.00	0.0	CTA
455	H	HS	S+	II2			1.60E-09	0.00	0.0	PNA
456	H+	PH2	PH2+	H			1.00E-09	0.00	0.0	CTA
457	II	H2S	H2S+	II			6.60E-09	0.00	0.0	MCTAIDS92
458	H	HCL	HCL+	H			2.20E-09	0.00	0.0	MCTA18502
459	H2	C3	C3+	H			4.00E-09	0.00	0.0	CTA
460	H2	C3H	C3H+	H2			2.00E-09	0.00	0.0	PNA
461	H	C3H	C3H+	H			2.00E-09	0.00	0.0	CTA
462	H2	C3H2	C3H2+	H2			2.00E-09	0.00	0.0	PNA
463	H	C3H2+	C3H2+	H			2.00E-09	0.00	0.0	CTA
464	H2	C3H+	C3H+	H2			2.00E-09	0.00	0.0	PNA
465	H	H2C3	C3H2+	H			2.00E-09	0.00	0.0	CTA
466	H	CCN	CCN+	H			4.00E-09	0.00	0.0	CTA HL89
467	H2	C3H3	C3H2+	H2			2.00E-09	0.00	0.0	PNA
468	H	C3H3	C3H3+	H			2.00E-09	0.00	0.0	CTA
469	H	CCO	C2O+	H			1.00E-09	0.00	0.0	CTA
470	H	SiC	SiC+	H			3.00E-09	0.00	0.0	CTA HL89
471	H2	C3H4	H2C3H+	H2			2.00E-09	0.00	0.0	PNA
472	H	C3H4	C3H4+	H			2.00E-09	0.00	0.0	CTA
473	H	CH2CN	CH2CN+	H			6.30E-09	0.00	0.0	CTA HL90
474	H+	HCSI	HC2H+	H			1.50E-09	0.00	0.0	CTA HL89
475	H+	HCSI	SiC+	II2			1.50E-09	0.00	0.0	PNA HL89
476	H	SIN	SIN+	H			3.00E-09	0.00	0.0	CTA HL89
477	H+	CP	CP+	H			1.00E-09	0.00	0.0	CTA
478	H+	SiCH2	SiCH2+	H			1.50E-09	0.00	0.0	CTA HL89
479	H+	SiCH2	HC2H+	H2			1.50E-09	0.00	0.0	PNA HL89
480	H+	HNSI	HNSI+	H			1.50E-09	0.00	0.0	CTA HL89

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
541	H+	C6	C6+	H			4.00E-09	0.00	0.0	CTA
542	H+	C6H	C6H+	H			2.00E-09	0.00	0.0	CTA
543	H+	C6H	C6+	H2			2.00E-09	0.00	0.0	PNA
544	H+	C6H2	C6H2+	H			2.00E-09	0.00	0.0	CTA HL89
545	H+	C6H2	C6H+	H2			2.00E-09	0.00	0.0	PNA HL89
546	H+	HC5N	HC5N+	H			4.00E-09	0.00	0.0	CTA
547	H+	SIC4	SIC4+	H			1.50E-09	0.00	0.0	CTA HM89
548	H+	C4P	C4P+	H			1.00E-09	0.00	0.0	CTA
549	H+	C4S	C4S+	H			1.00E-09	0.00	0.0	CTA MI90
550	H+	C7	C7+	H			4.00E-09	0.00	0.0	CTA HL89
551	H+	C7H	C7H+	H			3.00E-09	0.00	0.0	CTA HL89
552	H+	C7H	C7+	H2			3.00E-09	0.00	0.0	PNA HL89
553	H+	C7H2	C7H2+	H			2.50E-09	0.00	0.0	CTA HL89
554	H+	C7H2	C7H+	H2			2.50E-09	0.00	0.0	CTA HL89
555	H+	C7H4	C7H4+	H			2.00E-09	0.00	0.0	CTA HL89
556	H+	C7H4	C7H3+	H2			2.00E-09	0.00	0.0	PNA HL89
557	H+	H3C6N	HC3N+	HC3N			9.00E-09	0.00	0.0	PNA HL89
558	H+	C8	C8+	H			4.00E-09	0.00	0.0	CTA HL89
559	H+	C8H	C8H+	H			2.00E-09	0.00	0.0	CTA HL89
560	H+	C8H	C8+	H2			2.00E-09	0.00	0.0	PNA HL89
561	H+	C8H2	C8H2+	H			2.00E-09	0.00	0.0	CTA HL89
562	H+	C8H2	C8H+	H2			2.00E-09	0.00	0.0	PNA HL89
563	H+	HC7N	HC7N+	H			1.00E-08	0.00	0.0	CTA HL89
564	H+	C9	C9+	H			4.00E-09	0.00	0.0	CTA HL89
565	H+	C9H	C9H+	H			3.50E-09	0.00	0.0	CTA HL89
566	H+	C9H	C9+	H2			3.50E-09	0.00	0.0	PNA HL89
567	H+	C9H2	C9H2+	H			2.50E-09	0.00	0.0	CTA HL89
568	H+	C9H2	C9H+	H2			2.50E-09	0.00	0.0	PNA HL89
569	H+	HC8N	HC8N+	HC7N			1.00E-08	0.00	0.0	PNA HL89
570	H+	HC9N	HC9N+	HC9N			1.30E-09	0.00	0.0	CTA HL89
571	H+	C	CH	ELECTR			1.00E-09	0.00	0.0	ADA
572	H+	C	NH	ELECTR			1.00E-09	0.00	0.0	ADA
573	H+	O	OH	ELECTR			1.00E-09	0.00	0.0	ADA
574	H+	CH	CH2	ELECTR			1.00E-10	0.00	0.0	ADA
575	H+	CH	CH3	ELECTR			1.00E-09	0.00	0.0	ADA
576	H+	CH2	CH3	ELECTR			1.00E-09	0.00	0.0	ADA
577	H+	NH	NH2	ELECTR			1.00E-10	0.00	0.0	ADA
578	H+	CH3	CH4	ELECTR			1.00E-09	0.00	0.0	ADA
579	H+	NH2	NH3	ELECTR			1.00E-09	0.00	0.0	ADA
580	H+	OH	H2O	ELECTR			1.00E-10	0.00	0.0	ADA
581	H+	H2O	OH+	H2			3.80E-09	0.00	0.0	NIA
582	H+	C2	C2H	ELECTR			1.00E-09	0.00	0.0	ADA
583	H+	C2H	C2H2	ELECTR			1.00E-09	0.00	0.0	ADA
584	H+	CN	HCN	ELECTR			1.00E-10	0.00	0.0	ADA
585	H+	HCN	CN+	H2			3.80E-09	0.00	0.0	NIA
586	H+	CO	HCO	ELECTR			5.00E-11	0.00	0.0	ADA
587	H+	HCO	H2CO	ELECTR			1.00E-09	0.00	0.0	ADA
588	H+	H2+	HEH+	H2			6.40E-10	0.00	0.0	MCTE17901
589	H+	HE	HEH+	H			1.30E-10	0.00	0.0	MPTE17404
590	H+	C	CH+	H			2.40E-09	0.00	0.0	PTE
591	H+	N	NH+	H			1.90E-09	0.00	0.0	PTE
592	H+	O	OH+	H			1.50E-09	0.00	0.0	PTE
593	H+	H2	II	II2			2.30E-07	-0.50	0.0	MNA
594	H+	H2	H3+	H			2.08E-09	0.00	0.0	MHA17404
595	H+	CH	CH+	H2			7.10E-10	0.00	0.0	CTE
596	H+	CH	CH2+	H			7.10E-10	0.00	0.0	PTE
597	H+	CH2	CH3+	H			1.00E-09	0.00	0.0	PTE
598	H+	CH2	CH2+	H2			1.00E-09	0.00	0.0	CTE
599	H+	NH	NH2+	H			7.60E-10	0.00	0.0	PTE
600	H+	NH	NH+	II2			7.60E-10	0.00	0.0	CTE

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
601	H2+	NH2	NH2+	H2			2.10E-09	0.00	0.0	CTE
602	H2+	CH4	CH4+	H2			1.40E-09	0.00	0.0	MCTE17503
603	H2+	CH4	CH5+	H			1.14E-10	0.00	0.0	MPTA17503
604	H2+	CH4	CH3+	H	H2		2.30E-09	0.00	0.0	MPNE17503
605	H2+	OH	OH+	H2			7.60E-10	0.00	0.0	CTE
606	H2+	OH	H2O+	H			7.60E-10	0.00	0.0	PTE
607	H2+	NH3	NH3+	H2			5.70E-09	0.00	0.0	MCTE17503
608	H2+	H2O	H2O+	H2			3.90E-09	0.00	0.0	MCTE17503
609	H2+	H2O	H3O+	H			3.40E-09	0.00	0.0	MPTA17503
610	H2+	C2	C2H+	H			1.10E-09	0.00	0.0	PTE
611	H2+	C2	C2+	H2			1.10E-09	0.00	0.0	CTE
612	H2+	C2H	C2H+	H2			1.00E-09	0.00	0.0	CTE
613	H2+	C2H2	C2H2+	H			1.00E-09	0.00	0.0	PTE
614	H2+	C2H2	C2H2+	H2			4.82E-09	0.00	0.0	MCTE17503
615	H2+	C2H2	C2H3+	H			4.80E-10	0.00	0.0	MPTA17503
616	H2+	CN	HCN+	H			1.20E-09	0.00	0.0	PTE
617	H2+	CN	CN+	H2			1.20E-09	0.00	0.0	CTE
618	H2+	HCN	HCN+	H2			2.70E-09	0.00	0.0	CTE
619	H2+	CO	CO+	H2			8.40E-10	0.00	0.0	MCTE17423
620	H2+	CO	HCO+	H			2.16E-09	0.00	0.0	MPTA17423
621	H2+	C2H4	C2H4+	H2			8.82E-10	0.00	0.0	MPNE17503
622	H2+	C2H4	C2H3+	H2	H2		1.81E-09	0.00	0.0	MPNE17503
623	H2+	C2H4	C2H4+	H2			2.21E-09	0.00	0.0	MCTE17503
624	H2+	N2	N2H+	H			2.00E-09	0.00	0.0	MPTA17503
625	H2+	HCO	H3+	CO			1.00E-09	0.00	0.0	HAE
626	H2+	HCO	HCO+	H2			1.00E-09	0.00	0.0	CTE
627	H2+	C2H6	C2H6+	H2			2.94E-10	0.00	0.0	MCTE17503
628	H2+	C2H6	C2H5+	H2	H		1.37E-09	0.00	0.0	MCTE17503
629	H2+	C2H6	C2H4+	H2	H2		2.35E-09	0.00	0.0	MCTE17503
630	H2+	NO	HNO+	H			1.10E-09	0.00	0.0	PTE
631	H2+	NO	NO+	H2			1.10E-09	0.00	0.0	CTE
632	H2+	H2CO	H2CO+	H2			1.40E-09	0.00	0.0	CTE
633	H2+	H2CO	HCO+	H			1.40E-09	0.00	0.0	PNE
634	H2+	O2	O2H+	H			1.90E-09	0.00	0.0	MCTE17503
635	H2+	O2	O2+	H2			8.00E-10	0.00	0.0	MCTE17503
636	H2+	H2S	H2S+	H			8.00E-10	0.00	0.0	MPNE17503
637	H2+	H2S	H2S+	H2			2.70E-09	0.00	0.0	MCTE17503
638	H2+	H2S	S+	H2			7.70E-10	0.00	0.0	MPNE17503
639	H2+	CO2	HCO2+	H			2.35E-09	0.00	0.0	MPTA17608
640	H3+	C	CH+	H2			2.00E-09	0.00	0.0	PTE
641	H3+	O	OH+	H2			8.00E-10	0.00	0.0	MPTA27604
642	H3+	NA	NA+	H	H2		1.10E-09	0.00	0.0	PNA
643	H3+	MG	MG+	H	H2		1.00E-09	0.00	0.0	PNA
644	H3+	SI	SIH+	H2			3.70E-09	0.00	0.0	PTE
645	H3+	S	US+	H2			2.60E-09	0.00	0.0	PTE
646	H3+	CL	HCL+	H2			1.00E-09	0.00	0.0	PTE
647	H3+	FE	FE+	H	H2		4.90E-09	0.00	0.0	PNA
648	H3+	CH	CH2+	H2			2.30E-07	-0.50	0.0	MNA
649	H3+	CH	CH3+	H2			1.20E-09	0.00	0.0	PTE
650	H3+	CH2	CH3+	H2			1.70E-09	0.00	0.0	PTE
651	H3+	NH	NH2+	H2			1.30E-09	0.00	0.0	PTE
652	H3+	CH3	CH4+	H2			2.10E-09	0.00	0.0	PTE
653	H3+	NH2	NH3+	H2			1.80E-09	0.00	0.0	PTE
654	H3+	CH4	CH5+	H2			2.40E-09	0.00	0.0	MPTA18006
655	H3+	OH	H2O+	H2			1.30E-09	0.00	0.0	PTE
656	H3+	NH3	NH4+	H2			2.70E-09	0.00	0.0	MPTA17516
657	H3+	I2O	I2O+	H2			5.90E-09	0.00	0.0	MPTA17405
658	H3+	C2	C2H+	H2			1.80E-09	0.00	0.0	PTE
659	H3+	C2H	C2H2+	H2			1.70E-09	0.00	0.0	PTE
660	H3+	C2H2	C2H3+	H2			3.50E-09	0.00	0.0	MPTA17405
661	H3+	HCN	HCN+	H2			2.00E-09	0.00	0.0	PTE
662	H3+	HNC	HNC+	H2			8.10E-09	0.00	0.0	MPTA18512
663	H3+	C2H3	C2H4+	H2			8.10E-09	0.00	0.0	PTE
664	H3+	CO	HCO+	H2			1.70E-09	0.00	0.0	MPTA17505
665	H3+	CO	HOC+	H2			2.70E-11	0.00	0.0	MPTA17505
666	H3+	CO	HOC+	H2			2.70E-11	0.00	0.0	MPTA17505
667	H3+	C2H4	C2H5+	H2			1.15E-09	0.00	0.0	MPNALAG92
668	H3+	C2H4	C2H5+	H2			1.15E-09	0.00	0.0	MPNALAG92
669	H3+	N2	N2H+	H2			1.80E-09	0.00	0.0	MPTA18208
670	H3+	SiH	SiH2+	H2			1.70E-09	0.00	0.0	PTE
671	H3+	HCO	H2CO+	H2			1.40E-09	0.00	0.0	PTE
672	H3+	C2H5	C2H6+	H2			1.40E-09	0.00	0.0	PTE
673	H3+	C2H6	C2H5+	H2			1.10E-09	0.00	0.0	MPTA18117
674	H3+	NO	HNO+	H2			1.10E-09	0.00	0.0	MPTA18208
675	H3+	SiH2	SiH3+	H2			2.00E-09	0.00	0.0	PTE
676	H3+	P	PH+	H2			1.00E-09	0.00	0.0	MPTA17906
677	H3+	H2CO	H3CO+	H2			6.30E-09	0.00	0.0	PTE
678	H3+	HNO	H2NO+	H2			2.00E-09	0.00	0.0	PTE
679	H3+	SiH3	SiH4+	H2			2.00E-09	0.00	0.0	PTE
680	H3+	PH	PH2+	H2			2.00E-09	0.00	0.0	PTE
681	H3+	O2	O2H+	H2			5.00E-09	0.00	150.0	MPTA18414
682	H3+	SiH4	SiH5+	H2			2.00E-09	0.00	0.0	PTE
683	H3+	CH3OH	CH3OH2+	H2			3.14E-09	0.00	0.0	MPTA1G90
684	H3+	CH3OH	CH3+	H2O			2.56E-09	0.00	0.0	MPNA1G90
685	H3+	HS	H2S+	H2			1.90E-09	0.00	0.0	PTE
686	H3+	PH2	PH3+	H2			2.00E-09	0.00	0.0	PTE
687	H3+	H2S	H2S+	H2			3.70E-09	0.00	0.0	MPTA17405
688	H3+	HCL	H2CL+	H2			3.80E-09	0.00	0.0	MPTA18502
689	H3+	C3	C3H+	H2			2.00E-09	0.00	0.0	PTE
690	H3+	C3H	C3H2+	H2			2.00E-09	0.00	0.0	PTE
691	H3+	C3H2	C3H3+	H2			2.00E-09	0.00	0.0	PTE
692	H3+	H2C3	H2C3H+	H2			2.00E-09	0.00	0.0	PTE
693	H3+	CCN	CCNH+	H2			9.00E-09	0.00	0.0	PTE
694	H3+	C3H3	C3H4+	H2			2.00E-09	0.00	0.0	PTE
695	H3+	CCO	H2CO+	H2			1.00E-09	0.00	0.0	PTE
696	H3+	SIC	CSH5+	H2			3.00E-09	0.00	0.0	PTE
697	H3+	C3H4	C3H5+	H2			6.75E-10	0.00	0.0	MPTA1AG92
698	H3+	C3H4	H2C3H+	H2			2.25E-09	0.00	0.0	MPNALAG92
699	H3+	CH2CN	CH3CN+	H2			3.70E-09	0.00	0.0	PTE
700	H3+	HCSI	SIC12+	H2			2.00E-09	0.00	0.0	PTE
701	H3+	CH3CN	HAC2N+	H2			1.05E-08	0.00	0.0	MPTA1G90
702	H3+	SIN	HNS1+	H2			2.00E-09	0.00	0.0	PTE
703	H3+	CP	HCP+	H2			1.00E-09	0.00	0.0	PTE
704	H3+	SIC12	SIC13+	H2			2.00E-09	0.00	0.0	PTE
705	H3+	CH2CO	CH3CO+	H2			2.00E-09	0.00	0.0	PTE
706	H3+	HNS1	SIN12+	H2			2.00E-09	0.00	0.0	PTE
707	H3+	SIC13	SIC14+	H2			2.00E-09	0.00	0.0	PTE
708	H3+	HCP	PCH2+	H2			1.00E-09	0.00	0.0	PTE
709	H3+	SIO	SIOH+	H2			2.00E-09	0.00	0.0	PTE
710	H3+	CS	HCS+	H2			2.90E-09	0.00	0.0	PTE
711	H3+	CO2	HCO2+	H2			2.00E-09	0.00	0.0	MPTA18208
712	H3+	CH3CHO	CH2HO+	H2			8.90E-09	0.00	0.0	MPTA1G90
713	H3+	PN	HPN+	H2			1.00E-09	0.00	0.0	PTE
714	H3+	CH2PH	PCH4+	H2			1.00E-09	0.00	0.0	PTE
715	H3+	HCS	H2CS+	H2			2.00E-09	0.00	0.0	PTE
716	H3+	NS	HNS+	H2			2.80E-09	0.00	0.0	PTE
717	H3+	NO2	NO+	H2			7.00E-10	0.00	0.0	MPNA17005
718	H3+	H2CS	H2CS+	H2			2.80E-09	0.00	0.0	PTE
719	H3+	H2SIO	H2SIO+	H2			2.00E-09	0.00	0.0	PTE
720	H3+	CHOOH	HCO+	H2O			4.30E-09	0.00	0.0	MPNA17818

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
721	H3+	CHOOH	H3O+	CO	H2		1.80E-09	0.00	0.0	MPNA17818
722	H3+	C2H5OH	H3O+	C2H4	H2		5.70E-10	0.00	0.0	MPNA1C90
723	H3+	C2H5OH	C2H5+	H2O	H2		4.85E-09	0.00	0.0	MPNA1G90
724	H3+	CH3OCH3	C2H6OH+	H2			2.00E-09	0.00	0.0	PTA MC90
725	H3+	PO	HPO+	H2			1.00E-09	0.00	0.0	PTA TA84
726	H3+	SO	H2O+	H2			1.90E-09	0.00	0.0	PTA
727	H3+	IPO	H2PO+	H2			1.00E-09	0.00	0.0	PTA
728	H3+	C4	C4H+	H2			2.00E-09	0.00	0.0	PTA
729	H3+	C4H	C4H2+	H2			2.00E-09	0.00	0.0	PTA
730	H3+	C3N	HC3N+	H2			9.00E-09	0.00	0.0	PTA
731	H3+	C4H2	C4H3+	H2			2.60E-09	0.00	0.0	MPTA1DF66
732	H3+	HC3N	H2C3N+	H2			9.10E-09	0.00	0.0	MPTA17911
733	H3+	C3O	HC3O+	H2			2.00E-09	0.00	0.0	PTA
734	H3+	SIC2	SIC2H+	H2			2.00E-09	0.00	0.0	PTA HM89
735	H3+	SIC2H	SIC2H2+	H2			2.00E-09	0.00	0.0	PTA HM89
736	H3+	HC3N	H4C3N+	H2			9.90E-09	0.00	0.0	MPTA1PF92
737	H3+	SINC	SINC+	H2			2.00E-09	0.00	0.0	PTA HM89
738	H3+	SIC2H2	SIC2H3+	H2			2.00E-09	0.00	0.0	PTA HM89
739	H3+	CCP	PC2H+	H2			1.00E-09	0.00	0.0	PTA
740	H3+	HCCP	PC2H2+	H2			1.00E-09	0.00	0.0	PTA
741	H3+	C2S	HC2S+	H2			1.00E-09	0.00	0.0	PTA MH90
742	H3+	C2H6CO	C3H6OH+	H2			4.30E-09	0.00	0.0	MPTA1HG90
743	H3+	C2H6CO	H3CO+	C2H4	H2		3.01E-09	0.00	0.0	MPNA1HG90
744	H3+	C2H6CO	C3H5+	H2O	H2		8.60E-10	0.00	0.0	MPNA1HG90
745	H3+	C2H6CO	CH3CO+	CH4	H2		4.30E-10	0.00	0.0	MPNA1HG90
746	H3+	SIS	HSIS+	H2			8.70E-09	0.00	0.0	PTA
747	H3+	OCs	HOCs+	H2			1.90E-09	0.00	0.0	MPTA18208
748	H3+	SIO2	HSIO2+	H2			2.00E-09	0.00	0.0	PTA HM89
749	H3+	C5	C5H+	H2			2.00E-09	0.00	0.0	PTA
750	H3+	HCOOCH3	H5CO2+	H2			3.00E-09	0.00	0.0	PTA MC90
751	H3+	C5H	C5H2+	H2			4.00E-09	0.00	0.0	PTA
752	H3+	C5H2	C5H3+	H2			3.00E-09	0.00	0.0	PTA
753	H3+	C5H4	C5H5+	H2			2.50E-09	0.00	0.0	PTA HL89
754	H3+	S2	S2H+	H2			2.00E-09	0.00	0.0	PTA MH90
755	H3+	SO2	HSO2+	H2			1.30E-09	0.00	0.0	MPTA18208
756	H3+	SIC3	SIC3H+	H2			2.00E-09	0.00	0.0	PTA HM89
757	H3+	HS2	HS2+	H2			2.00E-09	0.00	0.0	PTA MH90
758	H3+	SIC3H	SIC3H2+	H2			2.00E-09	0.00	0.0	PTA HM89
759	H3+	C3P	PC3H+	H2			1.00E-09	0.00	0.0	PTA
760	H3+	H2S2	H3S2+	H2			2.00E-09	0.00	0.0	PTA MH90
761	H3+	C3S	HC3S+	H2			1.00E-09	0.00	0.0	PTA MH90
762	H3+	C6	C6H+	H2			2.00E-09	0.00	0.0	PTA
763	H3+	C6H	C6H2+	H2			2.50E-09	0.00	0.0	PTA
764	H3+	C6H2	C6H3+	H2			2.00E-09	0.00	0.0	PTA HL89
765	H3+	C5N	HC5N+	H2			8.00E-09	0.00	0.0	PTA
766	H3+	HC5N	H2C5N+	H2			2.00E-09	0.00	0.0	PTA
767	H3+	SIC4	SIC4H+	H2			2.00E-09	0.00	0.0	PTA HM89
768	H3+	C4P	PC4H+	H2			1.00E-09	0.00	0.0	PTA
769	H3+	C4S	HC4S+	H2			1.00E-09	0.00	0.0	PTA MH90
770	H3+	C7	C7H+	H2			2.00E-09	0.00	0.0	PTA HL89
771	H3+	C7H	C7H2+	H2			4.00E-09	0.00	0.0	PTA HL89
772	H3+	C7H2	C7H3+	H2			3.00E-09	0.00	0.0	PTA HL89
773	H3+	C7H4	C7H5+	H2			2.50E-09	0.00	0.0	PTA HL89
774	H3+	C8	C8H+	H2			2.00E-09	0.00	0.0	PTA HL89
775	H3+	C8H	C8H2+	H2			2.50E-09	0.00	0.0	PTA HL89
776	H3+	C8H2	C8H3+	H2			2.00E-09	0.00	0.0	PTA HL89
777	H3+	C9	C9H+	H2			2.00E-09	0.00	0.0	PTA HL89
778	H3+	C9H	C9H2+	H2			4.00E-09	0.00	0.0	PTA HL89
779	H3+	C9H2	C9H3+	H2			3.00E-09	0.00	0.0	PTA HL89
780	H3+	C7N	HC7N+	H2			4.00E-09	0.00	0.0	PTA HL89

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
811	HE+	N2	N2+	HE			6.40E-10	0.00	0.0	MCTA17602
812	HE+	N2	N+	N	HE		9.60E-10	0.00	0.0	MPNA17602
813	HE+	SH	SH+	H	HE		1.80E-09	0.00	0.0	PNA HM89
814	HE+	HCO	CO+	H	HE		4.90E-10	0.00	0.0	PNA
815	HE+	HCO	CH+	O	HE		4.90E-10	0.00	0.0	PNA
816	HE+	HCO	HEH+	CO	HE		3.00E-10	0.00	0.0	HAA
817	HE+	CH2NH	CH2+	NH	HE		1.00E-09	0.00	0.0	PNA
818	HE+	C2H5	C2H5+	HE	HE		5.00E-10	0.00	0.0	PNA
819	HE+	C2H5	C2H4+	H	HE		5.00E-10	0.00	0.0	PNA
820	HE+	C2H5	C2H3+	H2	HE		4.20E-10	0.00	0.0	MPNA17502
821	HE+	C2H6	C2H4+	H2	HE		8.40E-10	0.00	0.0	MCOA17502
822	HE+	C2H6	C2H3+	H2	HE		1.80E-09	0.00	0.0	MPNA17502
823	HE+	C2H6	C2H3+	H2	HE		2.00E-10	0.00	0.0	MPNA17702
824	HE+	NO	O+	N	HE		2.00E-10	0.00	0.0	MPNA17702
825	HE+	NO	N+	O	HE		1.40E-09	0.00	0.0	MPNA17702
826	HE+	SH2	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
827	HE+	SH2	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
828	HE+	SH2	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
829	HE+	H2CO	CO+	H2	HE		1.88E-09	0.00	0.0	MPNA15A92
830	HE+	H2CO	HCO+	H	HE		1.14E-09	0.00	0.0	MPNA15A92
831	HE+	H2CO	H2CO+	HE	HE		9.69E-10	0.00	0.0	MPNA15A92
832	HE+	H2CO	CH2+	O	HE		1.71E-09	0.00	0.0	MPNA15A92
833	HE+	HNO	NO+	H	HE		1.00E-09	0.00	0.0	PNA
834	HE+	HNO	H+	NO	HE		1.00E-09	0.00	0.0	PNA
835	HE+	SH3	SH2+	H	HE		1.00E-09	0.00	0.0	PNA HM89
836	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
837	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
838	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
839	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
840	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
841	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
842	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
843	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
844	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
845	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
846	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
847	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
848	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
849	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
850	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
851	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
852	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
853	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
854	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
855	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
856	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
857	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
858	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
859	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
860	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
861	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
862	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
863	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
864	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
865	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
866	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
867	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
868	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
869	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
870	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
871	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
872	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
873	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
874	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
875	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
876	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
877	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
878	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
879	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
880	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
881	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
882	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
883	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
884	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
885	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
886	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
887	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
888	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
889	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
890	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
891	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
892	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
893	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
894	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
895	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
896	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
897	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
898	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
899	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89
900	HE+	SH3	SH+	H	HE		1.00E-09	0.00	0.0	PNA HM89

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
961	HE+	HC3N	CCN+	CH	HE	HE	2.84E-09	0.00	0.0	MPNA18518
962	HE+	HC3N	C3N+	H	HE	HE	2.45E-09	0.00	0.0	MPNA18518
963	HE+	C3O	C3+	O	HE	HE	1.00E-09	0.00	0.0	PNA
964	HE+	C3O	C2+	CO	HE	HE	1.00E-09	0.00	0.0	PNA
965	HE+	C3O	Si+	C2	HE	HE	2.00E-09	0.00	0.0	PNA HM89
966	HE+	SiC2H	SiC2+	H	HE	HE	1.00E-09	0.00	0.0	PNA HM89
967	HE+	SiC2H	Si+	C2H	HE	HE	1.00E-09	0.00	0.0	PNA HM89
968	HE+	HC3N	C2H3+	CN	HE	HE	5.25E-10	0.00	0.0	MPNA1PF92
969	HE+	HC3N	C2H2+	HCN	HE	HE	3.50E-09	0.00	0.0	MPNA1PF92
970	HE+	HC3N	I2C3H+	N	HE	HE	3.25E-10	0.00	0.0	MPNA1PF92
971	HE+	HC3N	HC3N+	H2	HE	HE	3.15E-09	0.00	0.0	MPNA1PF92
972	HE+	HC3N	H2C3N+	H	HE	HE	1.26E-09	0.00	0.0	MPNA1PF92
973	HE+	SiNC	CN+	Si	HE	HE	2.00E-09	0.00	0.0	PNA HM89
974	HE+	SiC2H2	SiC2H+	H	HE	HE	1.00E-09	0.00	0.0	PNA HM89
975	HE+	SiC2H2	SiH+	C2H	HE	HE	1.00E-09	0.00	0.0	PNA HM89
976	HE+	CCP	P+	C2	HE	HE	5.00E-10	0.00	0.0	PNA
977	HE+	CCP	C+	CP	HE	HE	5.00E-10	0.00	0.0	PNA
978	HE+	HCCP	CP+	CH	HE	HE	5.00E-10	0.00	0.0	PNA
979	HE+	HCCP	CH+	CP	HE	HE	5.00E-10	0.00	0.0	PNA
980	HE+	C2S	C+	CS	HE	HE	2.50E-10	0.00	0.0	PNA MH90
981	HE+	C2S	C+	C	HE	HE	2.50E-10	0.00	0.0	PNA MH90
982	HE+	C2S	Si+	S	HE	HE	2.50E-10	0.00	0.0	PNA MH90
983	HE+	C2S	C2+	C2	HE	HE	2.50E-10	0.00	0.0	PNA MH90
984	HE+	C2H6CO	CH3CO+	CH3	HE	HE	3.00E-09	0.00	0.0	PNA MC90
985	HE+	SiS	Si+	S	HE	HE	3.80E-09	0.00	0.0	PNA
986	HE+	SiS	Si+	Si	HE	HE	3.80E-09	0.00	0.0	PNA
987	HE+	OCs	CS+	O	HE	HE	7.60E-10	0.00	0.0	PNA
988	HE+	OCs	S+	CO	HE	HE	7.60E-10	0.00	0.0	PNA
989	HE+	OCs	CO+	S	HE	HE	7.60E-10	0.00	0.0	PNA
990	HE+	OCs	O+	CS	HE	HE	7.60E-10	0.00	0.0	PNA
991	HE+	SiO2	Si+	O2	HE	HE	2.00E-09	0.00	0.0	PNA HM89
992	HE+	C5	C3+	C2	HE	HE	1.00E-09	0.00	0.0	PNA
993	HE+	C5	C4+	C	HE	HE	1.00E-09	0.00	0.0	PNA
994	HE+	HCOOCH3	HCO2+	CH3	HE	HE	3.00E-09	0.00	0.0	PNA MC90
995	HE+	C5H	C5+	H	HE	HE	1.50E-09	0.00	0.0	PNA
996	HE+	C5H	C3H+	C2	HE	HE	1.50E-09	0.00	0.0	PNA
997	HE+	C5H2	C5+	H2	HE	HE	1.00E-09	0.00	0.0	PNA
998	HE+	C5H2	C5H+	H	HE	HE	1.00E-09	0.00	0.0	PNA
999	HE+	C5H2	C3H+	C2H	HE	HE	1.00E-09	0.00	0.0	PNA
1000	HE+	C5H4	C5H2+	H2	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1001	HE+	C5H4	C5H3+	H	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1002	HE+	S2	S+	S	HE	HE	2.00E-09	0.00	0.0	PNA
1003	HE+	SO2	SO2+	HE	HE	HE	4.30E-10	0.00	0.0	MCTA17302
1004	HE+	SO2	S+	O2	HE	HE	9.00E-10	0.00	0.0	MPNA17302
1005	HE+	SO2	SO+	O	HE	HE	2.97E-09	0.00	0.0	MPNA17302
1006	HE+	SiC3	SiC2+	C	HE	HE	2.00E-09	0.00	0.0	PNA HM89
1007	HE+	I3C4N	C1H3+	C3N	HE	HE	7.00E-08	0.00	0.0	PNA HL89
1008	HE+	HS2	S+	HS	HE	HE	1.00E-09	0.00	0.0	PNA MH90
1009	HE+	HS2	S2+	H	HE	HE	1.00E-09	0.00	0.0	PNA MH90
1010	HE+	SiC3H	SiC3+	H	HE	HE	1.00E-09	0.00	0.0	PNA HM89
1011	HE+	SiC3H	Si+	C3H	HE	HE	1.00E-09	0.00	0.0	PNA HM89
1012	HE+	C3P	P+	C3	HE	HE	5.00E-10	0.00	0.0	PNA
1013	HE+	C3P	C3+	P	HE	HE	5.00E-10	0.00	0.0	PNA
1014	HE+	H2S2	HS+	HS	HE	HE	2.00E-09	0.00	0.0	PNA MH90
1015	HE+	H2S2	S2H+	H	HE	HE	2.00E-09	0.00	0.0	PNA MH90
1016	HE+	C3S	C2+	CS	HE	HE	5.00E-10	0.00	0.0	PNA MH90
1017	HE+	C3S	CS+	C2	HE	HE	5.00E-10	0.00	0.0	PNA
1018	HE+	C6	C4+	C2	HE	HE	1.40E-09	0.00	0.0	PNA
1019	HE+	C6	C5+	C	HE	HE	1.40E-09	0.00	0.0	PNA
1020	HE+	C6H	C6+	H	HE	HE	1.40E-09	0.00	0.0	PNA
1021	HE+	C6H	C6H+	C2	HE	HE	1.40E-09	0.00	0.0	PNA
1022	HE+	C6H2	C6H+	H	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1023	HE+	C6H2	C6H+	C2H	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1024	HE+	C5N	C4+	CN	HE	HE	3.00E-09	0.00	0.0	PNA HL89
1025	HE+	C5N	C2H+	C3N	HE	HE	1.00E-09	0.00	0.0	PNA
1026	HE+	HC5N	C2H+	C3N	HE	HE	1.00E-09	0.00	0.0	PNA
1027	HE+	HC5N	C2H+	C3N	HE	HE	1.00E-09	0.00	0.0	PNA
1028	HE+	SiC4	SiC3+	C	HE	HE	2.00E-09	0.00	0.0	PNA HM89
1029	HE+	CAP	COP+	C2	HE	HE	5.00E-10	0.00	0.0	PNA
1030	HE+	CAP	COP+	C2	HE	HE	5.00E-10	0.00	0.0	PNA
1031	HE+	C4S	C3+	CS	HE	HE	5.00E-10	0.00	0.0	PNA MH90
1032	HE+	C4S	C3+	CS	HE	HE	5.00E-10	0.00	0.0	PNA MH90
1033	HE+	C7	C6+	C	HE	HE	1.40E-09	0.00	0.0	PNA HL89
1034	HE+	C7H	C7+	H	HE	HE	1.40E-09	0.00	0.0	PNA HL89
1035	HE+	C7H	C7+	H	HE	HE	2.00E-09	0.00	0.0	PNA HL89
1036	HE+	C7H	C7H+	C2	HE	HE	2.00E-09	0.00	0.0	PNA HL89
1037	HE+	C7H2	C7H+	H2	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1038	HE+	C7H2	C7H+	H	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1039	HE+	C7H2	C7H+	C2H	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1040	HE+	C7H4	C7H2+	H2	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1041	HE+	C7H4	C7H3+	H	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1042	HE+	H3C6N	CH3+	C5N	HE	HE	7.00E-08	0.00	0.0	PNA HL89
1043	HE+	C8	C6+	C2	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1044	HE+	C8	C7+	C	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1045	HE+	C8H	C8+	H	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1046	HE+	C8H	C6H+	C2	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1047	HE+	C8H2	C8H+	H	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1048	HE+	C8H2	C8H+	H	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1049	HE+	C8H2	C6H+	C2H	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1050	HE+	C7N	C6+	CN	HE	HE	3.00E-09	0.00	0.0	PNA HL89
1051	HE+	HC7N	C6H+	CN	HE	HE	7.00E-09	0.00	0.0	PNA HL89
1052	HE+	C9	C7+	C2	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1053	HE+	C9	C8+	C	HE	HE	1.50E-09	0.00	0.0	PNA HL89
1054	HE+	C9H	C9+	H	HE	HE	2.50E-09	0.00	0.0	PNA HL89
1055	HE+	C9H	C7H+	C2	HE	HE	2.50E-09	0.00	0.0	PNA HL89
1056	HE+	C9H2	C9+	H2	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1057	HE+	C9H2	C9H+	H	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1058	HE+	C9H2	C7H+	C2H	HE	HE	1.00E-09	0.00	0.0	PNA HL89
1059	HE+	H3C8N	CH3+	C7N	HE	HE	7.00E-09	0.00	0.0	PNA HL89
1060	HE+	HC9N	C8H+	CN	HE	HE	7.00E-09	0.00	0.0	PNA HL89
1061	HE+	HC9N	C8H+	CN	HE	HE	7.00E-09	0.00	0.0	PNA HL89
1062	HE+	HEH+	H2+	HE	HE	HE	9.10E-10	0.00	0.0	MPTA17901
1063	HE+	HEH+	H3+	HE	HE	HE	1.50E-09	0.00	0.0	MPTA18006
1064	C+	H	CH+	PHOTON	HE	HE	1.70E-17	0.00	0.0	RAA PH80
1065	C+	O	CO+	PHOTON	HE	HE	2.50E-18	0.00	0.0	RAA DD90
1066	C+	NA	NA+	C	HE	HE	1.10E-09	0.00	0.0	CTA
1067	C+	MG	MG+	C	HE	HE	1.10E-09	0.00	0.0	CTA
1068	C+	Si	Si+	C	HE	HE	2.10E-09	0.00	0.0	CTA
1069	C+	P	P+	C	HE	HE	1.00E-09	0.00	0.0	CTA
1070	C+	S	S+	C	HE	HE	1.50E-09	0.00	0.0	CTA
1071	C+	Fe	Fe+	C	HE	HE	2.60E-09	0.00	0.0	CTA
1072	C+	H-	H-	C	HE	HE	2.30E-07	-0.50	0.0	MNA
1073	C+	H2	CH+	H	HE	HE	1.00E-10	0.00	4640.0	MIAA AS84
1074	C+	H2	CH2+	PHOTON	HE	HE	4.00E-16	-0.20	0.0	RAA H85
1075	C+	C-	CH2+	C	HE	HE	2.30E-07	-0.50	0.0	MNA
1076	C+	CH	C3+	H	HE	HE	3.80E-10	0.00	0.0	COA
1077	C+	CH	CH+	C	HE	HE	3.80E-10	0.00	0.0	CTA
1078	C+	CH2	CH2+	C	HE	HE	3.80E-10	0.00	0.0	CTA
1079	C+	CH2	C3H+	H	HE	HE	5.20E-10	0.00	0.0	CTA
1080	C+	NH	CN+	H	HE	HE	7.80E-10	0.00	0.0	COA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
1081	C+	CH3	C2H+	H2			1.00E-09	0.00	0.0	COA
1082	C+	CH3	C2H2+	H			1.30E-09	0.00	0.0	COA
1083	C+	NH2	HCN+	H			1.10E-09	0.00	0.0	COA
1084	C+	CH4	C2H3+	H			1.10E-09	0.00	0.0	MCOA18012
1085	C+	CH4	C2H2+	H2			4.00E-10	0.00	0.0	MCOA18012
1086	C+	OH	CO+	H			7.70E-10	0.00	0.0	COA
1087	C+	NH3	H2NC+	H			1.75E-09	0.00	0.0	MCOA17707
1088	C+	NH3	NH3+	C			5.06E-10	0.00	0.0	MCTA17707
1089	C+	NH3	HCN+	H2			7.00E-11	0.00	0.0	MCOA17707
1090	C+	H2O	HCO+	H			9.00E-10	0.00	0.0	MCOA17601
1091	C+	H2O	HOC+	H			1.80E-09	0.00	0.0	MCOA17601
1092	C+	C2H	C3+	H			1.00E-09	0.00	0.0	COA
1093	C+	C2H2	C3H+	H			2.20E-09	0.00	0.0	MCOA18207
1094	C+	HCN	CNC+	H			3.10E-09	0.00	0.0	MCOA18012
1095	C+	HNC	CCN+	H			3.10E-09	0.00	0.0	COA
1096	C+	C2H3	C3H2+	H			1.00E-09	0.00	0.0	COA
1097	C+	C2H4	C2H3+	CH			8.50E-11	0.00	0.0	MPNA18309
1098	C+	C2H4	C2H4+	C			1.70E-11	0.00	0.0	MPNA18309
1099	C+	C2H4	C3H+	H2			8.50E-11	0.00	0.0	MCOA18309
1100	C+	C2H4	C3H2+	H2			3.40E-10	0.00	0.0	MCOA18309
1101	C+	C2H4	H2C3H+	H			1.02E-09	0.00	0.0	MCOA18309
1102	C+	SiH	SiC+	H			1.10E-09	0.00	0.0	COA HM89
1103	C+	HCO	HCO+	C			4.80E-10	0.00	0.0	CTA
1104	C+	HCO	CH+	CO			4.80E-10	0.00	0.0	HAA
1105	C+	C2H5	C2H5+	C			5.00E-10	0.00	0.0	CTA
1106	C+	C2H5	H2C3H+	H2			5.00E-10	0.00	0.0	CTA
1107	C+	NO	NO+	C			5.20E-10	0.00	0.0	MCTA18008
1108	C+	SiH2	SiH2+	C			1.00E-09	0.00	0.0	CTA HM89
1109	C+	SiH2	SiC+	H2			1.00E-09	0.00	0.0	COA HM89
1110	C+	SiH2	HC5H+	H			1.00E-09	0.00	0.0	COA HM89
1111	C+	H2CO	CH2+	CO			2.34E-09	0.00	0.0	MPNA17803
1112	C+	H2CO	HCO+	CH			7.80E-10	0.00	0.0	MPNA17803
1113	C+	H2CO	H2CO+	C			7.80E-10	0.00	0.0	MCTA17803
1114	C+	SiH3	SiH3+	C			1.00E-09	0.00	0.0	CTA HM89
1115	C+	SiH3	HC5H+	H2			1.00E-09	0.00	0.0	COA HM89
1116	C+	SiH3	SiCH2+	H			1.00E-09	0.00	0.0	COA HM89
1117	C+	O2	CO+	O			3.80E-10	0.00	0.0	MPNA17705
1118	C+	O2	O+	CO			6.20E-10	0.00	0.0	MPNA17705
1119	C+	PH	PH+	C			1.00E-09	0.00	0.0	CTA
1120	C+	SiH4	SiCH3+	H			1.00E-09	0.00	0.0	COA HM89
1121	C+	SiH4	SiCH2+	H2			1.00E-09	0.00	0.0	COA HM89
1122	C+	CH3OH	CH3+	HCO			2.08E-09	0.00	0.0	MPNA17803
1123	C+	CH3OH	H3CO+	CH			5.20E-10	0.00	0.0	MPNA17803
1124	C+	S-	C	S			2.30E-07	-0.50	0.0	MNA
1125	C+	HS	CS+	H			1.10E-09	0.00	0.0	COA
1126	C+	H2S	HCS+	H			1.40E-09	0.00	0.0	MCOA17601
1127	C+	H2S	H2S+	C			6.00E-10	0.00	0.0	MCTA17601
1128	C+	HCL	CCL+	H			1.10E-09	0.00	0.0	MCOA17601
1129	C+	C3	C4+	H			1.00E-13	-1.00	0.0	RAA H85
1130	C+	C3H	C4+	H			1.00E-09	0.00	0.0	COA
1131	C+	C3H2	C4+	H			1.00E-09	0.00	0.0	COA
1132	C+	C3H2	C4H+	H			1.00E-09	0.00	0.0	COA
1133	C+	HC23	C4+	H2			1.00E-09	0.00	0.0	COA
1134	C+	H2C3	C4H+	H			1.00E-09	0.00	0.0	COA
1135	C+	C3H3	H2C3H+	C			1.00E-09	0.00	0.0	CTA HL89
1136	C+	C3H3	C4H2+	H			1.00E-09	0.00	0.0	COA
1137	C+	C3H3	C4H+	H2			1.00E-09	0.00	0.0	COA
1138	C+	CCO	C2O+	C			1.00E-09	0.00	0.0	CTA
1139	C+	SiC	Si+	C2			2.50E-09	0.00	0.0	PNA HM89
1140	C+	SiC	SiC+	C			2.50E-09	0.00	0.0	CTA HM89
1141	C+	C3H4	C4H2+	H2			5.70E-10	0.00	0.0	MCOA18207
1142	C+	C3H4	C3H4+	C			5.70E-10	0.00	0.0	MCTA18207
1143	C+	C3H4	H2C3H+	CH			3.80E-10	0.00	0.0	PNA18207
1144	C+	C3H4	C3H2+	C3H2			1.90E-10	0.00	0.0	PNA18207
1145	C+	C3H4	C3H3+	C2H			1.90E-10	0.00	0.0	PNA18207
1146	C+	CH2CN	CH2CN+	C			2.00E-09	0.00	0.0	CTA HL90
1147	C+	HCSI	SiC2+	H			2.00E-09	0.00	0.0	COA HM89
1148	C+	CH3CN	C3H3+	CN			2.00E-09	0.00	0.0	PNA
1149	C+	SIN	SIN+	C			1.00E-09	0.00	0.0	CTA HM89
1150	C+	SIN	SiC+	N			1.00E-09	0.03	0.0	PNA HM89
1151	C+	CP	CP+	C			1.00E-09	0.00	0.0	CTA
1152	C+	OCN	CO+	CN			3.80E-09	0.00	0.0	PNA
1153	C+	SiCH2	SiCH2+	C			1.00E-09	0.00	0.0	CTA HM89
1154	C+	SiCH2	SiC2H+	H			1.00E-09	0.00	0.0	COA HM89
1155	C+	SiCH2	SiC3+	H2			1.00E-09	0.00	0.0	COA HM89
1156	C+	CH2CO	CH2CO+	C			2.00E-09	0.00	0.0	CTA
1157	C+	HNSI	SINC+	H			2.00E-09	0.00	0.0	COA HM89
1158	C+	SiCH3	SiC2H2+	H			1.00E-09	0.00	0.0	COA HM89
1159	C+	SiCH3	SiC2H3+	H2			1.00E-09	0.00	0.0	COA HM89
1160	C+	SiCH3	SiC3H+	C			1.00E-09	0.00	0.0	CTA HM89
1161	C+	HCP	HCP+	C			5.00E-10	0.00	0.0	CTA
1162	C+	HCP	CCP+	H			5.00E-10	0.00	0.0	COA
1163	C+	SiO	Si+	CO			5.40E-10	0.00	0.0	PNA HM89
1164	C+	CO2	CO+	CO			1.10E-09	0.00	0.0	MPNA18112
1165	C+	CH3CHO	CH3CHO+	C			1.50E-09	0.00	0.0	CTA MC90
1166	C+	CH3CHO	CH3CO+	CH			1.50E-09	0.00	0.0	PNA MC90
1167	C+	CH2PH	PC2H+	H2			1.00E-09	0.00	0.0	COA
1168	C+	NS	NS+	C			7.60E-10	0.00	0.0	CTA
1169	C+	NS	CS+	N			7.60E-10	0.00	0.0	PNA
1170	C+	H2CS	CH2+	CS			1.50E-09	0.00	0.0	HAA
1171	C+	H2SiO	H2SiO+	C			2.00E-09	0.00	0.0	CTA HM89
1172	C+	C2H5OH	C2H5OH+	C			1.50E-09	0.00	0.0	CTA MC90
1173	C+	C2H5OH	H3CO+	C2H3			1.50E-09	0.00	0.0	PNA MC90
1174	C+	CH3OCH3	CH3O+	C			2.00E-09	0.00	0.0	CTA MC90
1175	C+	PO	PO+	C			1.00E-09	0.00	0.0	CTA TA84
1176	C+	CCL	CCL+	C			1.00E-09	0.00	0.0	CTA
1177	C+	SO	S+	CO			2.60E-10	0.00	0.0	PNA
1178	C+	SO	CS+	O			2.60E-10	0.00	0.0	PNA
1179	C+	SO	SO+	C			2.60E-10	0.00	0.0	CTA
1180	C+	SO	CO+	S			2.60E-10	0.00	0.0	PNA
1181	C+	IPO	IPO+	C			1.00E-09	0.00	0.0	CTA
1182	C+	C4H	C5+	H			1.00E-09	0.00	0.0	RAA H85
1183	C+	C4H	C5+	H			1.31E-09	0.00	0.0	MCTA1DF86
1184	C+	C4H2	C4H2+	C			1.45E-10	0.00	0.0	MPNA1DF86
1185	C+	C4H2	C3H+	C2H			1.45E-10	0.00	0.0	MCTA1DF86
1186	C+	C4H2	C3H+	H			1.45E-10	0.00	0.0	MCTA1DF86
1187	C+	CLO	CLO+	C			1.00E-09	0.00	0.0	CTA
1188	C+	HC3N	C3H+	CN			4.90E-09	0.00	0.0	MPNA18518
1189	C+	HC3N	C4N+	H			1.20E-09	0.00	0.0	MCOA18518
1190	C+	HC3N	C3+	HCN			2.50E-10	0.00	0.0	MPNA18518
1191	C+	HC3N	CCN+	C2H			1.00E-10	0.00	0.0	MPNA18518
1192	C+	C3O	C4+	O			3.33E-10	0.00	0.0	COA
1193	C+	C3O	C3+	CO			3.33E-10	0.00	0.0	PNA
1194	C+	C3O	C3O+	C			3.33E-10	0.00	0.0	CTA
1195	C+	SiC2	SiC2+	C			2.00E-09	0.00	0.0	CTA HM89
1196	C+	SiC2H	SiC3+	H			1.00E-09	0.00	0.0	COA HM89
1197	C+	SiC2H	SiC2H+	C			1.00E-09	0.00	0.0	CTA HM89
1198	C+	HC3CN	H2C3H+	CN			1.80E-09	0.00	0.0	MPNA1PF92
1199	C+	H3C3N	C3H2+	HCN			9.84E-10	0.00	0.0	MPNA1PF92
1200	C+	H3C3N	H2C4N+	H			1.19E-09	0.00	0.0	MPNA1PF92

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
1201	C+	SIC2H2	SIC3H+	H			2.00E-09	0.00	0.0	COA HM89
1202	C+	CCP	CCP+	C			5.00E-10	0.00	0.0	CTA
1203	C+	CCP	CP+	C2			5.00E-10	0.00	0.0	PNA
1204	C+	HCCP	CCP+	CH			5.00E-10	0.00	0.0	PNA
1205	C+	HCCP	CP+	C2H			5.00E-10	0.00	0.0	PNA
1206	C+	C2S	C2S+	C			5.00E-10	0.00	0.0	CTA MH90
1207	C+	C2S	C3+	S			5.00E-10	0.00	0.0	PNA MH90
1208	C+	C2H6CO	C2H6CO+	S			3.00E-09	0.00	0.0	CTA MC90
1209	C+	SIS	SIC+	S			2.30E-09	0.00	0.0	PNA
1210	C+	SIS	SIS+	C			2.30E-09	0.00	0.0	CTA
1211	C+	OCS	OCS+	C			4.00E-10	0.00	0.0	MCTA17803
1212	C+	OCS	C3+	CO			1.60E-09	0.00	0.0	MPNA17803
1213	C+	HCOOCH3	COOCH4+	C			3.00E-09	0.00	0.0	CTA MC90
1214	C+	C5	C6+	PHOTON			1.00E-09	0.00	0.0	RAA HL89
1215	C+	C5H	C6+	H			3.00E-09	0.00	0.0	COA
1216	C+	C5H2	C6+	H2			1.20E-09	0.00	0.0	COA
1217	C+	C5H2	C6H+	H			1.20E-09	0.00	0.0	COA
1218	C+	SO2	SO+	CO			2.30E-09	0.00	0.0	MPNA17507
1219	C+	SIC3	SIC3+	C			2.00E-09	0.00	0.0	CTA HM89
1220	C+	C5H4	C6H3+	H			2.00E-09	0.00	0.0	COA
1221	C+	C5H4	C6H2+	H2			7.50E-10	0.00	0.0	COA HL89
1222	C+	C5H4	C6H3+	CH			7.50E-10	0.00	0.0	PNA HL89
1223	C+	SIC3H	SIC4+	H			2.00E-09	0.00	0.0	COA HM89
1224	C+	H3CAN	C2H3+	C3N			2.00E-09	0.00	0.0	PNA
1225	C+	C3P	C4+	P			1.00E-11	0.00	0.0	COA
1226	C+	C3S	C3S+	C			5.00E-10	0.00	0.0	CTA MH90
1227	C+	C3S	C4+	S			5.00E-10	0.00	0.0	PNA MH90
1228	C+	C6	C7+	PHOTON			1.00E-09	0.00	0.0	RAA HL89
1229	C+	C6H	C7+	H			2.00E-10	0.00	0.0	COA
1230	C+	C6H2	C7+	H2			1.20E-09	0.00	0.0	COA HL89
1231	C+	C6H2	C7H+	H			1.20E-09	0.00	0.0	COA HL89
1232	C+	HCSN	C8H+	CN			6.00E-09	0.00	0.0	PNA
1233	C+	C4P	C3+	P			1.00E-09	0.00	0.0	COA
1234	C+	C4S	C4S+	C			5.00E-10	0.00	0.0	CTA MH90
1235	C+	C4S	C6+	S			5.00E-10	0.00	0.0	PNA MH90
1236	C+	C7	C8+	PHOTON			1.00E-09	0.00	0.0	RAA HL89
1237	C+	C7H	C8+	II			3.00E-09	0.00	0.0	COA HL89
1238	C+	C7H2	C8+	H2			1.20E-09	0.00	0.0	COA HL89
1239	C+	C7H2	C8H+	H			1.20E-09	0.00	0.0	COA HL89
1240	C+	C7H4	C8H2+	H2			7.50E-10	0.00	0.0	COA HL89
1241	C+	C7H4	C7H3+	CH			7.50E-10	0.00	0.0	PNA HL89
1242	C+	C8	C9+	PHOTON			1.00E-09	0.00	0.0	RAA HL89
1243	C+	C8H	C9+	H			1.40E-09	0.00	0.0	COA HL89
1244	C+	C8H2	C9+	H2			1.20E-09	0.00	0.0	COA HL89
1245	C+	C8H2	C9H+	H			1.20E-09	0.00	0.0	COA HL89
1246	C+	C9	C10+	PHOTON			1.00E-09	0.00	0.0	RAA HL89
1247	C+	C9H	C10+	H			4.00E-09	0.00	0.0	COA HL89
1248	C+	C9H2	C10+	H2			2.40E-09	0.00	0.0	COA HL89
1249	C+	H3C4N	C4H3+	CN			5.00E-09	0.00	0.0	PNA HL89
1250	C+	H3C6N	C6H3+	CN			5.00E-09	0.00	0.0	PNA HL89
1251	C+	HCTN	C7H+	CN			6.00E-09	0.00	0.0	PNA HL89
1252	C+	H3C8N	C8H3+	CN			5.00E-09	0.00	0.0	PNA HL89
1253	C+	H3C9N	C9H+	CN			6.00E-09	0.00	0.0	PNA HL89
1254	C+	H	CH	ELECTR			5.00E-10	0.00	0.0	ADA
1255	C-	C	C2	ELECTR			5.00E-10	0.00	0.0	ADA
1256	C-	N	CN	ELECTR			5.00E-10	0.00	0.0	ADA
1257	C-	O	CO	ELECTR			5.00E-10	0.00	0.0	ADA
1258	C-	H2	CH2	ELECTR			1.00E-13	0.00	0.0	ADA
1259	C-	CH	C2H	ELECTR			5.00E-10	0.00	0.0	ADA
1260	C-	CH2	C2H2	ELECTR			5.00E-10	0.00	0.0	ADA
1261	C-	NH	HCN				5.00E-10	0.00	0.0	ADA
1262	C-	OH	HCO				5.00E-10	0.00	0.0	ADA
1263	C-	H2O	H2CO				5.00E-10	0.00	0.0	ADA
1264	C-	NO	CN-	O			1.00E-09	0.00	0.0	NIA
1265	C-	O2	O-	CO			4.00E-10	0.00	0.0	NIA
1266	C-	O2	CO2	ELECTR			5.00E-11	0.00	0.0	ADA
1267	C-	CO2	CO	ELECTR			7.50E-10	0.00	0.0	NIA
1268	CH+	H	C+	H2			1.20E-09	0.00	0.0	MPNA18403
1269	CH+	C	C2+	H			1.20E-09	0.00	0.0	CIA
1270	CH+	N	CN+	H			1.90E-10	0.00	0.0	MCOA18008
1271	CH+	O	CO+	II			3.50E-10	0.00	0.0	MCOA18008
1272	CH+	NA	NA+	CH			3.50E-10	0.00	0.0	CTA
1273	CH+	MG	MG+	CH			3.60E-10	0.00	0.0	CTA
1274	CH+	SI	SI+	CH			2.00E-10	0.00	0.0	CTA
1275	CH+	S	S+	CH			4.70E-10	0.00	0.0	CTA
1276	CH+	S	HS+	C			4.70E-10	0.00	0.0	PNA
1277	CH+	S	CS+	H			4.70E-10	0.00	0.0	COA
1278	CH+	FE	FE+	CH			2.60E-10	0.00	0.0	CTA
1279	CH+	H2	CH2+	H			1.20E-09	0.00	0.0	MHAA18403
1280	CH+	CH	C2+	H2			7.40E-10	0.00	0.0	COE
1281	CH+	CH2	C2H+	H2			1.00E-09	0.00	0.0	COE
1282	CH+	NH	CN+	H2			7.60E-10	0.00	0.0	COE
1283	CH+	NH2	HCN+	H2			1.10E-09	0.00	0.0	COE
1284	CH+	CH4	C2H3+	H2			1.43E-10	0.00	0.0	MCOE17705
1285	CH+	CH4	C2H2+	H2			1.09E-09	0.00	0.0	MCOE17705
1286	CH+	CH4	C2H4+	H			7.50E-10	0.00	0.0	MCOE17705
1287	CH+	OH	CO+	H2			4.59E-10	0.00	0.0	MCTE17707
1288	CH+	NH3	NH3+	CI1			4.03E-10	0.00	0.0	MPTTE17707
1289	CH+	NH3	NH4+	C			1.84E-09	0.00	0.0	MCOE17707
1290	CH+	NH3	H2NC+	H2			2.90E-09	0.00	0.0	MCOE17705
1291	CH+	H2O	HCO+	H2			5.80E-10	0.00	0.0	MPTTE17705
1292	CH+	H2O	H3O+	C			5.80E-10	0.00	0.0	MCOE17705
1293	CH+	H2O	H2CO+	H			1.00E-09	0.00	0.0	COE
1294	CH+	C2	C3+	H			9.80E-10	0.00	0.0	COE
1295	CI1+	C2H	C3+	H2			2.40E-09	0.00	0.0	COE
1296	CH+	C2H2	C3H2+	II			5.50E-10	0.00	0.0	COE
1297	CH+	CN	CNC+	H			5.50E-10	0.00	0.0	COE
1298	CH+	CN	CNC+	H			5.50E-10	0.00	0.0	COE
1299	CH+	HCN	CCNH+	H			2.40E-10	0.00	0.0	MCOE18501
1300	CH+	HCN	HCNH+	C			1.80E-09	0.00	0.0	MPTTE18501
1301	CH+	HCN	CCN+	H2			3.60E-10	0.00	0.0	MCOE18501
1302	CH+	HNC	HCNH+	C			1.80E-09	0.00	0.0	PTE
1303	CI1+	CO	HCO+	C			7.00E-12	0.00	0.0	MPTTE17705
1304	CH+	HCO	CH2+	CO			4.60E-10	0.00	0.0	HAE
1305	CH+	HCO	HCO+	CH			4.60E-10	0.00	0.0	CTE
1306	CH+	NO	NO+	CH			7.60E-10	0.00	0.0	MCTTE18008
1307	CH+	H2CO	CH3+	CO			9.60E-10	0.00	0.0	MHAE17803
1308	CH+	H2CO	HCO+	CH2			9.60E-10	0.00	0.0	MPNE17803
1309	CH+	H2CO	H3CO+	C			9.60E-10	0.00	0.0	MPNE17803
1310	CH+	O2	HCO+	O			9.70E-10	0.00	0.0	MPNA17705
1311	CH+	O2	HCO+	O+			1.00E-11	0.00	0.0	MPNE17705
1312	CH+	O2	CO+	OH			1.00E-11	0.00	0.0	MPNE17705
1313	CH+	CH3OH	CH3+	II2CO			1.45E-09	0.00	0.0	MHAE17803
1314	CH+	CH3OH	H3CO+	CH2			2.90E-10	0.00	0.0	MPNE17803
1315	CH+	CH3OH	CH3OH2+	C			1.16E-09	0.00	0.0	MPTTE17803
1316	CH+	H2S	HCS+	H2			1.47E-09	0.00	0.0	MCOE17803
1317	CH+	H2S	H3S+	C			6.30E-10	0.00	0.0	MPTTE17803
1318	CH+	CO2	HCO+	CO			1.60E-09	0.00	0.0	MPNE17705
1319	CH+	OCS	HCS+	CO			1.05E-09	0.00	0.0	MPNE17803
1320	CH+	OCS	HOCs+	C			8.55E-10	0.00	0.0	MPTTE17803

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
1321	N+	MG	MG+	N	N		1.20E-09	0.00	0.0	CTE
1322	N+	FE	FE+	N	N		1.50E-09	0.00	0.0	CTE
1323	N+	H-	H	N	N		2.30E-07	-0.50	0.0	MNA
1324	N+	H2	NH+	H	C		1.00E-09	0.00	85.0	MHAA AS84
1325	N+	C-	N	H	C		2.30E-07	-0.50	0.0	MNA
1326	N+	CH	CN+	H	H		3.60E-10	0.00	0.0	COE
1327	N+	CH	CH+	N	N		3.60E-10	0.00	0.0	CTE
1328	N+	CH2	CH2+	N	N		1.00E-09	0.00	0.0	CTE
1329	N+	NH	N2+	H	H		3.70E-10	0.00	0.0	COE
1330	N+	NH	NH+	N	N		3.70E-10	0.00	0.0	CTE
1331	N+	NH2	NH2+	N	N		1.00E-09	0.00	0.0	CTE
1332	N+	CH4	CH3+	N	H		4.70E-10	0.00	0.0	MPNEI8010
1333	N+	CH4	CH4+	N	H		2.80E-11	0.00	0.0	MCTEI8010
1334	N+	CH4	HCN+	H2	H		5.60E-11	0.00	0.0	MCTEI8010
1335	N+	CH4	HCNH+	H	H		3.80E-10	0.00	0.0	MCOEI8010
1336	N+	OH	OH+	N	N		3.70E-10	0.00	0.0	CTE
1337	N+	NH3	N2H+	H2	N		2.16E-10	0.00	0.0	MCOEI8010
1338	N+	NH3	NH2+	NH	N		2.16E-10	0.00	0.0	MPNEI8010
1339	N+	NH3	NH3+	N	N		1.97E-09	0.00	0.0	MCTEI8010
1340	N+	H2O	H2O+	N	N		2.80E-09	0.00	0.0	MCTEI8010
1341	N+	C2	C2+	N	N		1.00E-09	0.00	0.0	CTE
1342	N+	C2H	C2H+	N	N		9.50E-10	0.00	0.0	CTE
1343	N+	CN	CN+	N	N		1.10E-09	0.00	0.0	CTE
1344	N+	HCN	HCN+	N	N		1.20E-09	0.00	0.0	CTE
1345	N+	CO	CO+	N	N		8.25E-10	0.00	0.0	MCTEI8009
1346	N+	CO	NO+	N	C		1.45E-10	0.00	0.0	MPNEI8009
1347	N+	HCO	NH+	CO	CO		4.50E-10	0.00	0.0	HAE
1348	N+	HCO	HCO+	N	N		4.50E-10	0.00	0.0	CTE
1349	N+	NO	NO+	N	N		4.51E-10	0.00	0.0	MCTEI8010
1350	N+	H2O	N2+	O	O		7.90E-11	0.00	0.0	MPNEI8010
1351	N+	H2O	NO+	CH2	NH		2.90E-10	0.00	0.0	MPNEI8010
1352	N+	H2CO	HCO+	NH	NH		7.25E-10	0.00	0.0	MPNEI8010
1353	N+	H2CO	H2CO+	N	N		1.89E-09	0.00	0.0	MCTEI8010
1354	N+	O2	O+	NO	NO		3.66E-11	0.00	0.0	MPNEI8010
1355	N+	O2	NO+	O	O		2.63E-10	0.00	0.0	MPNEI8010
1356	N+	O2	O2+	N	N		3.11E-10	0.00	0.0	MCTEI8010
1357	N+	CH3OH	NO+	CH3	H		3.10E-10	0.00	0.0	MPNEI8010
1358	N+	CH3OH	CH3+	NO	H		1.24E-10	0.00	0.0	MPNEI8010
1359	N+	CH3OH	H2CO+	NH	H		9.30E-10	0.00	0.0	MPNEI8010
1360	N+	CH3OH	H3CO+	NH	NH		4.96E-10	0.00	0.0	MPNEI8010
1361	N+	CH3OH	CH3OH+	N	N		1.24E-09	0.00	0.0	MCTEI8010
1362	N+	S-	N	S	S		2.30E-07	-0.50	0.0	MNA
1363	N+	H2S	S+	NH	NH		2.28E-10	0.00	0.0	MPNEI8010
1364	N+	H2S	HS+	NH	NH		5.51E-10	0.00	0.0	MPNEI8010
1365	N+	H2S	NH+	HS	HS		5.70E-11	0.00	0.0	MPNEI8010
1366	N+	H2S	H2S+	N	N		1.06E-09	0.00	0.0	MCTEI8010
1367	N+	CO2	CO+	NO	NO		2.50E-10	0.00	0.0	MPNEI8010
1368	N+	CO2	CO2+	N	N		7.50E-10	0.00	0.0	MCTEI8010
1369	N+	OCs	S+	CO	CO		3.08E-10	0.00	0.0	MPNEI8010
1370	N+	OCs	CS+	NO	NO		7.00E-11	0.00	0.0	MPNEI8010
1371	N+	OCs	OCs+	N	N		1.02E-09	0.00	0.0	MCTEI8010
1372	CH2+	H	CH+	H2	H2		1.00E-09	0.00	7080.0	PNA
1373	CH2+	C	C2H+	H	H		1.20E-09	0.00	0.0	GIA
1374	CH2+	C	HCN+	H	H		2.20E-10	0.00	0.0	MCOAI8008
1375	CH2+	O	HCO+	H	H		7.50E-10	0.00	0.0	COA
1376	CH2+	S	HCS+	H	H		1.40E-09	0.00	0.0	COA
1377	CH2+	H2	CH3+	H	H		1.60E-09	0.00	0.0	MHAA17705
1378	CH2+	CH4	C2H5+	H	H		3.60E-10	0.00	0.0	MCOAI17705
1379	CH2+	CH4	C2H4+	H2	H2		8.40E-10	0.00	0.0	MCOAI17705
1380	CH2+	NH3	CH4N+	H	H		1.54E-09	0.00	0.0	MCOAI17701
1381	CH2+	NH3	NH4+	CH	CH		1.26E-09	0.00	0.0	MPTAI7701
1382	CH2+	H2O	H3CO+	H	H		1.20E-09	0.00	0.0	MCOAI8001
1383	CH2+	C2H	C3H2+	H	H		9.50E-10	0.00	0.0	COA
1384	CH2+	HCN	CH2CN+	H	H		1.80E-09	0.00	0.0	MCOAI8501
1385	CH2+	HCO	CH3+	CO	CO		4.50E-10	0.00	0.0	HAA
1386	CH2+	NO	NO+	CH2	CH2		4.20E-10	0.00	0.0	MCTAI8008
1387	CH2+	H2CO	HCO+	CH3	CH3		2.81E-09	0.00	0.0	MPNAI7803
1388	CH2+	H2CO	CH2CO+	H2	H2		1.65E-10	0.00	0.0	MCOAI7803
1389	CH2+	H2CO	CH3CO+	H	H		3.30E-10	0.00	0.0	MCOAI7803
1391	CH2+	O2	HCO+	OH	OH		9.10E-10	0.00	0.0	MPNAI7705
1392	CH2+	H2S	H3CS+	H	H		1.84E-09	0.00	0.0	MCOAI7803
1393	CH2+	H2S	HCS+	H2	H2		2.30E-10	0.00	0.0	MPNAI7803
1394	CH2+	H2S	H3S+	CH	CH		2.30E-10	0.00	0.0	MPTAI7803
1395	CH2+	CO2	H2CO+	CO	CO		1.60E-09	0.00	0.0	MPNAI7803
1396	CH2+	OCs	HCS+	HCO	HCO		1.08E-09	0.00	0.0	MPNAI7803
1397	CH2+	OCs	H2CS+	CO	CO		7.20E-10	0.00	0.0	MPNAI7803
1398	NH+	C	CH+	N	N		1.60E-09	0.00	0.0	PTE
1399	NH+	O	OH+	N	N		1.30E-09	0.00	0.0	COE
1401	NH+	S	HS+	N	N		6.90E-10	0.00	0.0	PTE
1402	NH+	S	S+	NH	NH		6.90E-10	0.00	0.0	CTE
1403	NH+	H2	NH2+	H	H		1.28E-09	0.00	0.0	MHAAI8010
1404	NH+	CH	H3+	N	N		2.25E-10	0.00	0.0	MPTAI8010
1405	NH+	CH	CH2+	N	N		9.90E-10	0.00	0.0	PTE
1406	NH+	CH2	CH3+	N	N		1.40E-09	0.00	0.0	PTE
1407	NH+	NH	NH2+	N	N		1.00E-09	0.00	0.0	PTE
1408	NH+	NH2	NH3+	N	N		1.50E-09	0.00	0.0	PTE
1409	NH+	OH	H2O+	N	N		1.00E-09	0.00	0.0	PTE
1410	NH+	NH3	NH3+	NH	NH		1.80E-09	0.00	0.0	MCTEI8010
1411	NH+	NH3	NH4+	N	N		6.00E-10	0.00	0.0	MPTEI8010
1412	NH+	H2O	H3O+	N	N		1.05E-09	0.00	0.0	MPTEI8010
1413	NH+	H2O	H2O+	NH	NH		1.05E-09	0.00	0.0	MCTEI8010
1414	NH+	H2O	NH2+	OH	OH		8.75E-10	0.00	0.0	MHAEI8010
1415	NH+	H2O	HNO+	H2	H2		3.50E-10	0.00	0.0	MCOEI8010
1416	NH+	H2O	NH3+	O	O		1.75E-10	0.00	0.0	MHAEI8010
1417	NH+	C2	CCN+	H	H		4.90E-10	0.00	0.0	GOE
1418	NH+	C2	HCN+	C	C		4.90E-10	0.00	0.0	PNE
1419	NH+	C2	C3H+	N	N		4.90E-10	0.00	0.0	PTE
1420	NH+	C2H	C2H2+	N	N		1.40E-09	0.00	0.0	PTE
1421	NH+	CN	HCN+	N	N		1.60E-09	0.00	0.0	PTE
1422	NH+	HCN	HCNH+	N	N		1.80E-09	0.00	0.0	PTE
1423	NH+	HNC	HCNH+	N	N		1.80E-09	0.00	0.0	PTE
1424	NH+	CO	HCO+	N	N		4.41E-10	0.00	0.0	MPTEI8010
1425	NH+	CO	NCO+	H	H		5.39E-10	0.00	0.0	MCOEI8010
1426	NH+	N2	N2H+	N	N		6.50E-10	0.00	0.0	MPTEI8010
1427	NH+	HCO	H2CO+	N	N		1.30E-09	0.00	0.0	PTE
1428	NH+	NO	NO+	NH	NH		7.12E-10	0.00	0.0	MCTEI8010
1429	NH+	NO	N2H+	O	O		1.78E-10	0.00	0.0	MPNEI8010
1430	NH+	H2CO	HCO+	NH2	NH2		1.82E-09	0.00	0.0	MPNEI8010
1431	NH+	H2CO	H2CO+	NH	NH		9.90E-10	0.00	0.0	MCTEI8010
1432	NH+	H2CO	H3CO+	N	N		4.98E-10	0.00	0.0	MPTEI8010
1433	NH+	O2	O2+	NH	NH		4.51E-10	0.00	0.0	MCTEI8010
1434	NH+	O2	O2H+	N	N		1.64E-10	0.00	0.0	MPTEI8010
1435	NH+	O2	NO+	OH	OH		2.05E-10	0.00	0.0	MPNEI8010
1436	NH+	CO2	HCO2+	N	N		3.85E-10	0.00	0.0	MPTEI8010
1437	NH+	CO2	HNO+	CO	CO		3.85E-10	0.00	0.0	MPNEI8010
1438	NH+	CO2	NO+	HCO	HCO		3.30E-10	0.00	0.0	MPNEI8010
1439	CH3+	H	CH2+	H2	H2		7.00E-10	0.00	10560.0	PNA
1440	CH3+	C	C2H+	H2	H2		1.20E-09	0.00	0.0	COA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
1441	CH3+	N	H2NC+	H			6.70E-11	0.00	0.0	MCOA17604
1442	CH3+	O	HCO+	H2			4.00E-10	0.00	0.0	MCOA17604
1443	CH3+	O	H2CO+	H			4.00E-11	0.00	0.0	MCOA17604
1444	CH3+	NA	MG+	CH3			3.40E-09	0.00	0.0	CTA
1445	CH3+	MG	NA+	CH3			3.50E-09	0.00	0.0	CTA
1446	CH3+	SI	HCSI+	H2			2.00E-10	0.00	0.0	COA HM89
1447	CH3+	SI	SiCH2+	H			2.00E-10	0.00	0.0	COA HM89
1448	CH3+	S	HCS+	H2			1.40E-09	0.00	0.0	COA
1449	CH3+	FE	FE+	CH3			2.40E-09	0.00	0.0	CTA
1450	CH3+	H2	CH5+	PHOTON			1.30E-14	-1.00	0.0	MRAA IS89
1451	CH3+	CH	C2H2+	H2			7.10E-10	0.00	0.0	COA
1452	CH3+	CH2	C2H3+	H2			9.90E-10	0.00	0.0	COA
1453	CH3+	NH	HCNH+	H			7.40E-10	0.00	0.0	COA
1454	CH3+	NH2	CH4+	H2			1.00E-09	0.00	0.0	COA
1455	CH3+	CH4	C2H5+	H2			1.20E-09	0.00	0.0	MCOA17803
1456	CH3+	OH	H2CO+	H2			7.20E-10	0.00	0.0	COA
1457	CH3+	NH3	NH4+	CH2			3.40E-10	0.00	0.0	MPTA18001
1458	CH3+	NH3	CH4+	H2			1.19E-09	0.00	0.0	MCOA18001
1459	CH3+	H2O	CH3OH2+	PHOTON			5.50E-12	-1.70	0.0	MRAA H85
1460	CH3+	C2	C3H+	H2			9.90E-10	0.00	0.0	COA
1461	CH3+	C2H	C3H2+	H2			5.00E-10	0.00	0.0	COA HL89
1462	CH3+	C2H	H2C3H+	H			5.00E-10	0.00	0.0	COA HL89
1463	CH3+	C2H2	H2C3H+	H2			1.20E-09	0.00	0.0	MCOA18501
1464	CH3+	CN	CH2CN+	H			1.10E-09	0.00	0.0	COA
1465	CH3+	HCN	H4C2N+	PHOTON			9.00E-09	-0.50	0.0	MRAA H85
1466	CH3+	C2H3	C3H4+	H2			6.00E-10	0.00	0.0	COA HL89
1467	CH3+	C2H3	C3H3+	H		H2	1.00E-10	0.00	0.0	COA HL89
1468	CH3+	C2H3	C2H3+	CH3			3.00E-10	0.00	0.0	CTA HL89
1469	CH3+	CO	CH3CO+	PHOTON			1.20E-13	-1.30	0.0	MRAA H85
1470	CH3+	C2H4	C3H5+	H2			5.24E-10	0.00	0.0	MCOA17712
1471	CH3+	C2H4	C2H3+	CH4			3.50E-10	0.00	0.0	MPNA17712
1472	CH3+	C2H4	H2C3H+	H2		H2	4.60E-11	0.00	0.0	MCOA17712
1473	CH3+	SiH	SiCH2+	H2			4.00E-10	0.00	0.0	COA
1474	CH3+	HCO	CH4+	CO			4.40E-10	0.00	0.0	HAA
1475	CH3+	HCO	HCO+	CH3			4.40E-10	0.00	0.0	CTA
1476	CH3+	NO	NO+	CH3			1.00E-09	0.00	0.0	MCTA18008
1477	CH3+	P	PCB2+	H			1.00E-09	0.00	0.0	PNA
1478	CH3+	H2CO	HCO+	CH4			1.60E-09	0.00	0.0	MPNA17803
1479	CH3+	O2	H3CO+	O			5.00E-12	0.00	0.0	PNA
1480	CH3+	CH3OH	C2H6OH+	CH4			2.30E-09	0.00	0.0	MPNA17803
1481	CH3+	CH3OH	C2H6OH+	PHOTON			7.80E-12	-1.10	0.0	RAA H87
1482	CH3+	HS	H2CS+	H2			1.00E-09	0.00	0.0	COA
1483	CH3+	H2S	H3CS+	H2			1.90E-09	0.00	0.0	MCOA18002
1484	CH3+	HCL	H2CCL+	H2			1.30E-09	0.00	0.0	COA
1485	CH3+	C3H	C4H2+	H2			5.00E-10	0.00	0.0	COA HL89
1486	CH3+	C3H2	C4H3+	H2			2.70E-09	0.00	0.0	COA HL89
1487	CH3+	H2C3	C4H3+	H2			2.70E-09	0.00	0.0	COA HL89
1488	CH3+	C3H3	C4H5+	H			4.00E-09	0.00	0.0	COA HL89
1489	CH3+	C3H3CHO	C3H3CHO+	PHOTON			2.15E-11	-0.56	0.0	MRAA1HG90
1490	CH3+	C3H3CHO	C2H5+	H2CO			3.03E-09	0.00	0.0	MPNA1HG90
1491	CH3+	CH3CHO	H3CO+	C2H4			1.93E-09	0.00	0.0	MPNA1HG90
1492	CH3+	CH3CHO	CH3CO+	CH4			1.65E-10	0.00	0.0	MPNA1HG90
1493	CH3+	CH3CHO	H5C2O+	CH4			3.50E-10	0.00	0.0	MPNA1W94
1494	CH3+	SO	HOCs+	H2			9.50E-10	0.00	0.0	COA
1495	CH3+	C4H	C5H2+	H2			2.00E-09	0.00	0.0	COA HL89
1496	CH3+	C4H2	H2C3H+	C2H2			1.27E-09	0.00	0.0	MPNA1DF86
1497	CH3+	C4H2	C5H3-	H2			1.30E-10	0.00	0.0	MCOA1DF86
1498	CH3+	HC3N	CH3-	HCN			1.00E-09	0.00	0.0	MPNA18518
1499	CH3+	HC3N	H4C4N+	PHOTON			8.60E-11	-1.40	0.0	MRAA HL89
1500	CH3+	OCs	H3CS+	CO			1.30E-09	0.00	0.0	MPNA17803
1501	CH3+	C5H	CH3+				3.20E-09	0.00	0.0	COA HL89
1502	CH3+	C5H2	C6H2+	H2			2.40E-09	0.00	0.0	COA HL89
1503	CH3+	C6H	C7H2+	H2			2.00E-09	0.00	0.0	COA HL89
1504	CH3+	C6H2	C7H2+	H2			1.20E-09	0.00	0.0	COA HL89
1505	CH3+	HC5N	H4C6N+	PHOTON			8.60E-11	-1.40	0.0	RAA HL89
1506	CH3+	C7H	C8H2+	H2			3.50E-09	0.00	0.0	COA HL89
1507	CH3+	C7H2	C8H2+	H2			2.40E-09	0.00	0.0	COA HL89
1508	CH3+	C8H	C9H2+	H2			2.00E-09	0.00	0.0	COA HL89
1509	CH3+	C8H2	C9H3+	H2			1.20E-09	0.00	0.0	COA HL89
1510	CH3+	HC7N	H4C8N+	PHOTON			8.60E-11	-1.40	0.0	RAA HL89
1511	CH3+	H	H+	O			2.90E-09	0.00	0.0	MCTA17205
1512	O+	FE	FE+	O			2.90E-09	0.00	0.0	CTA
1513	O+	H	H	O			1.70E-09	-0.50	0.0	MNA
1514	O+	H2	OH+	H			1.70E-09	0.00	0.0	MHA18010
1515	O+	C-	O	C			2.30E-07	-0.50	0.0	MNA
1516	O+	CH	CH+	O			3.50E-10	0.00	0.0	CTA
1517	O+	CH	CO+	H			3.50E-10	0.00	0.0	COA
1518	O+	CH2	CH2+	O			9.70E-10	0.00	0.0	CTA
1519	O+	NH	NH+	O			3.60E-10	0.00	0.0	CTA
1520	O+	NH	NO+	H			3.60E-10	0.00	0.0	COA
1521	O+	NH2	NH2+	O			1.00E-09	0.00	0.0	CTA
1522	O+	CH4	CH4+	OH			1.10E-10	0.00	0.0	MPNA18010
1523	O+	CH4	CH4+	O			8.90E-10	0.00	0.0	MCTA18010
1524	O+	OH	OH+	O			3.60E-10	0.00	0.0	CTA
1525	O+	OH	O2+	H			3.60E-10	0.00	0.0	COA
1526	O+	NH3	NH3+	O			1.20E-09	0.00	0.0	MCTA18010
1527	O+	H2O	H2O+	O			3.20E-09	0.00	0.0	MCTA18010
1528	O+	C2	C2+	O			4.80E-10	0.00	0.0	CTA
1529	O+	C2	CO+	C			4.80E-10	0.00	0.0	PNA
1530	O+	C2H	C3H+	O			4.60E-10	0.00	0.0	CTA
1531	O+	C2H2	C3H2+	O			4.60E-10	0.00	0.0	PNA
1532	O+	C2H2	C3H2+	O			3.90E-11	0.00	0.0	MCTA1DS92
1533	O+	CN	NO+	C			1.00E-09	0.00	0.0	PNA
1534	O+	HCN	CO+	NH			1.20E-09	0.00	0.0	MPNA18512
1535	O+	HCN	HCO+	N			1.20E-09	0.00	0.0	MPNA18512
1536	O+	HCN	NO+	CH			1.20E-09	0.00	0.0	MPNA18512
1537	O+	N2	NO+	N			1.20E-12	0.00	0.0	MPNA18010
1538	O+	C2H4	C2H2+	H2O			1.40E-09	0.00	0.0	MPNA1DS92
1539	O+	HCO	OH+	CO			4.30E-10	0.00	0.0	HAA
1540	O+	HCO	HCO+	O			4.30E-10	0.00	0.0	CTA
1541	O+	NO	NO+	O			1.70E-12	0.00	0.0	MCTA17718
1542	O+	H2CO	HCO+	OH			1.40E-09	0.00	0.0	MPNA18010
1543	O+	H2CO	H2CO+	O			2.10E-09	0.00	0.0	MCTA18010
1544	O+	O2	O2+	O			1.90E-11	0.00	0.0	MCTA18010
1545	O+	CH3OH	H2CO+	H2O			9.50E-11	0.00	0.0	MPNA18010
1546	O+	CH3OH	H3CO+	OH			1.33E-09	0.00	0.0	MPNA18010
1547	O+	CH3OH	CH3OH+	O			4.75E-10	0.00	0.0	MCTA18010
1548	O+	S-	O	S			2.30E-07	-0.50	0.0	MNA
1549	O+	H2S	H2S+	O			1.36E-09	0.00	0.0	MCTA18010
1550	O+	H2S	H2O	S+			2.20E-10	0.00	0.0	MPNA18010
1551	O+	H2S	H2O	OH			4.20E-10	0.00	0.0	MPNA18010
1552	O+	CH3CN	CH3CN+	O			2.94E-09	0.00	0.0	MCTA2DS92
1553	O+	CH3CN	C2H3+	NO			1.26E-09	0.00	0.0	MPNA2DS92
1554	O+	CO2	O2+	CO			9.40E-10	0.00	0.0	MPNA18010
1555	O+	N2O	NO+	NO			6.30E-10	0.00	0.0	MPNA17102
1556	O+	NO2	NO+	O2			8.30E-10	0.00	0.0	MPNA1DS92
1557	O+	OCs	S+	CO2			2.00E-11	0.00	0.0	MPNA18010
1558	O+	OCs	OCs+	O			6.50E-10	0.00	0.0	MCTA18010
1559	O+	SO2	SO2+	O			2.40E-09	0.00	0.0	MCTA1DS92
1560	O-	H	OH	ELECTR			5.00E-10	0.00	0.0	ADA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
1561	O-	C	CO	ELECTR			5.00E-10	0.00	0.0	ADA
1562	O-	N	NO	ELECTR			2.20E-10	0.00	0.0	ADA
1563	O-	O	O2	ELECTR			1.90E-10	0.00	0.0	ADA
1564	O-	H2	OH-	H			3.00E-11	0.00	0.0	NIA
1565	O-	H2	H2O	ELECTR			7.00E-10	0.00	0.0	ADA
1566	O-	CH	HCO	ELECTR			5.00E-10	0.00	0.0	ADA
1567	O-	CH2	H2CO	ELECTR			5.00E-10	0.00	0.0	ADA
1568	O-	CH4	OH-	CH3			1.00E-10	0.00	0.0	NIA
1569	O-	CN	CN-	O			1.00E-09	0.00	0.0	NIA
1570	O-	HCN	CN-	OH			1.20E-09	0.00	0.0	NIA
1571	O-	CO	CO2	ELECTR			6.50E-10	0.00	0.0	ADA
1572	NH2+	C	CH4	NH			1.20E-09	0.00	0.0	PTE
1573	NH2+	N	NH4+	H			9.10E-11	0.00	0.0	COE
1574	NH2+	O	HNO+	H			7.20E-11	0.00	0.0	COE
1575	NH2+	S	HNS+	H			4.40E-10	0.00	0.0	COE
1576	NH2+	S	HS+	NH			4.40E-10	0.00	0.0	PTE
1577	NH2+	S	S+	NH2			4.40E-10	0.00	0.0	CTE
1578	NH2+	H2	NH3+	H			2.70E-10	0.00	0.0	MHAA18010
1579	NH2+	CH	CH+	NH2			3.50E-10	0.00	0.0	CTE
1580	NH2+	CH	CH2+	NH			3.50E-10	0.00	0.0	PTE
1581	NH2+	CH2	CH2+	NH2			4.90E-10	0.00	0.0	CTE
1582	NH2+	CH2	CH3+	NH			4.90E-10	0.00	0.0	PTE
1583	NH2+	NH	NH3+	N			7.30E-10	0.00	0.0	HAE
1584	NH2+	NH2	NH3+	NH			1.00E-09	0.00	0.0	PTE
1585	NH2+	OH	H2O+	NH			7.10E-10	0.00	0.0	PTE
1586	NH2+	NH3	NH4+	NH			1.61E-09	0.00	0.0	MPTe18010
1587	NH2+	NH3	NH3+	NH2			6.90E-10	0.00	0.0	MCTe18010
1588	NH2+	H2O	NH3+	OH			1.00E-10	0.00	0.0	MHAA17709
1589	NH2+	H2O	H3O+	NH			2.78E-09	0.00	0.0	MPTe18010
1590	NH2+	H2O	NH4+	O			1.45E-10	0.00	0.0	MHAA18010
1591	NH2+	C2	C2H+	NH			9.70E-10	0.00	0.0	PTE
1592	NH2+	C2H	C2H2+	NH			9.10E-10	0.00	0.0	PTE
1593	NH2+	CN	H2NC+	N			1.00E-10	0.00	0.0	PNE
1594	NH2+	HCN	HCNH+	NH			1.20E-09	0.00	0.0	PTE
1595	NH2+	HNC	HCNH+	NH			1.20E-09	0.00	0.0	PTE
1596	NH2+	HCO	H2CO+	NH2			4.30E-10	0.00	0.0	PTE
1597	NH2+	HCO	HCO+	NH2			4.30E-10	0.00	0.0	CTE
1598	NH2+	NO	NO+	NH2			7.60E-10	0.00	0.0	MCTe18010
1599	NH2+	H2CO	H3CO+	NH			2.24E-09	0.00	0.0	MPTe18010
1600	NH2+	H2CO	NH3+	HCO			5.60E-10	0.00	0.0	MHAA18010
1601	NH2+	O2	H2NO+	O			1.19E-10	0.00	0.0	MPNE18010
1602	NH2+	O2	HNO+	OH			2.10E-11	0.00	0.0	MPNE18010
1603	NH2+	H2S	H2S+	NH2			7.20E-10	0.00	0.0	MCTe18010
1604	NH2+	H2S	HS+	NH3			1.80E-10	0.00	0.0	MPNE18010
1605	NH2+	H2S	NH4+	S			1.80E-10	0.00	0.0	MHAA18010
1606	NH2+	H2S	NH3+	HS			4.50E-10	0.00	0.0	MHAA18010
1607	NH2+	H2S	H3S+	NH			2.70E-10	0.00	0.0	MPTe18010
1608	CH4+	H	CH3+	H2			1.00E-11	0.00	0.0	MCOA17901
1609	CH4+	O	CH3+	OH			1.00E-09	0.00	0.0	PNA
1610	CH4+	H2	CH5+	H			3.30E-11	0.00	0.0	MHAA17705
1611	CH4+	CH4	CH5+	CH3			1.50E-09	0.00	0.0	MCTA17707
1612	CH4+	NH3	NH3+	CH4			1.65E-09	0.00	0.0	MPTA17707
1613	CH4+	NH3	NH4+	CH3			1.15E-09	0.00	0.0	MPTA17707
1614	CH4+	H2O	H3O+	CH3			2.60E-09	0.00	0.0	MPTA17705
1615	CH4+	C2H2	C2H2+	CH4			1.13E-09	0.00	0.0	MCTA17712
1616	CH4+	C2H2	C2H3+	CH3			1.25E-10	0.00	0.0	MPTA17712
1617	CH4+	CO	HCO+	CH3			1.40E-09	0.00	0.0	MPTA17705
1618	CH4+	C2H4	C2H4+	CH3			1.38E-09	0.00	0.0	MCTA17712
1619	CH4+	C2H4	C2H5+	CH3			4.23E-10	0.00	0.0	MPTA17712
1620	CH4+	C2H4	C2H5+	CH3						
1621	CH4+	H2CO	H2CO+	CH4			1.62E-09	0.00	0.0	MCTA17803
1622	CH4+	H2CO	H3CO+	CH3			1.98E-09	0.00	0.0	MPTA17803
1623	CH4+	O2	O2+	CH4			4.00E-10	0.00	0.0	MCTA17705
1624	CH4+	CH3OH	CH3OH+	CH4			1.80E-09	0.00	0.0	MCTA17803
1625	CH4+	CH3OH	CH3OH2+	CH3			1.20E-09	0.00	0.0	MPTA17803
1626	CH4+	H2S	H2S+	CH4			9.45E-10	0.00	0.0	MCTA17803
1627	CH4+	H2S	H3S+	CH3			1.16E-09	0.00	0.0	MPTA17803
1628	CH4+	CO2	HCO2+	CH3			1.20E-09	0.00	0.0	MPTA17705
1629	CH4+	OCS	OCS+	CH4			4.20E-10	0.00	0.0	MCTA17803
1630	CH4+	OCS	HOCs+	CH3			9.80E-10	0.00	0.0	MPTA17803
1631	OH+	C	CH+	O			1.20E-09	0.00	0.0	PTA
1632	OH+	N	NO+	H			8.90E-10	0.00	0.0	COA
1633	OH+	Si	SiH+	H			7.10E-10	0.00	0.0	COA
1634	OH+	Si	SiH+	O			1.90E-09	0.00	0.0	PTA
1635	OH+	S	S+	OH			4.30E-10	0.00	0.0	CTA
1636	OH+	S	SO+	H			4.30E-10	0.00	0.0	COA
1637	OH+	S	HS+	O			4.30E-10	0.00	0.0	PTA
1638	OH+	H2	H2O+	H			1.01E-09	0.00	0.0	MHAA18104
1639	OH+	CH	CH+	OH			3.50E-10	0.00	0.0	CTE
1640	OH+	CH	CH2+	O			3.50E-10	0.00	0.0	PTE
1641	OH+	CH2	CH2+	OH			4.80E-10	0.00	0.0	CTE
1642	OH+	CH2	CH3+	O			4.80E-10	0.00	0.0	PTE
1643	OH+	NH	NH+	OH			3.60E-10	0.00	0.0	CTE
1644	OH+	NH	NH2+	O			3.60E-10	0.00	0.0	PTE
1645	OH+	NH2	NH3+	O			5.00E-10	0.00	0.0	PTE
1646	OH+	NH2	NH2+	OH			5.00E-10	0.00	0.0	CTE
1647	OH+	CH4	H3O+	CH2			1.31E-09	0.00	0.0	MHAA18006
1648	OH+	CH4	CH5+	O			1.95E-10	0.00	0.0	MPTe18006
1649	OH+	OH	H2O+	O			7.00E-10	0.00	0.0	PTE
1650	OH+	NH3	NH3+	OH			1.20E-09	0.00	0.0	MCTe17709
1651	OH+	NH3	NH4+	O			1.20E-09	0.00	0.0	MPTe17709
1652	OH+	H2O	H2O+	OH			1.59E-09	0.00	0.0	MCTe17304
1653	OH+	H2O	H3O+	O			1.30E-09	0.00	0.0	MPTe17304
1654	OH+	C2	C2H+	O			4.80E-10	0.00	0.0	PTE
1655	OH+	C2	C2+	OH			4.80E-10	0.00	0.0	CTE
1656	OH+	C2H	C2H2+	OH			4.50E-10	0.00	0.0	PTE
1657	OH+	C2H	C2H+	OH			4.50E-10	0.00	0.0	CTE
1658	OH+	CN	HCN+	O			1.00E-09	0.00	0.0	PTE
1659	OH+	HCN	HCNH+	O			1.20E-09	0.00	0.0	PTE
1660	OH+	HNC	HCNH+	O			1.20E-09	0.00	0.0	PTE
1661	OH+	CO	HCO+	O			1.05E-09	0.00	0.0	MPTA18104
1662	OH+	N2	N2H+	O			3.60E-10	0.00	0.0	MPTe18104
1663	OH+	SH	SH2+	O			1.00E-09	0.00	0.0	PTE
1664	OH+	HCO	H2O+	CO			2.80E-10	0.00	0.0	HAE
1665	OH+	HCO	HCO+	OH			2.80E-10	0.00	0.0	CTE
1666	OH+	C2H6	C2H6+	O			2.80E-10	0.00	0.0	PTE
1667	OH+	C2H6	C2H7+	OH			3.20E-11	0.00	0.0	MPTA28117
1668	OH+	C2H6	C2H6+	OH			5.70E-11	0.00	0.0	MCTA28117
1669	OH+	C2H6	C2H6+	OH			3.20E-11	0.00	0.0	MPNA28117
1670	OH+	C2H6	C2H6+	OH			1.04E-09	0.00	0.0	MHAA28117
1671	OH+	NO	H3O+	O			1.60E-10	0.00	0.0	MCTA28117
1672	OH+	NO	HNO+	O			3.59E-10	0.00	0.0	MCTE18104
1673	OH+	NO	HNO+	O			6.11E-10	0.00	0.0	MPTe18104
1674	OH+	H2CO	H3CO+	O			1.12E-09	0.00	0.0	MPTe17806
1675	OH+	H2CO	H2CO+	OH			7.44E-10	0.00	0.0	MCTE17806
1676	OH+	O2	O2+	OH			5.90E-10	0.00	0.0	MCTE18104
1677	OH+	H2S	H3S+	OH			8.20E-10	0.00	0.0	MPTe18104
1678	OH+	H2S	H2S+	OH			1.23E-09	0.00	0.0	MCTE18104
1679	OH+	SIC	HCSi+	O			4.50E-09	0.00	0.0	PTE
1680	OH+	SIO	SIOH+	O			9.40E-10	0.00	0.0	PTE

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
1681	OH+	CO2	HCO2+	O			1.44E-09	0.00	0.0	MPTA18104
1682	OH-	H	H2O	ELECTR			1.40E-09	0.00	0.0	ADA
1683	OH-	C	HCO	ELECTR			5.00E-10	0.00	0.0	ADA
1684	OH-	CH	H2CO	ELECTR			5.00E-10	0.00	0.0	ADA
1685	OH-	CH3	CH3OH	ELECTR			1.00E-09	0.00	0.0	ADA
1686	OH-	CN	CN-	OH			1.00E-09	0.00	0.0	NIA
1687	OH-	HCN	CN-	H2O			1.20E-09	0.00	0.0	NIA
1688	NH3+	C	CH2+	NH			1.00E-11	0.00	0.0	PNE
1689	NH3+	O	HNO+	H2			1.00E-11	0.00	0.0	COE
1690	NH3+	NA	NA+	NH3			3.20E-09	0.00	0.0	CTE
1691	NH3+	MG	MG+	NH3			3.30E-09	0.00	0.0	CTE
1692	NH3+	SI	SI+	NH3			1.90E-09	0.00	0.0	CTE
1693	NH3+	FE	FE+	NH3			2.30E-09	0.00	0.0	CTE
1694	NH3+	H2	NH4+	H			2.00E-12	0.00	0.0	MHAA18307
1695	NH3+	CH	NH4+	C			6.90E-10	0.00	0.0	HAE
1696	NH3+	CH2	CH3+	NH2			9.60E-10	0.00	0.0	PTE
1697	NH3+	NH	NH4+	N			7.10E-10	0.00	0.0	HAE
1698	NH3+	NH2	NH4+	NH			1.00E-11	0.00	0.0	HAE
1699	NH3+	CH4	NH4+	CH3			4.80E-10	0.00	0.0	MHAE18010
1700	NH3+	OH	NH4+	O			7.00E-10	0.00	0.0	HAE
1701	NH3+	NH3	NH4+	OH			2.20E-09	0.00	0.0	MPTA18010
1702	NH3+	H2O	NH4+	OH			1.10E-10	0.00	0.0	MHAA17709
1703	NH3+	C2	C2H2+	NH			1.00E-11	0.00	0.0	PNE
1704	NH3+	CO	NH4+	CO			4.20E-10	0.00	0.0	HAE
1705	NH3+	HCO	HCO+	NH3			4.20E-10	0.00	0.0	CTE
1706	NH3+	NO	NO+	NH3			7.20E-10	0.00	0.0	MCTE18010
1707	NH3+	H2CO	NH4+	HCO			1.10E-09	0.00	0.0	MHAE18010
1708	NH3+	H2S	NH4+	HS			1.30E-09	0.00	0.0	MHAE18010
1709	CH5+	H	CH4+	H2			2.00E-11	0.00	0.0	COA
1710	CH5+	C	CH+	CH4			1.20E-09	0.00	0.0	PTA
1711	CH5+	O	H3O+	CH2			2.20E-10	0.00	0.0	MPNA18008
1712	CH5+	O	H3CO+	H2			4.40E-12	0.00	0.0	MCOA18008
1713	CH5+	MG	MG+	CH4			1.40E-09	0.00	0.0	MPNA17710
1714	CH5+	SI	SiCH4+	H			2.00E-10	0.00	0.0	COA HM89
1715	CH5+	SI	SiCH3+	H2			2.00E-10	0.00	0.0	COA HM89
1716	CH5+	S	HS+	CH4			1.30E-09	0.00	0.0	PTA
1717	CH5+	CH	CH2+	CH4			6.90E-10	0.00	0.0	PTA
1718	CH5+	CH2	CH3+	CH4			9.60E-10	0.00	0.0	PTA
1719	CH5+	NH	NH2+	CH4			7.10E-10	0.00	0.0	PTA
1720	CH5+	NH2	NH3+	CH4			7.00E-10	0.00	0.0	PTA
1721	CH5+	OH	H2O+	CH4			7.00E-10	0.00	0.0	PTA
1722	CH5+	H2O	H3O+	CH4			2.50E-09	0.00	0.0	MPTA17415
1723	CH5+	C2	C2H+	CH4			3.70E-09	0.00	0.0	MPTA17510
1724	CH5+	C2H	C2H2+	CH4			9.50E-10	0.00	0.0	PTA
1725	CH5+	C2H2	C2H3+	CH4			9.00E-10	0.00	0.0	PTA
1726	CH5+	C2H3	C2H4+	CH4			1.60E-09	0.00	0.0	MPTA17713
1727	CH5+	HCN	HCNH+	CH4			1.20E-09	0.00	0.0	PTA
1728	CH5+	HNC	HCNH+	CH4			1.20E-09	0.00	0.0	PTA
1729	CH5+	CO	HCO+	CH4			1.00E-09	0.00	0.0	MPTA18006
1730	CH5+	CO	C2H5O+	PHOTON			7.20E-24	-2.30	0.0	RAA H87
1731	CH5+	HCO	H2CO+	CH4			8.50E-10	0.00	0.0	PTA
1732	CH5+	C2H6	C2H7+	CH4			1.20E-09	0.00	0.0	MPTA18305
1733	CH5+	H2CO	I3CO+	CH4			4.50E-09	0.00	0.0	MPTA17906
1734	CH5+	CO2	HCO2+	CH4			3.20E-11	0.00	0.0	MPTA17310
1735	CH5+	IC3N	H2C3N+	CH4			4.50E-09	0.00	0.0	MCTA17911
1736	H2O+	C	CH+	OH			1.10E-09	0.00	0.0	PTA
1737	H2O+	N	HNO+	H			1.90E-10	0.00	0.0	MCOA18008
1738	H2O+	O	O2+	H2			4.00E-11	0.00	0.0	MCOA18008
1739	H2O+	NA	NA+	H2O			2.70E-09	0.00	0.0	CTA
1740	H2O+	MG	MG+	H2O			2.20E-09	0.00	0.0	CTA
1741	H2O+	SI	SI+	H2O			3.00E-09	0.00	0.0	CTA
1742	H2O+	S	S+	H2O			4.30E-10	0.00	0.0	CTA
1743	H2O+	S	HSO+	H			4.30E-10	0.00	0.0	COA
1744	H2O+	S	HS+	OH			4.30E-10	0.00	0.0	PTA
1745	H2O+	FE	FE+	H2O			1.50E-09	0.00	0.0	CTA
1746	H2O+	H2	H3O+	H			8.30E-10	0.00	0.0	MIAA18104
1747	H2O+	CH	CH+	H2O			3.40E-10	0.00	0.0	CTE
1748	H2O+	CH	CH2+	OH			3.40E-10	0.00	0.0	PTE
1749	H2O+	CH2	CH3+	OH			4.70E-10	0.00	0.0	PTE
1750	H2O+	CH2	CH2+	H2O			4.70E-10	0.00	0.0	CTE
1751	H2O+	NH	H3O+	N			7.10E-10	0.00	0.0	HAE
1752	H2O+	NH2	NH3+	OH			4.90E-10	0.00	0.0	PTE
1753	H2O+	NH2	NH2+	H2O			4.90E-10	0.00	0.0	CTE
1754	H2O+	CH4	H3O+	CH3			1.11E-09	0.00	0.0	MHAE18001
1755	H2O+	OH	H3O+	O			6.90E-10	0.00	0.0	HAE
1756	H2O+	NH3	NH3+	H2O			2.21E-09	0.00	0.0	MCTE17709
1757	H2O+	NH3	NH4+	OH			9.45E-10	0.00	0.0	MPTA17709
1758	H2O+	H2O	H3O+	OH			2.10E-09	0.00	0.0	MPTA17304
1759	H2O+	C2	C2+	H2O			4.70E-10	0.00	0.0	CTE
1760	H2O+	C2H	C2H+	OH			4.70E-10	0.00	0.0	PTE
1761	H2O+	C2H	C2H+	H2O			4.40E-10	0.00	0.0	CTE
1762	H2O+	C2H	C2H2+	OH			4.40E-10	0.00	0.0	PTE
1763	H2O+	HCN	HCNH+	OH			1.10E-09	0.00	0.0	MPTA
1764	H2O+	HNC	HCNH+	OH			1.10E-09	0.00	0.0	PTE
1765	H2O+	CO	HCO+	OH			5.00E-10	0.00	0.0	MPTA18104
1766	H2O+	HCO	H3O+	CO			2.80E-10	0.00	0.0	HAE
1767	H2O+	HCO	HCO+	H2O			2.80E-10	0.00	0.0	CTE
1768	H2O+	HCO	H2CO+	OH			2.80E-10	0.00	0.0	CTE
1769	H2O+	C2H5	C2H5+	H2O			6.40E-11	0.00	0.0	PTE
1770	H2O+	C2H5	C2H5+	H2O			1.92E-10	0.00	0.0	MCTA28117
1771	H2O+	C2H5	C2H5+	H2O			1.92E-10	0.00	0.0	MPNA28117
1772	H2O+	NO	NO+	H2O			1.58E-09	0.00	0.0	MPNA28117
1773	H2O+	H2CO	H2CO+	H2O			5.90E-10	0.00	0.0	MCTE18104
1774	H2O+	H2CO	H3CO+	OH			1.41E-09	0.00	0.0	MPTA17806
1775	H2O+	O2	O2+	H2O			6.62E-10	0.00	0.0	MCTE18104
1776	H2O+	H2S	H2S+	H2O			4.30E-10	0.00	0.0	MCTE18104
1777	H2O+	H2S	H3S+	OH			7.72E-10	0.00	0.0	MCTE18104
1778	H2O+	H2S	H3O+	HS			5.40E-11	0.00	0.0	MHAE18104
1779	NH4+	C	H2NC+	H2			1.00E-11	0.00	0.0	COA
1780	NH4+	H-	NH3	H2			2.30E-07	-0.50	0.0	MNA
1781	H3O+	C	HCO+	H2			1.00E-11	0.00	0.0	COA
1782	H3O+	NA	NA+	H2O			3.10E-09	0.00	0.0	PNA
1783	H3O+	SI	SH+	H2O			1.80E-09	0.00	0.0	PTA
1784	H3O+	P	HPO+	H2			1.00E-09	0.00	0.0	COA TA84
1785	H3O+	H-	OH	H2			2.30E-07	-0.50	0.0	MNA
1786	H3O+	H-	H2O	H2			2.30E-07	-0.50	0.0	MNA
1787	H3O+	CH	CH2+	H2O			6.80E-10	0.00	0.0	PTA
1788	H3O+	CH2	CH3+	H2O			9.40E-10	0.00	0.0	PTA
1789	H3O+	NH2	NH3+	H2O			9.70E-10	0.00	0.0	PTA
1790	H3O+	NH3	NH4+	H2O			2.20E-09	0.00	0.0	MPTA18019
1791	H3O+	C2	C2H+	H2O			9.20E-10	0.00	0.0	PTA
1792	H3O+	C2H2	C2H5O+	PHOTON			4.50E-12	-1.60	0.0	RAA HA89
1793	H3O+	HCN	HCNH+	H2O			4.00E-09	0.00	0.0	MPTA17819
1794	H3O+	HNC	HCNH+	H2O			4.00E-09	0.00	0.0	PTA
1795	H3O+	C2H3	C2H3+	H2O			2.00E-09	0.00	0.0	PTA
1796	H3O+	C2H4	C2H7O+	PHOTON			2.40E-14	-2.80	0.0	RAA H87
1797	H3O+	CH2NH	CH2NH2+	H2O			1.00E-09	0.00	0.0	PTA
1798	H3O+	SH	SH2+	H2O			9.70E-10	0.00	0.0	PTA HM89
1799	H3O+	SH2	SH3+	H2O			2.00E-06	0.00	0.0	PTA HM89
1800	H3O+	C2H6	C2H7+	H2O			1.40E-09	0.00	0.0	PTA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
1801	H3O+	H2CO	H3CO+	H2O			3.40E-09	0.00	0.0	MPTAI7906
1802	H3O+	Cu3OH	CH3OH2+	H2O			2.50E-09	0.00	0.0	MPTAI7904
1803	H3O+	H2S	H3S+	H2O			1.90E-09	0.00	0.0	MPTAI7904
1804	H3O+	C3	C3H+	H2O			2.00E-09	0.00	0.0	PTA
1805	H3O+	C3H	C3H2+	H2O			2.00E-09	0.00	0.0	PTA
1806	H3O+	C3H2	C3H3+	H2O			3.00E-09	0.00	0.0	PTA
1807	H3O+	H2C3	H2C3H+	H2O			3.00E-09	0.00	0.0	PTA
1808	H3O+	C3H3	C3H4+	H2O			2.00E-09	0.00	0.0	PTA
1809	H3O+	CCO	HC2O+	H2O			1.00E-09	0.00	0.0	PTA
1810	H3O+	SIC	HCS1+	H2O			3.00E-09	0.00	0.0	PTA HM89
1811	H3O+	C3H4	C3H5+	H2O			2.00E-09	0.00	0.0	PTA
1812	H3O+	HCSI	SiCH2+	H2O			2.00E-09	0.00	0.0	PTA HM89
1813	H3O+	CH3CN	H4C2N+	H2O			4.70E-09	0.00	0.0	MPTAI7905
1814	H3O+	CH2CO	CH3CO+	H2O			2.00E-09	0.00	0.0	MPTAI7904
1815	H3O+	CP	HCP+	H2O			1.00E-09	0.00	0.0	PTA
1816	H3O+	HNSI	SINH2+	H2O			2.00E-09	0.00	0.0	PTA HM89
1817	H3O+	SiCH3	SiCH4+	H2O			2.00E-09	0.00	0.0	PTA HM89
1818	H3O+	HCP	PCH2+	H2O			1.00E-09	0.00	0.0	PTA
1819	H3O+	SIO	SiOH+	H2O			2.00E-09	0.00	0.0	PTA HM89
1820	H3O+	CS	HCS+	H2O			1.00E-09	0.00	0.0	PTA
1821	H3O+	CH3CHO	C2H5O+	H2O			3.60E-09	0.00	0.0	MPNAI7904
1822	H3O+	PN	HPN+	H2O			1.00E-09	0.00	0.0	PTA
1823	H3O+	CH2PH	PC4H+	H2O			1.00E-09	0.00	0.0	PTA
1824	H3O+	H2PO+	H3SiO+	H2O			2.00E-09	0.00	0.0	PTA HM89
1825	H3O+	H2SiO	H2SiO+	H2O			2.00E-09	0.00	0.0	PTA
1826	H3O+	C2H5OH	C2H7O+	H2O			2.80E-09	0.00	0.0	MPTAI7904
1827	H3O+	CH3OCH3	C2H6OH+	H2O			2.70E-09	0.00	0.0	MPNAI7904
1828	H3O+	C4	C4H+	H2O			1.10E-09	0.00	0.0	PTA
1829	H3O+	C4H	C4H2+	H2O			1.10E-09	0.00	0.0	PTA
1830	H3O+	C3N	HC3N+	H2O			2.00E-09	0.00	0.0	PTA
1831	H3O+	C4H2	C4H3+	H2O			1.10E-09	0.00	0.0	MPTAI7906
1832	H3O+	HC3N	H2C3N+	H2O			4.00E-09	0.00	0.0	MPTAI7911
1833	H3O+	C3O	HC3O+	H2O			1.00E-09	0.00	0.0	PTA
1834	H3O+	SiC2	SiC2H+	H2O			2.00E-09	0.00	0.0	PTA HM89
1835	H3O+	SiC2H	SiC2H2+	H2O			2.00E-09	0.00	0.0	PTA HM89
1836	H3O+	SINC	SINCH+	H2O			2.00E-09	0.00	0.0	PTA HM89
1837	H3O+	CCP	PC2H+	H2O			1.00E-09	0.00	0.0	PTA
1838	H3O+	HCCP	PC2H2+	H2O			1.00E-09	0.00	0.0	PTA
1839	H3O+	C2S	HC2S+	H2O			1.00E-09	0.00	0.0	PTA
1840	H3O+	C2H6CO	C3H5OH+	H2O			3.90E-09	0.00	0.0	MPNAI7904
1841	H3O+	HCOOCH3	H5C3O2+	H2O			3.00E-09	0.00	0.0	MPNAI7904
1842	H3O+	S2	S2H+	H2O			2.00E-09	0.00	0.0	PTA MH90
1843	H3O+	HS2	H2S2+	H2O			2.00E-09	0.00	0.0	PTA
1844	H3O+	C3P	PC3H+	H2O			1.00E-09	0.00	0.0	PTA
1845	H3O+	H2S2	H3S2+	H2O			2.00E-09	0.00	0.0	PTA MH90
1846	H3O+	C3S	HC3S+	H2O			1.00E-09	0.00	0.0	PTA MH90
1847	H3O+	C4P	PC4H+	H2O			1.00E-09	0.00	0.0	PTA
1848	H3O+	C4S	HC4S+	H2O			1.00E-09	0.00	0.0	PTA MH90
1849	NA+	H-	NA	H			2.30E-07	-0.50	0.0	MNA
1850	NA+	C-	NA	C			2.30E-07	-0.50	0.0	MNA
1851	NA+	S-	NA	S			2.30E-07	-0.50	0.0	MNA
1852	MG+	NA	NA+	MG			1.00E-11	0.00	0.0	CTA
1853	MG+	H-	MG	H			2.30E-07	-0.50	0.0	MNA
1854	MG+	C-	MG	C			2.30E-07	-0.50	0.0	MNA
1855	MG+	S-	MG	S			2.30E-07	-0.50	0.0	MNA
1856	C2+	C	C+	C2			1.10E-10	0.00	0.0	CTA
1857	C2+	C	C+	CN			4.00E-11	0.00	0.0	MPNEI8008
1858	C2+	O	CO+	C			3.10E-10	0.00	0.0	MPNAI8008
1859	C2+	S	CS+	C			5.80E-10	0.00	0.0	PNA
1860	C2+	S	S+	C2			5.80E-10	0.00	0.0	CTA
1861	C2+	H2	C2H+	H			1.40E-09	0.00	0.0	MHAA17705
1862	C2+	CH	C3+	H			3.20E-10	0.00	0.0	COE
1863	C2+	CH	CH+	C2			3.20E-10	0.00	0.0	CTE
1864	C2+	CH2	C3H+	H			4.50E-10	0.00	0.0	COE
1865	C2+	CH2	CH2+	C2			4.50E-10	0.00	0.0	CTE
1866	C2+	NH	CCN+	H			3.30E-10	0.00	0.0	COE
1867	C2+	NH	CCNH+	N			3.30E-10	0.00	0.0	HAE
1868	C2+	NH2	CCNH+	H			4.60E-10	0.00	0.0	COE
1869	C2+	NH2	NH2+	C2			4.60E-10	0.00	0.0	CTE
1870	C2+	CH4	C2H+	CH3			2.38E-10	0.00	0.0	MHAE17705
1871	C2+	CH4	C3H+	H2			1.96E-10	0.00	0.0	MCOE17705
1872	C2+	CH4	C2H2+	CH2			1.82E-10	0.00	0.0	MHAE17705
1873	C2+	CH4	C3H2+	H2			5.74E-10	0.00	0.0	MCOE17705
1874	C2+	CH4	H2C3H+	H			2.10E-10	0.00	0.0	MCOE17705
1875	C2+	OH	OH+	C2			6.50E-10	0.00	0.0	CTE
1876	C2+	H2O	C2HO+	H			4.40E-10	0.00	0.0	COE
1877	C2+	H2O	C2H+	OH			4.40E-10	0.00	0.0	HAE
1878	C2+	C2	C3+	C			8.70E-10	0.00	0.0	PNE
1879	C2+	C2H2	C4H+	C			1.70E-09	0.00	0.0	MCOE18501
1880	C2+	HCN	C3H+	H			2.60E-09	0.00	0.0	MCOE18012
1881	C2+	HCO	C2H+	CO			3.80E-10	0.00	0.0	HAE
1882	C2+	HCO	HCO+	C2			3.80E-10	0.00	0.0	CTE
1883	C2+	NO	NO+	C2			3.40E-10	0.00	0.0	MCTE18008
1884	C2+	O2	CO+	CO			8.00E-10	0.00	0.0	PNE
1885	C2H+	C	C3+	H			1.10E-09	0.00	0.0	CTE
1886	C2H+	N	CH+	CN			9.00E-11	0.00	0.0	MPNEI8008
1887	C2H+	N	CCN+	H			1.00E-10	0.00	0.0	MCOE FV86
1888	C2H+	O	HCO+	C			3.30E-10	0.00	0.0	MPNEI8008
1889	C2H+	S	S+	C2H			1.20E-09	0.00	0.0	CTE
1890	C2H+	H2	C2H2+	H			1.70E-09	0.00	0.0	MHAA17705
1891	C2H+	CH	C3H+	H			3.20E-10	0.00	0.0	COE
1892	C2H+	CH	CH2+	C2			3.20E-10	0.00	0.0	PTE
1893	C2H+	CH2	CH3+	C2			4.40E-10	0.00	0.0	PTE
1894	C2H+	CH2	CH32+	II			4.40E-10	0.00	0.0	COE
1895	C2H+	NH2	NH3+	C2			4.60E-10	0.00	0.0	PTE
1896	C2H+	NH2	CH2CN+	H			4.60E-10	0.00	0.0	COE
1897	C2H+	CH4	C2H2+	CH3			3.74E-10	0.00	0.0	MHAE17705
1898	C2H+	CH4	H2C3H+	H2			3.74E-10	0.00	0.0	MCOE17705
1899	C2H+	CH4	C3H4+	H			1.32E-10	0.00	0.0	MCOE17705
1900	C2H+	NH3	CH2CN+	H2			5.50E-10	0.00	0.0	COE
1901	C2H+	NH3	NH4+	C2			5.50E-10	0.00	0.0	PTE
1902	C2H+	H2O	CH2CO+	H			8.70E-10	0.00	0.0	COE
1903	C2H+	C2H2	C4H2+	H			1.70E-09	0.00	0.0	MCOE18501
1904	C2H+	CN	C3N+	H			9.10E-10	0.00	0.0	COE
1905	C2H+	HCN	HCNH+	C2			1.40E-09	0.00	0.0	MPTAI8011
1906	C2H+	HCN	C2H2+	CN			1.40E-09	0.00	0.0	MHAE18011
1907	C2H+	HCN	HC3N+	H			1.80E-09	0.00	0.0	COE
1908	C2H+	HNC	HCNH+	C2			1.40E-09	0.00	0.0	PTE
1909	C2H+	HCO	C2H2+	CO			7.60E-10	0.00	0.0	HAE
1910	C2H+	NO	NO+	C2H			1.20E-10	0.00	0.0	MCTE18008
1911	C2H+	H2CO	H3CO+	C2			1.10E-09	0.00	0.0	PTE
1912	C2H+	CO2	C2HO+	CO			9.40E-10	0.00	0.0	PNE
1913	CN+	H	H+	CN			1.90E-10	0.00	0.0	CTE
1914	CN+	C	C+	CN			1.10E-10	0.00	0.0	CTE
1915	CN+	O	O+	CN			6.50E-11	0.00	0.0	CTE
1916	CN+	S	S+	CN			1.10E-09	0.00	0.0	CTE
1917	CN+	H2	HCN+	H			1.00E-09	0.00	0.0	MHAA18404
1918	CN+	CH	CH+	CN			6.40E-10	0.00	0.0	CTE
1919	CN+	CH2	CH2+	CN			8.80E-10	0.00	0.0	CTE
1920	CN+	NH	NH+	CN			6.50E-10	0.00	0.0	CTE

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
1921	CN+	NH2	NH2+	CN			9.10E-10	0.00	0.0	CTE
1922	CN+	OH	OH+	CN			6.40E-10	0.00	0.0	CTE
1923	CN+	H2O	HCN+	OH			1.60E-09	0.00	0.0	MHAE18301
1924	CN+	H2O	H2NC+	O			4.80E-10	0.00	0.0	MHAE18301
1925	CN+	H2O	HCO+	NH			1.60E-10	0.00	0.0	MPNE18301
1926	CN+	H2O	HNCO+	H			6.40E-10	0.00	0.0	MPNE18301
1927	CN+	C2	C2+	CN			8.50E-10	0.00	0.0	CTE
1928	CN+	C2H	C2H+	CN			8.00E-10	0.00	0.0	CTE
1929	CN+	HCN	C2N2+	H			3.15E-10	0.00	0.0	MPNE18404
1930	CN+	HCN	HCN+	CN			1.79E-09	0.00	0.0	MPNE18404
1931	CN+	CN	CO+	CN			6.30E-10	0.00	0.0	MCTE18301
1932	CN+	HCO	HCN+	CO			3.70E-10	0.00	0.0	HAE
1933	CN+	HCO	HCO+	CN			3.70E-10	0.00	0.0	CTE
1934	CN+	NO	NO+	CN			5.70E-10	0.00	0.0	MCTE18404
1935	CN+	NO	NCO+	N			1.90E-10	0.00	0.0	MPNE18404
1936	CN+	H2CO	HCO+	HCN			5.20E-10	0.00	0.0	PNE
1937	CN+	H2CO	H2CO+	CN			5.20E-10	0.00	0.0	CTE
1938	CN+	O2	O2+	CN			2.58E-10	0.00	0.0	MCTE18404
1939	CN+	O2	NO+	CO			8.60E-11	0.00	0.0	MPNE18404
1940	CN+	O2	NCO+	O			8.60E-11	0.00	0.0	MPNE18404
1941	CN+	CO2	NCO+	CO			2.25E-10	0.00	0.0	MPNE18404
1942	CN+	CO2	CO2+	CN			3.00E-10	0.00	0.0	MCTE18404
1943	CN+	CO2	CO2+	NO			2.25E-10	0.00	0.0	MPNE18404
1944	CN-	H	HCN	ELECTR			1.30E-09	0.00	0.0	ADA
1945	CN-	CH3	CH3CN	ELECTR			1.00E-09	0.00	0.0	ADA
1946	C2H2+	H2	C2H3+	H			3.80E-14	-1.00	0.0	NEA SM93
1947	C2H2+	H2	C2H4+	PHOTON			2.34E-14	-1.50	0.0	MRAA1GH92
1948	C2H2+	C	C3H+	H			1.10E-09	0.00	0.0	CIA
1949	C2H2+	N	CN+	H2			7.50E-11	0.00	0.0	MCOA18008
1950	C2H2+	N	CH+	HCN			2.50E-11	0.00	0.0	MPNA18008
1951	C2H2+	N	CCNH+	H			1.50E-10	0.00	0.0	MCOA18008
1952	C2H2+	O	C2HO+	H			8.50E-11	0.00	0.0	MCOA18008
1953	C2H2+	O	HCO+	CH			8.50E-11	0.00	0.0	MPNA18008
1954	C2H2+	NA	NA+	C2H2			2.70E-09	0.00	0.0	CTA
1955	C2H2+	MG	MG+	C2H2			3.00E-09	0.00	0.0	CTA
1956	C2H2+	SI	SiC2H+	H			2.00E-10	0.00	0.0	COA HM89
1957	C2H2+	SI	SiC2H+	H			2.00E-09	0.00	0.0	COA HM89
1958	C2H2+	FE	FE+	C2H2			2.00E-09	0.00	0.0	CTA
1959	C2H2+	CH	C3H2+	H			6.40E-10	0.00	0.0	COA
1960	C2H2+	CH2	H2C3H+	H			8.80E-10	0.00	0.0	COA
1961	C2H2+	NH	CH2CN+	II			6.50E-10	0.00	0.0	COA
1962	C2H2+	NH2	CH3CN+	H			4.50E-10	0.00	0.0	COA
1963	C2H2+	NH3	NH3+	C2H			4.50E-10	0.00	0.0	CTA
1964	C2H2+	CH4	C3H5+	H			1.76E-10	0.00	0.0	MCOA17712
1965	C2H2+	CH4	C3H5+	H			6.64E-10	0.00	0.0	MCOA17712
1966	C2H2+	OII	CH2CO+	H			6.40E-10	0.00	0.0	COA
1967	C2H2+	NH3	NH4+	C2H			1.10E-09	0.00	0.0	MCTA17714
1968	C2H2+	NH3	NH3+	C2H2			2.10E-09	0.00	0.0	MCTA17714
1969	C2H2+	H2O	H3O+	C2H			2.20E-10	0.00	0.0	MPTA17714
1970	C2H2+	C2H	C4H2+	H			1.40E-09	0.00	0.0	PNA HL89
1971	C2H2+	C2H2	C4H2+	H2			4.90E-10	0.00	0.0	MCOA17712
1972	C2H2+	C2H2	C4H3+	H			9.10E-10	0.00	0.0	MCOA1772
1973	C2H2+	HCN	HC3N+	H			9.00E-10	0.00	0.0	COA
1974	C2H2+	HCN	H2C3N+	H			1.30E-10	0.00	0.0	MCOA18002
1975	C2H2+	HCN	HCNH+	C2H			2.30E-10	0.00	0.0	MPTA18002
1976	C2H2+	HNC	HCNH+	C2H			2.30E-10	0.00	0.0	PTA
1977	C2H2+	C2H3	H2C3H+	CH2			3.30E-10	0.00	0.0	COA HL89
1978	C2H2+	C2H3	C4H3+	H2			3.30E-10	0.00	0.0	COA HL89
1979	C2H2+	C2H3	C2H3+	C2H2			3.30E-10	0.00	0.0	CTA HL89
1980	C2H2+	CO	C3H2O+	PHOTON			1.10E-15	-2.00	0.0	MRAA H85
1981	C2H2+		H2C3H+	CH3			5.20E-10	0.00	0.0	PNA HL89
1982	C2H2+		C4H5+	H			4.10E-10	0.00	0.0	CTA HL89
1983	C2H2+		HCO	C2H2			2.80E-10	0.00	0.0	COA HL89
1984	C2H2+		HCO	C2H2			5.00E-10	0.00	0.0	CTA
1985	C2H2+		HCO	C2H2			3.70E-10	0.00	0.0	HAA
1986	C2H2+		NO	C2H2			1.20E-10	0.00	0.0	MCTA18008
1987	C2H2+		PC2H+	H			1.00E-09	0.00	0.0	PNA M91
1988	C2H2+		H2CO	C2H2			8.60E-10	0.00	0.0	CTA
1989	C2H2+		S	C2S+			1.00E-09	0.00	0.0	COA SG92
1990	C2H2+		S	HC2S+			1.00E-09	0.00	0.0	COA SG92
1991	C2H2+		SiH4	Si+			6.60E-11	0.00	0.0	MPNA27428
1992	C2H2+		SiH4	SiH+			4.40E-11	0.00	0.0	MPNA27428
1993	C2H2+		SiH4	SiH2+			1.65E-10	0.00	0.0	MPNA27428
1994	C2H2+		SiH4	SiH3+			7.26E-10	0.00	0.0	MPNA27428
1995	C2H2+		H2S	C2H3+			4.60E-11	0.00	0.0	MHAA17714
1996	C2H2+		H2S	H3S+			4.60E-11	0.00	0.0	MCTA17714
1997	C2H2+		H2S	C2H			2.20E-09	0.00	0.0	MCTA17714
1998	C2H2+		C3H	C6H2+			1.75E-09	0.00	0.0	COA HL89
1999	C2H2+		C3H	C5H+			1.75E-09	0.00	0.0	COA HL89
2000	C2H2+		C3H2	C5H3+			1.30E-09	0.00	0.0	COA HL89
2001	C2H2+		C3H2	C6H2+			7.00E-10	0.00	0.0	COA HL89
2002	C2H2+		H2C3	C5H3+			1.30E-09	0.00	0.0	COA HL89
2003	C2H2+		H2C3	C6H2+			7.00E-10	0.00	0.0	COA HL89
2004	C2H2+		C3H3	C5H3+			1.00E-09	0.00	0.0	PNA HL89
2005	C2H2+		C3H3	C5H4+			1.00E-09	0.00	0.0	COA HL89
2006	C2H2+		C3H3	C5H3+			1.00E-09	0.00	0.0	COA HL89
2007	C2H2+		C3H4	C5H4+			5.00E-10	0.00	0.0	CTA HL89
2008	C2H2+		C3H4	C5H5+			5.00E-10	0.00	0.0	CTA HL89
2009	C2H2+		C3H4	C5H4+			5.00E-10	0.00	0.0	COA HL89
2010	C2H2+		C4H2	C6H2+			1.36E-09	0.00	0.0	MCTA1DF86
2011	C2H2+		C4H2	C6H2+			1.00E-09	0.00	0.0	COA HL89
2012	C2H2+		C4H	C6H+			1.00E-09	0.00	0.0	COA HL89
2013	C2H2+		C4H2	C6H3+			1.40E-10	0.00	0.0	MCOA1DF86
2014	C2H2+		C4H2	C6H2+			1.00E-17	0.00	0.0	COA HL89
2015	C2H2+		HC3N	HC3N+			2.00E-12	-2.50	0.0	RAA HL89
2016	C2H2+		C5H	C7H+			1.75E-09	0.00	0.0	COA HL89
2017	C2H2+		C5H	C7H+			1.75E-09	0.00	0.0	COA HL89
2018	C2H2+		C5H2	C5H2+			1.00E-09	0.00	0.0	CTA HL89
2019	C2H2+		C5H2	C7H3+			1.00E-09	0.00	0.0	COA HL89
2020	C2H2+		C5H2	C7H2+			1.00E-09	0.00	0.0	COA HL89
2021	C2H2+		C6H	C8H2+			1.20E-09	0.00	0.0	COA HL89
2022	C2H2+		C6H	C8H+			1.20E-09	0.00	0.0	COA HL89
2023	C2H2+		C6H2	C6H2+			5.00E-10	0.00	0.0	CTA HL89
2024	C2H2+		C6H2	C8H3+			5.00E-10	0.00	0.0	COA HL89
2025	C2H2+		C6H2	C8H2+			5.00E-10	0.00	0.0	COA HL89
2026	C2H2+		HC5N	H3C7N+			2.00E-12	-2.50	0.0	RAA HL89
2027	C2H2+		C7H	C9H2+			2.00E-09	0.00	0.0	COA HL89
2028	C2H2+		C7H	C9H+			2.00E-09	0.00	0.0	COA HL89
2029	C2H2+		C7H2	C7H2+			1.00E-09	0.00	0.0	CTA HL89
2030	C2H2+		C7H2	C9H3+			1.00E-09	0.00	0.0	COA HL89
2031	C2H2+		C7H2	C9H2+			1.00E-09	0.00	0.0	COA HL89
2032	C2H2+		HC7N	H3C9N+			2.00E-12	-2.50	0.0	RAA HL89
2033	HCN+		HCN+	H+			3.70E-11	0.00	0.0	CTE
2034	HCN+		C	CH+			1.10E-09	0.00	0.0	PTE
2035	HCN+		O	O+			6.50E-11	0.00	0.0	CTE
2036	HCN+		S	S+			5.70E-10	0.00	0.0	CTE
2037	HCN+		S	HS+			5.70E-10	0.00	0.0	PTE
2038	HCN+		H2	HCNH+			9.00E-10	0.00	0.0	MHAA17701
2039	HCN+		CH	CH2+			6.30E-10	0.00	0.0	PTE
2040	HCN+		CH2	CH3+			8.70E-10	0.00	0.0	PTE

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
2041	HCN+	NH	NH2+	CN			6.50E-10	0.00	0.0	PTE
2042	HCN+	NH2	NH3+	CN			9.00E-10	0.00	0.0	PTE
2043	HCN+	CH4	HCNH+	CH3			1.04E-09	0.00	0.0	MHAE18012
2044	HCN+	CH4	C2H3+	NH2			2.60E-10	0.00	0.0	MPNE18012
2045	HCN+	OH	H2O+	CN			6.30E-10	0.00	0.0	PTE
2046	HCN+	NH3	NH3+	HCN			1.68E-09	0.00	0.0	MCTE1801
2047	HCN+	NH3	HCNH+	NH2			8.40E-10	0.00	0.0	MPNE1801
2048	HCN+	H2O	H3O+	CN			1.80E-09	0.00	0.0	MCTE1801
2049	HCN+	H2O	H2O+	HCN			1.80E-09	0.00	0.0	MCTE1801
2050	HCN+	C2	C2H+	CN			8.40E-10	0.00	0.0	PTE
2051	HCN+	C2H	C2H2+	CN			7.90E-10	0.00	0.0	PTE
2052	HCN+	HCN	HCNH+	CN			1.60E-09	0.00	0.0	MCTE1801
2053	HCN+	HNC	HCNH+	CN			1.00E-09	0.00	0.0	PTE
2054	HCN+	CO	HCO+	CN			1.40E-10	0.00	0.0	MCTE1810
2055	HCN+	HCO	H2CO+	CN			3.70E-10	0.00	0.0	PTE
2056	HCN+	HCO	HCNH+	CO			3.70E-10	0.00	0.0	HAE
2057	HCN+	NO	NO+	HCN			8.10E-10	0.00	0.0	CTE
2058	HCN+	H2CO	H3CO+	CN			1.00E-09	0.00	0.0	PTE
2059	HCN+	O2	O2+	HCN			3.20E-10	0.00	0.0	MCTE1810
2060	HCN+	CO2	HCO2+	CN			2.10E-10	0.00	0.0	MCTE1801
2061	C2H3+	C	C3H2+	H			1.00E-09	0.00	0.0	CIA
2062	C2H3+	C	C3H+	H2			1.00E-09	0.00	0.0	CIA
2063	C2H3+	N	C2NH+	H2			2.20E-10	0.00	0.0	MCOA FV86
2064	C2H3+	O	HCO+	CH2			1.00E-10	0.00	0.0	PNA
2065	C2H3+	O	HC2O+	H2			1.00E-10	0.00	0.0	COA
2066	C2H3+	Si	SiC2H+	H2			2.00E-10	0.00	0.0	COA HM89
2067	C2H3+	Si	SiC2H2+	H			2.00E-10	0.00	0.0	COA HM89
2068	C2H3+	S	HC2S+	H2			1.00E-09	0.00	0.0	COA MH90
2069	C2H3+	CH4	C3H5+	H2			2.00E-10	0.00	0.0	MCOA18012
2070	C2H3+	NH3	NH4+	C2H2			2.50E-09	0.00	0.0	MPTA17714
2071	C2H3+	H2O	H3O+	C2H2			1.11E-09	0.00	0.0	MPTA17714
2072	C2H3+	C2H	C2H2+	C2H2			3.30E-10	0.00	0.0	CTA HL89
2073	C2H3+	C2H	C4H3+	H			3.30E-10	0.00	0.0	COA HL89
2074	C2H3+	C2H	C4H2+	H2			3.30E-10	0.00	0.0	COA HL89
2075	C2H3+	C2H2	C4H3+	H2			7.20E-10	0.00	0.0	MCOA18012
2076	C2H3+	HCN	HCNH+	C2H2			2.90E-09	0.00	0.0	MPTA18011
2077	C2H3+	HNC	HCNH+	C2H2			2.90E-09	0.00	0.0	PNA
2078	C2H3+	C2H3	C3H3+	CH3			5.00E-10	0.00	0.0	COA
2079	C2H3+	C2H3	C2H5+	C2H			5.00E-10	0.00	0.0	COA
2080	C2H3+	CO	H3C3O+	PHOTON			2.00E-15	-2.50	0.0	MRAA H85
2081	C2H3+	C3H	C3H2+	C2H2			1.00E-06	0.00	0.0	PTA HL89
2082	C2H3+	C3H	C3H3+	CH3			1.00E-06	0.00	0.0	COA HL89
2083	C2H3+	C3H	C3H2+	CH3			1.00E-06	0.00	0.0	COA HL89
2084	C2H3+	C3H2	C3H3+	CH3			1.00E-06	0.00	0.0	COA HL89
2085	C2H3+	C3H2	C3H4+	H			8.00E-10	0.00	0.0	COA HL89
2086	C2H3+	C3H2	C3H3+	H2			8.00E-10	0.00	0.0	COA HL89
2087	C2H3+	H2C3	H2C3H+	C2H2			8.00E-10	0.00	0.0	PTA HL89
2088	C2H3+	H2C3	C3H4+	CH3			8.00E-10	0.00	0.0	COA HL89
2089	C2H3+	H2C3	C3H3+	H2			8.00E-10	0.00	0.0	COA HL89
2090	C2H3+	C3H3	C3H4+	C2H2			1.00E-06	0.00	0.0	PTA HL89
2091	C2H3+	C3H3	C3H5+	CH3			1.00E-06	0.00	0.0	COA HL89
2092	C2H3+	C3H3	C3H4+	H2			1.00E-09	0.00	0.0	COA HL89
2093	C2H3+	C3H4	C3H5+	H2			5.00E-10	0.00	0.0	PTA HL89
2094	C2H3+	C3H4	C4H2+	C2H2			4.00E-10	0.00	0.0	PTA HL89
2095	C2H3+	C4H	C4H2+	C2H2			4.00E-10	0.00	0.0	COA HL89
2096	C2H3+	C4H	C6H3+	H			4.00E-10	0.00	0.0	COA HL89
2097	C2H3+	C4H	C6H2+	H2			4.00E-10	0.00	0.0	COA HL89
2098	C2H3+	C4H2	C4H3+	C2H2			3.00E-10	0.00	0.0	PTA HL89
2099	C2H3+	C4H2	C6H3+	H2			3.00E-10	0.00	0.0	COA HL89
2100	C2H3+	C4H2	C6H4+	H			3.00E-10	0.00	0.0	COA HL89
2101	C2H3+	C4H2	C6H4+	H			3.00E-10	0.00	0.0	COA HL89
2102	C2H3+	H2S+	H2S+	C2H2			1.60E-09	0.00	0.0	MPTA1890
2103	C2H3+	H2C3N+	H2C3N+	C2H2			3.80E-09	0.00	0.0	MPTA18518
2104	C2H3+	C3H	C3H2+	C2H2			1.00E-09	0.00	0.0	PTA HL89
2105	C2H3+	C5H	C7H3+	H			1.00E-09	0.00	0.0	COA IIL89
2106	C2H3+	C5H2	C3H3+	C2H2			1.00E-09	0.00	0.0	COA HL89
2107	C2H3+	C5H2	C3H3+	C2H2			8.00E-10	0.00	0.0	PTA HL89
2108	C2H3+	C5H2	C7H4+	II			8.00E-10	0.00	0.0	COA HL89
2109	C2H3+	C6H	C6H2+	C2H2			5.00E-10	0.00	0.0	PTA HL89
2110	C2H3+	C6H	C8H3+	H			5.00E-10	0.00	0.0	COA HL89
2111	C2H3+	C6H	C8H2+	H2			5.00E-10	0.00	0.0	COA HL89
2112	C2H3+	C6H2	C6H3+	C2H2			3.00E-10	0.00	0.0	PTA HL89
2113	C2H3+	C6H2	C8H4+	H			3.00E-10	0.00	0.0	COA IIL89
2114	C2H3+	C6H2	C8H3+	H2			3.00E-10	0.00	0.0	COA HL89
2115	C2H3+	C7H	C7H2+	C2H2			1.10E-09	0.00	0.0	PTA HL89
2116	C2H3+	C7H	C9H3+	H			1.10E-09	0.00	0.0	COA HL89
2117	C2H3+	C7H	C9H2+	H2			1.10E-09	0.00	0.0	COA HL89
2118	C2H3+	C7H2	C7H3+	C2H2			8.00E-10	0.00	0.0	PTA HL89
2119	C2H3+	C7H2	C9H4+	H			8.00E-10	0.00	0.0	COA HL89
2120	C2H3+	C7H2	C9H3+	H2			8.00E-10	0.00	0.0	COA HL89
2121	Si+	H	SiH+	PHOTON			1.00E-17	0.00	0.0	RAA HM89
2122	Si+	O	SiO+	PHOTON			1.00E-17	0.00	0.0	RAA HM89
2123	Si+	NA	SiO+	SI			2.70E-09	0.00	0.0	CTA
2124	Si+	MG	MG+	SI			2.90E-09	0.00	0.0	CTA
2125	Si+	FE	FE+	SI			1.90E-09	0.00	0.0	CTA
2126	Si+	H-	SiH2+	PHOTON			2.30E-07	-0.50	0.0	MNA
2127	Si+	H2	SiH2+	C			3.00E-18	0.00	0.0	RAA HM89
2128	Si+	C-	SiC+	H			2.30E-07	-0.50	0.0	MNA
2129	Si+	CH	SiC+	H			6.30E-10	0.00	0.0	COA HM89
2130	Si+	CH2	HC3+	H			8.70E-10	0.00	0.0	COA IIM89
2131	Si+	NH	SiN+	H			1.00E-09	0.00	0.0	COA HM89
2132	Si+	CH3	SiCH2+	H			1.00E-09	0.00	0.0	COA HM89
2133	Si+	CH3	HC3+	H2			1.00E-09	0.00	0.0	COA HM89
2134	Si+	CH4	SiCH4+	PHOTON			4.00E-16	-1.50	0.0	RAA HM89
2135	Si+	OH	SiO+	H			6.30E-10	0.00	0.0	COA HM89
2136	Si+	NH3	SiNH2+	H			6.40E-10	0.00	0.0	MCOA1B90
2137	Si+	H2O	SiOH+	H			2.30E-10	0.00	0.0	MCOA1B90
2138	Si+	C2H	SiC2+	H			1.00E-09	0.00	0.0	COA HM89
2139	Si+	C2H2	SiC2H+	H			2.50E-10	0.00	0.0	MCOA1B90
2140	Si+	C2H2	SiC2H2+	PHOTON			1.00E-13	-1.00	0.0	MRAA1B90
2141	Si+	HCN	SINC+	PHOTON			1.40E-12	0.00	0.0	MCOA1B90
2142	Si+	HCN	SINC+	PHOTON			6.00E-15	-1.50	0.0	MRAA1B90
2143	Si+	HCN	SINC+	PHOTON			1.00E-09	0.00	0.0	COA HM89
2144	Si+	C2H3	SiC2H2+	H			1.00E-09	0.00	0.0	COA HM89
2145	Si+	C2H4	SiC2H3+	H			1.00E-09	0.00	0.0	COA HM89
2146	Si+	O2	SiO+	O			1.00E-13	0.00	0.0	MPNA18111
2147	Si+	S-	Si	S			2.30E-07	-0.50	0.0	MNA
2148	Si+	C3H	SiC3+	H			1.00E-09	0.00	0.0	COA HM89
2149	Si+	C3H2	SiC3H+	H			1.00E-09	0.00	0.0	COA HM89
2150	Si+	H2C3	SiC3H+	H			1.00E-09	0.00	0.0	COA HM89
2151	Si+	C3H3	SiC3H2+	H			1.00E-09	0.00	0.0	COA HM89
2152	Si+	C3H4	SiC3H2+	II2			2.20E-09	0.00	0.0	MPNA28705
2153	Si+	C2H5OH	SiOH+	H			1.00E-09	0.00	0.0	COA HM89
2154	Si+	C4H	SiC4+	H			1.00E-09	0.00	0.0	COA HM89
2155	Si+	C4H2	C4H+	SiH			1.60E-09	0.00	0.0	MPNA1B90
2156	Si+	OCS	SiS+	CO			9.00E-10	0.00	0.0	MPNA1B90
2157	N2+	II	H+	N2			1.20E-10	0.00	0.0	CTE
2158	N2+	C	C+	N2			1.10E-10	0.00	0.0	CTE
2159	N2+	N	N+	N2			1.00E-11	0.00	0.0	MCTE16804
2160	N2+	O	NO+	N			1.30E-10	0.00	0.0	MPNE17418

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
2161	N2+	O	O+	N2			1.00E-11	0.00	0.0	MCTE17418
2162	N2+	NA	NA+	N2			6.20E-10	0.00	0.0	MCTE16901
2163	N2+	MG	MG+	N2			7.00E-10	0.00	0.0	CTE
2164	N2+	S	S+	N2			1.10E-09	0.00	0.0	CTE
2165	N2+	FE	FE+	N2			4.30E-10	0.00	0.0	CTE
2166	N2+	H2	N2H+	H			2.00E-09	0.00	0.0	MHAA18010
2167	N2+	CH	CH+	N2			6.30E-10	0.00	0.0	CTE
2168	N2+	CH2	CH2+	N2			8.70E-10	0.00	0.0	CTE
2169	N2+	NH	NH+	N2			6.50E-10	0.00	0.0	CTE
2170	N2+	NH2	NH2+	N2			8.90E-10	0.00	0.0	CTE
2171	N2+	CH4	CH2+	H2	N2		7.00E-11	0.00	0.0	MPNE18010
2172	N2+	CH4	CH3+	N2	N2		9.30E-10	0.00	0.0	MPNE18010
2173	N2+	OH	OH+	N2			6.30E-10	0.00	0.0	CTE
2174	N2+	CO	CO+	N2			7.40E-11	0.00	0.0	MCTE18010
2175	N2+	NH3	NH3+	N2			1.90E-09	0.00	0.0	MCTE18010
2176	N2+	H2O	N2H+	OH			5.00E-10	0.00	0.0	MCTE18010
2177	N2+	H2O	H2O+	N2			2.30E-09	0.00	0.0	MHAE18010
2178	N2+	C2	C2+	N2			8.40E-10	0.00	0.0	MCTE18010
2179	N2+	C2H	C2H+	N2			7.90E-10	0.00	0.0	CTE
2180	N2+	CN	CN+	N2			1.00E-10	0.00	0.0	CTE
2181	N2+	HCN	HCN+	N2			3.90E-10	0.00	0.0	CTE
2182	N2+	HCO	HCO+	N2			3.70E-10	0.00	0.0	MCTE18010
2183	N2+	HCO	N2H+	CO			3.70E-10	0.00	0.0	CTE
2184	N2+	NO	NO+	N2			4.40E-10	0.00	0.0	MCTE17905
2185	N2+	H2CO	H2CO+	N2			3.77E-10	0.00	0.0	MCTE18010
2186	N2+	H2CO	HCO+	N2			2.52E-09	0.00	0.0	MPNE18010
2187	N2+	O2	O2+	N2			5.00E-11	0.00	0.0	MCTE18010
2188	N2+	H2S	S+	N2			2.25E-10	0.00	0.0	MPNE18010
2189	N2+	H2S	HS+	N2			1.13E-09	0.00	0.0	MPNE18010
2190	N2+	H2S	H2S+	N2			1.50E-10	0.00	0.0	MCTE18010
2191	N2+	CO2	CO2+	N2			7.70E-10	0.00	0.0	MCTE18010
2192	N2+	OCS	S+	N2			1.04E-09	0.00	0.0	MPNE18010
2193	N2+	OCS	OCS+	N2			2.60E-10	0.00	0.0	MCTE18010
2194	N2+	H	H+	CO			7.50E-10	0.00	0.0	MCTE18010
2195	CO+	C	C+	CO			1.10E-10	0.00	0.0	MCTA18403
2196	CO+	O	O+	CO			1.40E-10	0.00	0.0	CTA
2197	CO+	S	S+	CO			1.10E-09	0.00	0.0	CTA
2198	CO+	H2	HCO+	H			1.80E-09	0.00	0.0	MHAA17805
2199	CO+	CH	CH+	CO			3.20E-10	0.00	0.0	CTE
2200	CO+	CH	HCO+	C			3.20E-10	0.00	0.0	PTE
2201	CO+	CH2	CH2+	CO			4.30E-10	0.00	0.0	CTE
2202	CO+	CH2	HCO+	CH			4.30E-10	0.00	0.0	CTE
2203	CO+	NH	NH+	CO			3.20E-10	0.00	0.0	HAE
2204	CO+	NH	HCO+	N			3.20E-10	0.00	0.0	HAE
2205	CO+	NH2	HCO+	NH			4.50E-10	0.00	0.0	HAE
2206	CO+	NH2	NH2+	CO			4.50E-10	0.00	0.0	CTE
2207	CO+	CH4	CH4+	CO			7.99E-10	0.00	0.0	MCTE17805
2208	CO+	CH4	HCO+	CH3			4.55E-10	0.00	0.0	MCTE17805
2209	CO+	CH4	CH3CO+	H			5.20E-11	0.00	0.0	MCOE17805
2210	CO+	OH	OH+	CO			3.10E-10	0.00	0.0	CTE
2211	CO+	OH	HCO+	O			3.10E-10	0.00	0.0	HAE
2212	CO+	NH3	HCO+	NH2			4.12E-11	0.00	0.0	MHAE18001
2213	CO+	NH3	NH3+	CO			2.02E-09	0.00	0.0	MCTE18001
2214	CO+	H2O	H2O+	CO			1.72E-09	0.00	0.0	MCTE18001
2215	CO+	H2O	HCO+	OH			8.84E-10	0.00	0.0	MIAE18001
2216	CO+	C2	C2+	CO			8.40E-10	0.00	0.0	CTE
2217	CO+	C2H	HCO+	C2			3.90E-10	0.00	0.0	HAE
2218	CO+	C2H	C2H+	CO			3.90E-10	0.00	0.0	CTE
2219	CO+	HCN	HCN+	CO			3.40E-09	0.00	0.0	MCTE18001
2220	CO+	HCO	HCO+	CO			7.40E-10	0.00	0.0	CTE
2221	CO+	CO+	NO+	CO			3.30E-10	0.00	0.0	MCTE17201
2222	CO+	HCO	HCO+	CO			1.65E-09	0.00	0.0	MHAE17805
2223	CO+	H2CO	H2CO+	CO			1.35E-09	0.00	0.0	MCTE17805
2224	CO+	O2	O2+	CO			1.20E-10	0.00	0.0	MCTE17805
2225	CO+	H2S	H2S+	CO			2.44E-09	0.00	0.0	MCTE18401
2226	CO+	H2S	HCO+	HS			1.56E-10	0.00	0.0	MHAE18401
2227	CO+	CO2	CO2+	CO			1.00E-09	0.00	0.0	MCTA17805
2228	CO+	SO2	SO+	CO2			1.70E-09	0.00	0.0	MPNE17507
2229	HCNH+	NA	NA+	HCN			1.35E-09	0.00	0.0	PNA
2230	HCNH+	NA	NA+	HCN			1.35E-09	0.00	0.0	PNA
2231	HCNH+	SI	SIN+	H2			5.00E-10	0.00	0.0	PNA
2232	HCNH+	CH	CH2+	HCN			3.15E-10	0.00	0.0	PTA
2233	HCNH+	CH	CH2+	HCN			3.15E-10	0.00	0.0	PTA
2234	HCNH+	CH2	CH3+	HCN			4.35E-10	0.00	0.0	PTA
2235	HCNH+	CH2	CH3+	HCN			4.35E-10	0.00	0.0	PTA
2236	HCNH+	NH2	NH3+	HCN			4.45E-10	0.00	0.0	PTA
2237	HCNH+	NH2	NH3+	HCN			4.45E-10	0.00	0.0	PTA
2238	HCNH+	NH3	NH4+	HCN			1.10E-09	0.00	0.0	MPTA17701
2239	HCNH+	NH3	NH4+	HCN			1.10E-09	0.00	0.0	MPTA17701
2240	HCNH+	H2CO	H3CO+	HCN			1.05E-09	0.00	0.0	MPTA17814
2241	HCNH+	H2CO	H3CO+	HCN			1.05E-09	0.00	0.0	MPTA17814
2242	HCNH+	H2S	H3S+	HCN			1.70E-10	0.00	0.0	MPTA17813
2243	HCNH+	H2S	H3S+	HCN			1.70E-10	0.00	0.0	MPTA17813
2244	HCNH+	H3CN	H4CN+	HCN			2.25E-09	0.00	0.0	MPTA17813
2245	HCNH+	H3CN	H4CN+	HCN			2.25E-09	0.00	0.0	MPTA17813
2246	HCNH+	SI	SIN+	H2			5.00E-10	0.00	0.0	MPTA17813
2247	HCNH+	C	H2C3H+	H			1.00E-09	0.00	0.0	PNA
2248	HCNH+	C	C3H+	H2			1.00E-09	0.00	0.0	PNA
2249	HCNH+	C	CH3CN+	H			1.00E-10	0.00	0.0	MPNA1790
2250	HCNH+	O	HCO+	CH3			1.00E-10	0.00	0.0	PNA
2251	HCNH+	O	CH3CO+	H			1.00E-10	0.00	0.0	COA
2252	HCNH+	SI	SIC2H3+	H			2.00E-10	0.00	0.0	COA
2253	HCNH+	SI	SIC2H2+	H2			2.00E-10	0.00	0.0	COA
2254	HCNH+	S	HC2S+	H2			1.00E-09	0.00	0.0	COA
2255	HCNH+	NH3	NH4+	C2H3			1.68E-09	0.00	0.0	MPTA1790
2256	HCNH+	NH3	NH3+	C2H4			4.20E-10	0.00	0.0	MCTA1790
2257	HCNH+	C2H	I2C3H+	CH2			5.00E-10	0.00	0.0	PNA
2258	HCNH+	C2H	C4H3+	H2			5.00E-10	0.00	0.0	COA
2259	HCNH+	C2H2	H2C3H+	CH3			1.14E-09	0.00	0.0	MPNA1790
2260	HCNH+	C2H2	C2H3+	H			1.04E-10	0.00	0.0	MCOA1790
2261	HCNH+	C2H3	C2H3+	C2H4			5.00E-10	0.00	0.0	CTA
2262	HCNH+	C2H3	C2H5+	C2H2			5.00E-10	0.00	0.0	PTA
2263	HCNH+	SIH4	C2H5+	SIH3			5.04E-10	0.00	0.0	MHAA27428
2264	HCNH+	SIH4	SIH2+	C2H6			1.96E-10	0.00	0.0	MPNA27428
2265	HCNH+	HC3N	H2C3N+	C2H5			6.16E-10	0.00	0.0	MPNA27428
2266	HCNH+	C3H	C4H2+	C2H3			1.10E-09	0.00	0.0	MPTA17911
2267	HCNH+	C3H	C4H2+	CH3			1.90E-09	0.00	0.0	PNA
2268	HCNH+	C3H	C5H4+	II			6.30E-10	0.00	0.0	COA
2269	HCNH+	C3H2	C4H3+	CH3			1.50E-09	0.00	0.0	PNA
2270	HCNH+	C3H2	C5H5+	II			5.00E-10	0.00	0.0	COA
2271	HCNH+	C2H4+	C4H3+	CH3			5.00E-10	0.00	0.0	PNA
2272	HCNH+	C2H4+	C5H5+	II			5.00E-10	0.00	0.0	COA
2273	HCNH+	C2H4+	C3H3+	C2H4			8.00E-10	0.00	0.0	CTA
2274	HCNH+	C2H4+	C4H3+	CH4			8.00E-10	0.00	0.0	PNA
2275	HCNH+	C2H4+	C5H5+	H2			8.00E-10	0.00	0.0	COA
2276	HCNH+	C2H4+	C4H5+	CH3			8.00E-10	0.00	0.0	PNA
2277	HCNH+	C2H4+	C5H2+	CH3			7.50E-10	0.00	0.0	PNA
2278	HCNH+	C4H	C6H4+	H			2.50E-10	0.00	0.0	COA
2279	HCNH+	C4H2	C5H3+	CH3			5.00E-10	0.00	0.0	PNA
2280	HCNH+	C4H2	C6H4+	H2			5.00E-10	0.00	0.0	COA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
2281	C2H4+	C5H	C6H2+	CH3			2.10E-09	0.00	0.0	PNA HL89
2282	C2H4+	C5H	C7H4+	H			7.00E-10	0.00	0.0	COA HL89
2283	C2H4+	C5H2	C6H3+	CH3			1.50E-09	0.00	0.0	PNA HL89
2284	C2H4+	C5H2	C7H5+	H			5.00E-10	0.00	0.0	COA HL89
2285	C2H4+	C6H	C7H2+	CH3			7.50E-10	0.00	0.0	PNA HL89
2286	C2H4+	C6H	C8H4+	H			2.50E-10	0.00	0.0	COA HL89
2287	C2H4+	C6H2	C7H3+	CH3			5.00E-10	0.00	0.0	COA HL89
2288	C2H4+	C6H	C8H3+	H2			5.00E-10	0.00	0.0	COA HL89
2289	C2H4+	C7H	C8H2+	CH3			2.30E-09	0.00	0.0	PNA HL89
2290	C2H4+	C7	C9H4+	H			7.50E-10	0.00	0.0	COA HL89
2291	C2H4+	C7H2	C8H3+	CH3			1.50E-09	0.00	0.0	PNA HL89
2292	C2H4+	C7H2	C9H4+	H2			5.00E-10	0.00	0.0	COA HL89
2293	SiH+	H	Si+	H2			1.90E-09	0.00	0.0	COA HL89
2294	SiH+	C	SiC+	H			2.00E-10	0.00	0.0	COA HL89
2295	SiH+	N	SiN+	H			2.00E-10	0.00	0.0	COA HL89
2296	SiH+	O	SiO+	H			4.00E-10	0.00	0.0	COA HL89
2297	SiH+	H2	SiH3+	PHOTON			3.00E-17	-1.00	0.0	RAA HL89
2298	SiH+	CH	CH2+	SI			6.00E-10	0.00	0.0	PTA HM89
2299	SiH+	NH3	NH4+	SI			1.00E-09	0.00	0.0	PTA HM89
2300	SiH+	H2O	H3O+	SI			8.00E-10	0.00	0.0	PTA HM89
2301	N2H+	C	CH+	N2			1.10E-09	0.00	0.0	PTA
2302	N2H+	O	OH+	N2			1.40E-10	0.00	0.0	MPTA18006
2303	N2H+	S	HS+	N2			1.10E-09	0.00	0.0	PTA
2304	N2H+	CH	CH2+	N2			6.30E-10	0.00	0.0	PTA
2305	N2H+	CH2	CH3+	N2			8.60E-10	0.00	0.0	PTA
2306	N2H+	NH	NH2+	N2			6.40E-10	0.00	0.0	PTA
2307	N2H+	NH2	NH3+	N2			8.90E-10	0.00	0.0	PTA
2308	N2H+	CH4	CH5+	N2			8.90E-10	0.00	0.0	MPTA17005
2309	N2H+	OH	I2O+	N2			6.20E-10	0.00	0.0	PTA
2310	N2H+	NH3	NH4+	N2			2.30E-09	0.00	0.0	MPTA17415
2311	N2H+	H2O	H3O+	N2			2.60E-09	0.00	0.0	MPTA18208
2312	N2H+	C2	C2H+	N2			8.30E-10	0.00	0.0	PTA
2313	N2H+	C2H	C2H2+	N2			7.80E-10	0.00	0.0	PTA
2314	N2H+	C2H2	C2H3+	N2			1.41E-09	0.00	0.0	MPTA17713
2315	N2H+	HCN	HCNH+	N2			3.20E-09	0.00	0.0	MPTA17605
2316	N2H+	HNC	HCNH+	N2			3.20E-09	0.00	0.0	PTA
2317	N2H+	CO	HCO+	N2			8.80E-10	0.00	0.0	MPTA18006
2318	N2H+	HCO	H2CO+	N2			7.30E-10	0.00	0.0	PTA
2319	N2H+	H2CO	H3CO+	N2			3.30E-09	0.00	0.0	MPTA17906
2320	N2H+	CO2	HCO2+	N2			9.80E-10	0.00	0.0	MPTA18006
2321	N2H+	HC3N	H2C3N+	N2			4.20E-09	0.00	0.0	MPTA18412
2322	HCO+	C	CH+	CO			1.10E-09	0.00	0.0	PTA
2323	HCO+	NA	NA+	HCO			2.60E-09	0.00	0.0	CTA
2324	HCO+	MG	MG+	HCO			2.90E-09	0.00	0.0	CTA
2325	HCO+	SI	SiH+	CO			1.60E-09	0.00	0.0	PTA
2326	HCO+	S	HS+	CO			3.30E-10	0.00	0.0	PTA
2327	HCO+	FE	FE+	HCO			1.90E-09	0.00	0.0	CTA
2328	HCO+	H	CO	H2			2.30E-07	-0.50	0.0	MNA
2329	HCO+	CH	CH2+	CO			6.30E-10	0.00	0.0	PTA
2330	HCO+	CH2	CH3+	CO			8.60E-10	0.00	0.0	PTA
2331	HCO+	NH	NH2+	CO			6.40E-10	0.00	0.0	PTA
2332	HCO+	NH2	NH3+	CO			8.90E-10	0.00	0.0	PTA
2333	HCO+	CH4	C2H5O+	PHOTON			1.00E-17	0.00	0.0	RAA HL89
2334	HCO+	OH	H2O+	CO			6.20E-10	0.00	0.0	PTA
2335	HCO+	OH	HCO2+	H			1.00E-09	0.00	0.0	COA
2336	HCO+	NH3	NH4+	CO			2.20E-09	0.00	0.0	MPTA17711
2337	HCO+	I2O	H3O+	CO			2.50E-09	0.00	0.0	MPTA17805
2338	HCO+	H2O	CHOOH2+	PHOTON			4.00E-13	-1.30	0.0	RAA HL89
2339	HCO+	C2	C2H+	CO			8.30E-10	0.00	0.0	PTA
2340	HCO+	C2H	C2H2+	CO			7.80E-10	0.00	0.0	PTA
2341	HCO+						1.40E-09	0.00	0.0	MPTA17713
2342	HCO+						3.10E-09	0.00	0.0	MPTA18512
2343	HCO+						3.10E-09	0.00	0.0	PTA
2344	HCO+						1.40E-09	0.00	0.0	PTA
2345	HCO+						1.40E-09	0.00	0.0	PTA
2346	HCO+						8.70E-10	0.00	0.0	PTA HM89
2347	HCO+						7.30E-10	0.00	0.0	PTA
2348	HCO+						1.00E-09	0.00	0.0	PTA
2349	HCO+						1.40E-09	0.00	0.0	PTA
2350	HCO+						1.20E-10	0.00	0.0	MPTA18117
2351	HCO+						1.00E-09	0.00	0.0	PTA HM89
2352	HCO+						2.00E-09	0.00	0.0	PTA HM89
2353	HCO+						3.30E-09	0.00	0.0	MPTA17906
2354	HCO+						1.00E-09	0.00	0.0	PTA
2355	HCO+						1.40E-09	0.00	0.0	PTA HM89
2356	HCO+						2.70E-09	0.00	0.0	MPTA17902
2357	HCO+						8.20E-10	0.00	0.0	PTA
2358	HCO+						1.00E-09	0.00	0.0	PTA
2359	HCO+						1.60E-09	0.00	0.0	MPTA17507
2360	HCO+						2.00E-09	0.00	0.0	PTA
2361	HCO+						1.40E-09	0.00	0.0	PTA
2362	HCO+						1.40E-09	0.00	0.0	PTA
2363	HCO+						1.40E-09	0.00	0.0	PTA
2364	HCO+						1.40E-09	0.00	0.0	PTA
2365	HCO+						1.00E-09	0.00	0.0	PTA
2366	HCO+						2.00E-09	0.00	0.0	PTA HM89
2367	HCO+						1.40E-09	0.00	0.0	PTA
2368	HCO+						1.40E-09	0.00	0.0	PTA HM89
2369	HCO+						2.00E-09	0.00	0.0	PTA HM89
2370	HCO+						1.80E-09	0.00	0.0	MPTA17902
2371	HCO+						1.00E-09	0.00	0.0	PTA AM90
2372	HCO+						2.00E-09	0.00	0.0	PTA HM89
2373	HCO+						2.00E-09	0.00	0.0	PTA HM89
2374	HCO+						1.00E-09	0.00	0.0	PTA AM90
2375	HCO+						7.90E-10	0.00	0.0	PTA HM89
2376	HCO+						3.40E-09	0.00	0.0	MPTA17902
2377	HCO+						1.00E-09	0.00	0.0	PTA
2378	HCO+						1.10E-09	0.00	0.0	PTA
2379	HCO+						1.10E-09	0.00	0.0	PTA
2380	HCO+						2.20E-09	0.00	0.0	MPTA17902
2381	HCO+						2.20E-09	0.00	0.0	MPTA17902
2382	HCO+						2.10E-09	0.00	0.0	MPTA17902
2383	HCO+						7.50E-10	0.00	0.0	PTA
2384	HCO+						1.00E-09	0.00	0.0	PTA
2385	HCO+						1.00E-09	0.00	0.0	PTA
2386	HCO+						1.00E-09	0.00	0.0	PTA
2387	HCO+						1.00E-09	0.00	0.0	PTA
2388	HCO+						1.00E-09	0.00	0.0	PTA
2389	HCO+						1.40E-09	0.00	0.0	PTA
2390	HCO+						1.40E-09	0.00	0.0	PTA
2391	HCO+						3.70E-09	0.00	0.0	PTA
2392	HCO+						1.40E-09	0.00	0.0	PTA
2393	HCO+						4.00E-09	0.00	0.0	MPTA18412
2394	HCO+						2.00E-09	0.00	0.0	PTA
2395	HCO+						2.00E-09	0.00	0.0	PTA HM89
2396	HCO+						2.00E-09	0.00	0.0	PTA HM89
2397	HCO+						3.50E-09	0.00	0.0	PTA HL89
2398	HCO+						2.00E-09	0.00	0.0	PTA HM89
2399	HCO+						2.00E-09	0.00	0.0	PTA HM89
2400	HCO+						1.00E-09	0.00	0.0	PTA AM90

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
2401	HCO+	HCCP	PC2H2+	CO			1.00E-09	0.00	0.0	PTA AM90
2402	HCO+	C2S	HC2S+	CO			1.00E-09	0.00	0.0	PTA MH90
2403	HCO+	C2H6CO	C3H6OH+	CO			2.70E-09	0.00	0.0	MPTA17902
2404	HCO+	SIS	HSIS+	CO			3.30E-09	0.00	0.0	PTA
2405	HCO+	OC3	HCOS+	CO			1.10E-09	0.00	0.0	MPTA17805
2406	HCO+	SiO2	HSiO2+	CO			2.00E-09	0.00	0.0	PTA HM89
2407	HCO+	C5	CSH+	CO			2.00E-09	0.00	0.0	PTA
2408	HCO+	HCOOCH3	HSC2O2+	CO			2.90E-09	0.00	0.0	MPTA17902
2409	HCO+	C5H	C5H2+	CO			3.00E-09	0.00	0.0	PTA
2410	HCO+	C3H2	C3H3+	CO			2.50E-09	0.00	0.0	PTA
2411	HCO+	C3H4	C3H5+	CO			2.00E-09	0.00	0.0	PTA HL89
2412	HCO+	S2	S2H+	CO			2.00E-09	0.00	0.0	PTA MH90
2413	HCO+	SIC3	SIC3H+	CO			2.00E-09	0.00	0.0	PTA HM89
2414	HCO+	H3C4N	H4C4N+	CO			4.00E-09	0.00	0.0	PTA MH90
2415	HCO+	HS2	HS2+	CO			2.00E-09	0.00	0.0	PTA MH90
2416	HCO+	SIC3H	SIC3H2+	CO			2.00E-09	0.00	0.0	PTA HM89
2417	HCO+	C3P	PC3H+	CO			2.00E-09	0.00	0.0	PTA HM90
2418	HCO+	H2S2	HS2+	CO			1.00E-09	0.00	0.0	PTA
2419	HCO+	C3S	HC3S+	CO			1.40E-09	0.00	0.0	PTA
2420	HCO+	C6	C6H+	CO			2.00E-09	0.00	0.0	PTA
2421	HCO+	C6H	C6H2+	CO			2.00E-09	0.00	0.0	PTA
2422	HCO+	C6H2	C6H3+	CO			3.00E-09	0.00	0.0	PTA
2423	HCO+	C3N	HC5N+	CO			2.00E-09	0.00	0.0	PTA
2424	HCO+	HC5N	H2C5N+	CO			2.00E-09	0.00	0.0	PTA
2425	HCO+	SIC4	SIC4H+	CO			1.00E-09	0.00	0.0	PTA
2426	HCO+	C4P	PC4H+	CO			1.00E-09	0.00	0.0	PTA
2427	HCO+	C4S	HC4S+	CO			1.40E-09	0.00	0.0	PTA
2428	HCO+	C7	C7H+	CO			1.00E-09	0.00	0.0	PTA
2429	HCO+	C7H	C7H2+	CO			3.00E-09	0.00	0.0	PTA
2430	HCO+	C7H2	C7H3+	CO			2.50E-09	0.00	0.0	PTA
2431	HCO+	C7H4	C7H5+	CO			2.00E-09	0.00	0.0	PTA
2432	HCO+	H3C6N	H4C6N+	CO			4.00E-09	0.00	0.0	PTA
2433	HCO+	C8	C8H+	CO			1.40E-09	0.00	0.0	PTA
2434	HCO+	C8H	C8H2+	CO			2.00E-09	0.00	0.0	PTA
2435	HCO+	C8H2	C8H3+	CO			1.40E-09	0.00	0.0	PTA
2436	HCO+	C7N	HC7N+	CO			3.00E-09	0.00	0.0	PTA
2437	HCO+	HC7N	H2C7N+	CO			4.00E-09	0.00	0.0	PTA
2438	HCO+	C9	C9H+	CO			1.40E-09	0.00	0.0	PTA
2439	HCO+	C9H	C9H2+	CO			3.00E-09	0.00	0.0	PTA
2440	HCO+	C9H2	C9H3+	CO			2.50E-09	0.00	0.0	PTA
2441	HCO+	C9N	HC9N+	CO			3.00E-09	0.00	0.0	PTA
2442	HCO+	HC9N	H2C9N+	CO			4.00E-09	0.00	0.0	PTA
2443	HCO+	H3C8N	H4C8N+	CO			1.30E-09	0.00	0.0	MPNA18505
2444	HOC+	H2	HCO+	H2			4.00E-10	0.00	0.0	MPNA18505
2445	HOC+	CO	HCO+	CO			2.10E-09	0.00	0.0	MPTA17415
2446	C2H5+	NH3	NH4+	C2H4			1.40E-09	0.00	0.0	MPTA17415
2447	C2H5+	H2O	H3O+	C2H4			6.65E-11	0.00	0.0	MPTA18113
2448	C2H5+	C2H2	C3H3+	C2H4			1.22E-10	0.00	0.0	MPTA17712
2449	C2H5+	C2H2	C4H5+	C2H4			1.22E-10	0.00	0.0	MPTA17712
2450	C2H5+	HCN	HCNH+	C2H4			2.70E-09	0.00	0.0	MPTA18011
2451	C2H5+	HCN	HCNH+	C2H4			2.70E-09	0.00	0.0	PTA
2452	C2H5+	C2H4	C3H5+	C2H4			3.90E-10	0.00	0.0	MPNA17712
2453	C2H5+	H2CO	H3CO+	C2H4			3.10E-09	0.00	0.0	MPTA17906
2454	C2H5+	H2S	H3S+	C2H4			6.70E-10	0.00	0.0	MPTA17701
2455	C2H6+	NH3	NH3+	C2H6			6.24E-10	0.00	0.0	MCTA17701
2456	C2H6+	NH3	NH4+	C2H5			1.61E-09	0.00	0.0	MPTA17701
2457	C2H6+	H2O	H3O+	C2H5			2.95E-09	0.00	0.0	MPTA17701
2458	C2H6+	H2S	H2S+	C2H6			1.98E-09	0.00	0.0	MCTA17701
2459	C2H6+	H2S	H3S+	C2H5			8.90E-10	0.00	0.0	MPTA17701
2460	C2H6+	C2H4	C2H4+	C2H6			1.15E-09	0.00	0.0	MCTA17712
2461	NO+	NA	NA+	NO			7.70E-11	0.00	0.0	MCTA16901
2462	NO+	MG	MG+	NO			8.10E-10	0.00	0.0	CTA
2463	NO+	SI	SI+	NO			1.60E-09	0.00	0.0	CTA
2464	NO+	FE	FE+	NO			9.20E-10	0.00	0.0	CTA
2465	SiH2+	C	HC3H+	H			1.10E-09	0.00	0.0	COA HM89
2466	SiH2+	N	HNSH+	H			1.00E-10	0.00	0.0	COA HM89
2467	SiH2+	O	HSOH+	H			6.30E-10	0.00	0.0	COA HM89
2468	SiH2+	S	HSIS+	H			1.10E-09	0.00	0.0	COA HM89
2469	SiH2+	O2	HSOH+	OH			2.40E-11	0.00	0.0	MPNA17809
2470	H2CO+	NA	NA+	H2CO			2.60E-09	0.00	0.0	CTA
2471	H2CO+	MG	MG+	H2CO			2.90E-09	0.00	0.0	CTA
2472	H2CO+	SI	SI+	H2CO			2.00E-09	0.00	0.0	CTA
2473	H2CO+	S	HS+	HCO			5.50E-10	0.00	0.0	PTA
2474	H2CO+	S	HS+	HCO			5.50E-10	0.00	0.0	CTA
2475	H2CO+	FE	FE+	H2CO			1.90E-09	0.00	0.0	CTA
2476	H2CO+	CH	CH+	H2CO			3.10E-10	0.00	0.0	CTE
2477	H2CO+	CH	CH2+	HCO			3.10E-10	0.00	0.0	CTE
2478	H2CO+	CH2	CH3+	HCO			4.30E-10	0.00	0.0	CTE
2479	H2CO+	CH2	CH2+	HCO			4.30E-10	0.00	0.0	CTE
2480	H2CO+	NH	H3CO+	N			6.40E-10	0.00	0.0	HAE
2481	H2CO+	NH2	NH3+	HCO			8.80E-10	0.00	0.0	CTE
2482	H2CO+	CH4	H3CO+	CH3			9.35E-11	0.00	0.0	MHAE17805
2483	H2CO+	CH4	CH3CO+	H			1.65E-11	0.00	0.0	MCOE17805
2484	H2CO+	NH3	NH4+	HCO			1.28E-09	0.00	0.0	MPTA17805
2485	H2CO+	NH3	NH3+	H2CO			4.25E-10	0.00	0.0	MCTE17805
2486	H2CO+	H2O	H3O+	HCO			2.60E-09	0.00	0.0	MPTA17805
2487	H2CO+	C2	C2H+	HCO			8.20E-10	0.00	0.0	CTE
2488	H2CO+	C2H	C2H2+	HCO			7.70E-10	0.00	0.0	CTE
2489	H2CO+	HCN	HCNH+	HCO			1.40E-09	0.00	0.0	MPTA17701
2490	H2CO+	HNC	HCNH+	HCO			1.40E-09	0.00	0.0	CTE
2491	H2CO+	HCO	HCO+	HCO			3.60E-10	0.00	0.0	CTE
2492	H2CO+	HCO	H3CO+	CO			3.60E-10	0.00	0.0	CTE
2493	H2CO+	H2CO	H3CO+	HCO			7.80E-10	0.00	0.0	CTE
2494	H2CO+	H2CO	H3CO+	HCO			3.20E-09	0.00	0.0	MPTA17805
2495	H2CO+	O2	HCO+	O2H			7.70E-11	0.00	0.0	MPNE17805
2496	P+	SI	P	SI+			1.00E-09	0.00	0.0	CTA
2497	P+	H2	PH2+	PHOTON			7.50E-18	-1.30	0.0	MRAA SM89
2498	P+	CH4	PC2H2+	H2			9.60E-10	0.00	0.0	MCOA1SM89
2499	P+	OH	PO+	H			5.00E-10	0.00	0.0	COA
2500	P+	NI3	NI3+	P			9.40E-10	0.00	0.0	MCTA1SM89
2501	P+	NI3	PNH2+	II			8.60E-10	0.00	0.0	MCOA1SM89
2502	P+	H2O	HPO+	H			5.10E-10	0.00	0.0	MCOA18302
2503	P+	H2O	HPO+	H2			5.00E-11	0.00	0.0	MCOA18302
2504	P+	C2H2	PC2H2+	H			1.24E-09	0.00	0.0	MCOA1SM89
2505	P+	C2H2	PC2H2+	PHOTON			6.00E-11	0.00	0.0	MRAA1SM89
2506	P+	C2H4	PC2H2+	H2			1.20E-09	0.00	0.0	MCOA1SM89
2507	P+	O2	PO+	O			5.60E-10	0.00	0.0	MPNA18302
2508	HNO+	C	CH+	NO			1.00E-09	0.00	0.0	COA
2509	HNO+	O	NO2+	II			1.00E-12	0.00	0.0	CTA
2510	HNO+	S	HS+	NO			1.10E-09	0.00	0.0	PTA
2511	HNO+	CH	CH2+	NO			6.20E-10	0.00	0.0	PTA
2512	HNO+	CH2	CH3+	NO			8.60E-10	0.00	0.0	PTA
2513	HNO+	NH	NH2+	NO			6.30E-10	0.00	0.0	PTA
2514	HNO+	NH2	NH3+	NO			8.80E-10	0.00	0.0	PTA
2515	HNO+	CH4	CH5+	NO			1.00E-10	0.00	0.0	MPTA17104
2516	HNO+	OH	H2O+	NO			6.20E-10	0.00	0.0	PTA
2517	HNO+	NH3	NH4+	NO			1.10E-09	0.00	0.0	PTA
2518	HNO+	H2O	H3O+	NO			2.30E-09	0.00	0.0	MPTA18208
2519	HNO+	C2	C2H+	NO			8.20E-10	0.00	0.0	PTA
2520	HNO+	C2H	C2H2+	NO			7.70E-10	0.00	0.0	PTA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
2521	HNO+	CN	HCO+	NO			8.70E-10	0.00	0.0	PTA
2522	HNO+	HCN	HCNH+	NO			9.90E-10	0.00	0.0	PTA
2523	HNO+	HCN	HCNH+	NO			9.90E-10	0.00	0.0	PTA
2524	HNO+	CO	HCO+	NO			1.00E-10	0.00	0.0	MPTA17104
2525	HNO+	N ₂ H+	NO	NO			1.00E-11	0.00	0.0	MPTA17104
2526	HNO+	HCO	HCO+	NO			7.20E-10	0.00	0.0	PTA
2527	HNO+	NO	NO+	HNO			7.00E-10	0.00	0.0	MCTA17005
2528	HNO+	HCO	HCO+	NO			1.00E-09	0.00	0.0	PTA
2529	HNO+	CO ₂	HCO ₂ +	NO			1.00E-10	0.00	0.0	MPTA17104
2530	SH ₃ +	C	SIC ₂ H ₂ +	H			2.00E-10	0.00	0.0	CIA HM89
2531	SH ₃ +	N	SH ₃ +	H ₂			1.00E-10	0.00	0.0	COA HM89
2532	SH ₃ +	N	SIN ₂ H ₂ +	H			1.00E-10	0.00	0.0	COA HM89
2533	SH ₃ +	O	H ₂ SiO+	H			2.00E-10	0.00	0.0	COA HM89
2534	SH ₃ +	O	SiOH+	H ₂			2.00E-10	0.00	0.0	COA HM89
2535	SH ₃ +	H ₂	SiH ₅ +	PHOTON			1.00E-18	-0.50	0.0	RAA HM89
2536	SH ₃ +	O ₂	H ₃ SiO+	O			2.90E-12	0.00	0.0	MPNA17609
2537	HCO+	NA	NA+	H ₂ CO			2.60E-09	0.00	0.0	PNA
2538	HCO+	CH	CH ₂ +	H ₂ CO			6.20E-10	0.00	0.0	PTE
2539	HCO+	NH ₂	H ₂ CO	H ₂ CO			8.80E-10	0.00	0.0	PTE
2540	HCO+	NH ₃	NH ₄ +	H ₂ CO			2.30E-09	0.00	0.0	MPTA17701
2541	HCO+	H ₂ O	H ₃ O+	H ₂ CO			2.30E-10	0.00	0.0	MPTA17802
2542	HCO+	HCN	HCNH+	H ₂ CO			1.30E-09	0.00	0.0	MPTA17814
2543	HCO+	HNC	HCNH+	H ₂ CO			1.30E-09	0.00	0.0	PTE
2544	HCO+	I ₂ S	H ₃ S+	H ₂ CO			5.00E-10	0.00	0.0	MPTA17814
2545	S+	NA	NA+	S			2.60E-10	0.00	0.0	CTA
2546	S+	MG	MG+	S			2.90E-10	0.00	0.0	CTA
2547	S+	SI	SI+	S			1.60E-09	0.00	0.0	CTA
2548	S+	FE	FE+	S			1.80E-10	0.00	0.0	CTA
2549	S+	H-	S	II			2.30E-07	-0.50	0.0	MNA
2550	S+	H ₂	H ₂ S+	II			1.10E-10	0.00	9860.0	MHAA M86
2551	S+	H ₂	H ₂ S+	PHOTON			1.00E-17	-0.20	0.0	RAA1 H89
2552	S+	C-	S	C			2.30E-07	-0.50	0.0	MNA
2553	S+	CH	CS+	H			6.20E-10	0.00	0.0	COA
2554	S+	CH ₂	HCS+	H			1.00E-11	0.00	0.0	COA
2555	S+	NH	NS+	H			6.30E-10	0.00	0.0	COA
2556	S+	CH ₃	I ₂ CS-	H			1.00E-11	0.00	0.0	COA
2557	S+	CH ₄	I ₂ CS-	H			3.80E-10	0.00	0.0	MCOA18110
2558	S+	CH ₄	HCS+	H ₂			2.00E-11	0.00	0.0	MCOA18110
2559	S+	OH	SO+	H			6.10E-10	0.00	0.0	COA
2560	S+	NH ₃	NH ₃ +	S			1.44E-09	0.00	0.0	MCTA17507
2561	S+	C ₂	CS+	C			8.10E-10	0.00	0.0	PNA
2562	S+	C ₂ H	C ₂ S+	H			1.00E-09	0.00	0.0	COA MH90
2563	S+	C ₂ H ₂	HC ₂ S+	H			9.50E-10	0.00	0.0	MCOA SH88
2564	S+	C ₂ H ₃	HC ₂ S+	H ₂			1.00E-09	0.00	0.0	COA MH90
2565	S+	SiH	SiH+	S			4.20E-10	0.00	0.0	COA
2566	S+	SiH	SiH+	S			4.20E-10	0.00	0.0	CTA
2567	S+	HCO	HCO+	CO			3.60E-10	0.00	0.0	HAA
2568	S+	NO	NO+	S			3.60E-10	0.00	0.0	CTA
2569	S+	NO	NO+	S			3.70E-10	0.00	0.0	MCTA18110
2570	S+	H ₂ CO	H ₂ S+	CO			3.33E-10	0.00	0.0	MHAA18401
2571	S+	H ₂ CO	HCO+	HS			3.33E-10	0.00	0.0	MHAA18401
2572	S+	O ₂	SO+	O			1.50E-11	0.00	0.0	MPNA18110
2573	S+	S-	S	S			2.30E-07	-0.50	0.0	MNA
2574	S+	H ₂ S	S ₂ +	H ₂			6.34E-10	0.00	0.0	MCOA18110
2575	S+	H ₂ S	H ₂ S+	S			4.40E-11	0.00	0.0	MCTA18110
2576	S+	H ₂ S	C ₂ S+	H			2.02E-10	0.00	0.0	MCOA18110
2577	S+	C ₃ H	C ₃ S+	H			1.00E-09	0.00	0.0	COA MH90
2578	S+	C ₃ H ₂	HC ₃ S+	H			1.00E-09	0.00	0.0	COA MH90
2579	S+	H ₂ C ₃	HC ₃ S+	H			1.30E-09	0.00	0.0	COA MH90
2580	S+	SIC	SIC+	S			3.70E-09	0.00	0.0	CTA
2581	S+	C ₄ H	C ₄ S+	H			1.00E-09	0.00	0.0	COA MH90
2582	S+	C ₄ H ₂	C ₄ H ₂ +	S			7.20E-10	0.00	0.0	MCTA WB88
2583	S+	C ₄ H ₂	HC ₄ S+	H			4.80E-10	0.00	0.0	MCTA WB88
2584	S+	C ₄ H ₂	C ₄ H ₂ +	CS			2.40E-10	0.00	0.0	MPNA WB88
2585	S+	C ₄ H ₂	C ₄ H ₂ +	HS			1.60E-10	0.00	0.0	MPNA WB88
2586	S+	SIS	SIS+	S			3.20E-09	0.00	0.0	CTA
2587	S-	H	HS	ELECTR			1.00E-10	0.00	0.0	ADA
2588	S-	C	CS	ELECTR			1.00E-10	0.00	0.0	ADA
2589	S-	N	NS	ELECTR			1.00E-10	0.00	0.0	ADA
2590	S-	O	SO	ELECTR			1.00E-10	0.00	0.0	ADA
2591	S-	CO	OCS	ELECTR			3.00E-10	0.00	0.0	ADA
2592	S-	O ₂	SO ₂	ELECTR			3.00E-11	0.00	0.0	ADA
2593	O ₂ +	C	CO+	O			5.20E-11	0.00	0.0	PNA
2594	O ₂ +	C	C+	O ₂			5.20E-11	0.00	0.0	CTA
2595	O ₂ +	N	NO+	O			1.80E-10	0.00	0.0	MPNA16603
2596	O ₂ +	NA	NA+	O ₂			7.10E-10	0.00	0.0	MCTA16901
2597	O ₂ +	MG	MG+	O ₂			1.20E-09	0.00	0.0	CTA
2598	O ₂ +	SI	SI+	O ₂			1.60E-09	0.00	0.0	CTA
2599	O ₂ +	S	SO+	O			5.40E-10	0.00	0.0	PNA
2600	O ₂ +	S	FE+	O ₂			5.40E-10	0.00	0.0	CTA
2601	O ₂ +	FE	FE+	O ₂			1.10E-09	0.00	0.0	CTA
2602	O ₂ +	CH	CH+	O ₂			3.10E-10	0.00	0.0	CTE
2603	O ₂ +	CH	HCO+	O			3.10E-10	0.00	0.0	PNE
2604	O ₂ +	CH ₂	H ₂ CO+	O			4.30E-10	0.00	0.0	PNE
2605	O ₂ +	CH ₂	CH ₂ +	O ₂			4.30E-10	0.00	0.0	CTE
2606	O ₂ +	NH	NO ₂ +	H			3.20E-10	0.00	0.0	COF
2607	O ₂ +	NH	HNO+	O			3.20E-10	0.00	0.0	PNE
2608	O ₂ +	NH ₂	NH ₂ +	O ₂			8.70E-10	0.00	0.0	CTE
2609	O ₂ +	CH ₃	CH ₃ OH+	H			3.80E-12	-1.80	0.0	COE
2610	O ₂ +	NH ₃	NH ₃ +	O ₂			2.00E-09	0.00	0.0	MCTE18010
2611	O ₂ +	C ₂	C ₂ +	CO			4.10E-10	0.00	0.0	PNE
2612	O ₂ +	C ₂	C ₂ +	O ₂			4.10E-10	0.00	0.0	CTE
2613	O ₂ +	HCO	O ₂ H+	CO			3.60E-10	0.00	0.0	HAE
2614	O ₂ +	I ₂ CO	I ₂ CO+	O ₂			3.60E-10	0.00	0.0	CTE
2615	O ₂ +	NO	NO+	O ₂			4.50E-10	0.00	0.0	MCTE17414
2616	O ₂ +	H ₂ CO	H ₂ CO+	O ₂			2.30E-10	0.00	0.0	MPNE18010
2617	O ₂ +	H ₂ CO	H ₂ CO+	O ₂			2.07E-09	0.00	0.0	MCTE18010
2618	O ₂ +	CH ₃ OH	H ₃ CO+	O ₂			5.00E-10	0.00	0.0	MPNE18010
2619	O ₂ +	CH ₃ OH	CH ₃ OH+	O ₂			5.00E-10	0.00	0.0	MCTE18010
2620	O ₂ +	H ₂ S	H ₂ S+	O ₂			1.40E-09	0.00	0.0	MCTE18010
2621	O ₂ +	NO ₂	NO ₂ +	O ₂			6.60E-10	0.00	0.0	MCTE17303
2622	PH+	O	PO+	H			1.00E-09	0.00	0.0	COA TA84
2623	PH+	H ₂	PH ₃ +	PHOTON			2.40E-17	-1.40	0.0	MRAA SM89
2624	PH+	NH ₃	NH ₄ +	P			4.00E-10	0.00	0.0	MPTAISM89
2625	PH+	NH ₃	PNH ₂ +	H ₂			5.90E-10	0.00	0.0	MCOAISM89
2626	PH+	NH ₃	PNH ₃ -	H			1.10E-09	0.00	0.0	MCOAISM89
2627	PH+	I ₂ O	H ₂ O+	H ₂			7.40E-10	0.00	0.0	MCOAISM89
2628	PH+	H ₂ O	H ₂ O+	H			2.00E-10	0.00	0.0	MCOAISM89
2629	PH+	H ₂ O	H ₂ O+	P			2.50E-10	0.00	0.0	MPTAISM89
2630	PH+	CH ₄	PC ₂ H ₃ -	H ₂			1.10E-09	0.00	0.0	MCOAISM89
2631	PH+	CH ₄	PC ₂ H ₄ +	H			5.50E-11	0.00	0.0	MCOAISM89
2632	PH+	CH ₂	PC ₂ H ₂ +	H			1.30E-09	0.00	0.0	MCOAISM89
2633	PH+	C ₂ H ₄	PC ₂ H ₂ +	CH ₃			3.60E-10	0.00	0.0	MPNAISM89
2634	PH+	C ₂ H ₄	PC ₂ H ₂ +	H ₂			8.40E-10	0.00	0.0	MCOAISM89
2635	PH+	HCN	HCNH+	P			1.70E-09	0.00	0.0	MPTAISM89
2636	PH+	O ₂	PO+	OH			5.40E-10	0.00	0.0	MPNA18302
2637	PH ₂ +	O ₂	PO+	H ₂ O			7.80E-11	0.00	0.0	MPNAISM89
2638	PH ₂ +	H ₂ O	H ₂ O+	H ₂			3.30E-10	0.00	0.0	MCOAISM89
2639	PH ₂ +	H ₂ O	H ₃ O+	PH			1.60E-10	0.00	0.0	MPTAISM89
2640	PH ₂ +	HCN	HCNH+	PH			1.00E-09	0.00	0.0	MPTAISM89

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note	Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note	
2641	PH2+	NH3	NH4+	PH			4.00E-10	0.00	0.0	MPTA18M89	2701	SIH5+	O	H3SiO+	H2			1.00E-10	0.00	0.0	COA HM89	
2642	PH2+	NH3	PNH3+	H2			1.60E-09	0.00	0.0	MCOA18M89	2702	SIH5+	H2O	H3O+	SH4			2.00E-09	0.00	0.0	PTA HM89	
2643	PH2+	C2H2	PC2H2+	H2			1.40E-09	0.00	0.0	MCOA18M89	2703	CH3OH2+	H2CO	H5C2O2+	H2			2.10E-11	0.00	0.0	PNA MC90	
2644	PH2+	CH4	PC2H4+	H2			1.10E-09	0.00	0.0	MCOA18M89	2704	CH3OH2+	H2CO	H5C2O+	H2O			2.10E-11	0.00	0.0	MPNA18M89	
2645	PH2+	C2H4	PC2H2+	CH4			1.40E-10	0.00	0.0	MPNA18M89	2705	CH3OH2+	CH3OH	C2H6OH+	H2O			7.60E-11	-1.60	0.0	MPNA18M89	
2646	PH2+	C2H4	PC2H4+	H2			1.10E-09	0.00	0.0	MCOA18M89	2706	H2S+	H	HS+	H2			2.00E-10	0.00	0.0	MCOA M86	
2647	SIH4+	C	SIH2+	H2			3.00E-10	0.00	0.0	COA HM89	2707	H2S+	C	HCS+	H			1.00E-09	0.00	0.0	COA	
2648	SIH4+	H2	SIH5+	H			1.00E-09	0.00	0.0	IAA HM89	2708	H2S+	N	NS+	H2			7.90E-10	0.00	0.0	COA	
2649	SIH4+	H2O	H3O+	SIH3			2.00E-09	0.00	0.0	PTA HM89	2709	H2S+	O	HS+	OH			3.10E-10	0.00	0.0	PNA	
2650	SIH4+	CO	HCO+	SIH3			1.00E-09	0.00	0.0	PTA HM89	2710	H2S+	O	SO+	H2			3.10E-10	0.00	0.0	COA	
2651	PH3+	NH3	NH4+	PH2			2.30E-09	0.00	0.0	MPTA18M89	2711	H2S+	NA	NA+	HS			2.50E-09	0.00	0.0	CTA	
2652	PH3+	C2H2	PC2H3+	H2			5.80E-10	0.00	0.0	MCOA18M89	2712	H2S+	MG	MG+	H2S			2.80E-09	0.00	0.0	CTA	
2653	HS+	H	S+	H2			1.10E-10	0.00	0.0	MCOA M86	2713	H2S+	SI	SI+	H2S			1.60E-09	0.00	0.0	CTA	
2654	HS+	H2	H2S+	H			2.00E-10	0.00	6380.0	2714	H2S+	S	S+	HS			1.10E-09	0.00	0.0	CTA		
2655	HS+	C	CS+	H			9.90E-10	0.00	0.0	COA	2715	H2S+	FE	FE+	H2S			1.80E-09	0.00	0.0	CTA	
2656	HS+	N	NS+	H			7.40E-10	0.00	0.0	COA	2716	H2S+	NH3	NH4+	HS			1.36E-09	0.00	0.0	MPTA18110	
2657	HS+	O	SO+	H			2.90E-10	0.00	0.0	COA	2717	H2S+	NH3	NH3+	HS			3.40E-10	0.00	0.0	MCTA18110	
2658	HS+	O	S+	OH			2.90E-10	0.00	0.0	PNA	2718	H2S+	H2O	H3O+	HS			8.10E-10	0.00	0.0	MPTA18110	
2659	HS+	NA	NA+	HS			2.20E-09	0.00	0.0	CTA	2719	H2S+	HCO	HCO+	HS			7.00E-10	0.00	0.0	CTA	
2660	HS+	MG	MG+	HS			2.60E-09	0.00	0.0	CTA	2720	H2S+	NO	NO+	HS			3.70E-10	0.00	0.0	MCTA18110	
2661	HS+	SI	SI+	HS			1.40E-09	0.00	0.0	CTA	2721	H2S+	H2S	H3S+	HS			1.00E-09	0.00	0.0	MPTA18110	
2662	HS+	S	S+	HS			9.70E-10	0.00	0.0	CTA	2722	CL+	H2	HCL+	H			1.00E-09	0.00	0.0	MHAA18103	
2663	HS+	FE	FE+	HS			1.60E-09	0.00	0.0	CTA	2723	CL+	O2	O2+	CL			4.60E-10	0.00	0.0	MCTE17602	
2664	HS+	H2	H3S+	PHOTON			2.40E-16	-0.80	0.0	RAA MH90	2724	H3S+	H	H3S+	H2			6.00E-11	0.00	0.0	MCOA M86	
2665	HS+	CH	CH2+	S			5.80E-10	0.00	0.0	PTE	2725	H2S+	H2	H3S+	H			1.00E-09	0.00	0.0	2900.0	
2666	HS+	CH4	H3CS+	H2			4.86E-10	0.00	0.0	MCOA18110	2726	H3S+	S	H2S2+	H			1.00E-09	0.00	0.0	COA	
2667	HS+	CH4	CH3+	H2S			5.40E-11	0.00	0.0	MPNA18110	2727	H3S+	NH3	NH4+	H2S			1.90E-09	0.00	0.0	MPTA18110	
2668	HS+	NH3	NH3+	HS			5.25E-10	0.00	0.0	MCTE18110	2728	H3S+	HCN	HCNH+	H2S			1.50E-09	0.00	0.0	MPTA17809	
2669	HS+	NH3	NH4+	S			9.75E-10	0.00	0.0	MPTA18110	2729	H3S+	HNC	HCNH+	HS			1.50E-09	0.00	0.0	PTA	
2670	HS+	H2O	H3O+	S			7.80E-10	0.00	0.0	MPTA17802	2730	H3S+	H2CO	H3CO+	H2S			2.20E-09	0.00	0.0	MPTA17906	
2671	HS+	HCN	HCNH+	S			8.60E-10	0.00	0.0	MPTA18401	2731	HCL+	H2	H2CO+	H			1.30E-09	0.00	0.0	MHAA18103	
2672	HS+	HNC	HCNH+	S			8.60E-10	0.00	0.0	PTE	2732	C3+	H2	C3H+	H			3.00E-10	0.00	0.0	MIAA18309	
2673	HS+	NO	NO+	HS			4.50E-10	0.00	0.0	MCTE18110	2733	C3+	C2H2	C5H+	H			6.00E-10	0.00	0.0	COE	
2674	HS+	H2S	H3S+	S			4.70E-10	0.00	0.0	MPTA18110	2734	H2CL+	H2O	H3O+	HCL			2.00E-09	0.00	0.0	MCTA18502	
2675	HS+	H2S	H2S+	HS			2.90E-10	0.00	0.0	MCTE18110	2735	H2CL+	CO	HCO+	HCL			7.80E-10	0.00	0.0	MPTA18502	
2676	HS+	H2S	S2H+	H2			2.80E-10	0.00	0.0	MCOA18110	2736	C3H+	H2	C3H2+	H			1.00E-12	0.00	928.0	PNA MM93	
2677	O2H+	C	CH+	O2H			1.00E-09	0.00	0.0	PTA	2737	C3H+	H2	C3H3+	PHOTON			1.69E-12	-1.00	0.0	RAA MM93	
2678	O2H+	N	NO2+	H			1.00E-12	0.00	0.0	COA	2738	C3H+	II2	H2C3H+	PHOTON			1.69E-12	-1.00	0.0	RAA MM93	
2679	O2H+	O	OH+	O2			6.20E-10	0.00	0.0	PTA	2739	C3H+	SI	SI3+	H			6.12E-10	0.00	0.0	MPNA1830	
2680	O2H+	S	HS+	O2			1.10E-09	0.00	0.0	PTA	2740	C3H+	CH4	C2H3+	C2H2			1.08E-10	0.00	0.0	MCOA1830	
2681	O2H+	H2	H3+	O2			6.40E-10	0.00	0.0	MPTA18414	2741	C3H+	CH4	C4H3+	H2			4.80E-10	0.00	0.0	MCOA1830	
2682	O2H+	CH	CH2+	O2			6.20E-10	0.00	0.0	PTA	2742	C3H+	NH3	H2NC+	C2H2			3.20E-10	0.00	0.0	MPNA18304	
2683	O2H+	CH2	CH3+	O2			8.30E-10	0.00	0.0	PTA	2743	C3H+	NH3	NH3+	C3H			8.00E-10	0.00	0.0	MCTA18304	
2684	O2H+	NH	NH2+	O2			6.30E-10	0.00	0.0	PTA	2744	C3H+	NH3	NH4+	C3			8.00E-10	0.00	0.0	MPTA18304	
2685	O2H+	NH2	NH3+	O2			8.70E-10	0.00	0.0	PTA	2745	C3H+	H2O	HCO+	C2H2			2.70E-10	0.00	0.0	MPNA18304	
2686	O2H+	OH	H2O+	O2			6.10E-10	0.00	0.0	PTA	2746	C3H+	H2O	C2H3+	CO			1.80E-10	0.00	0.0	MHAA18304	
2687	O2H+	NH3	NH4+	O2			2.00E-09	0.00	0.0	MPTA17516	2747	C3H+	H2O	HC3O+	H2			2.30E-11	0.00	0.0	MCOA18304	
2688	O2H+	H2O	H3O+	O2			8.20E-10	0.00	0.0	PTA	2748	C3H+	C2H2	C5H2+	PHOTON			3.00E-10	0.00	0.0	MCOA18304	
2689	O2H+	C2	C2H+	O2			8.10E-10	0.00	0.0	PTA	2749	C3H+	C2H2	H2C3H+	C2H2			2.90E-12	-1.00	0.0	MRAA18304	
2690	O2H+	C2H	C2H2+	O2			7.60E-10	0.00	0.0	PTA	2750	C3H+	C2H4	H2C3H+	C2H2			9.00E-10	0.00	0.0	MHAA18304	
2691	O2H+	CN	HCN+	O2			8.60E-10	0.00	0.0	PTA	2751	C3H+	C2H4	C3H3+	H2			5.00E-11	0.00	0.0	MCOA18304	
2692	O2H+	HCN	HCNH+	O2			9.70E-10	0.00	0.0	PTA	2752	C3H+	NO	CCNH+	CO			4.20E-10	0.00	0.0	MPNA18304	
2693	O2H+	HNC	HCNH+	O2			9.70E-10	0.00	0.0	PTA	2753	C3H+	NO	NO+	C3H			1.30E-10	0.00	0.0	MCTA18304	
2694	O2H+	CO	HCO+	O2			8.40E-10	0.00	0.0	PTA	2754	C3H+	O2	HC3O+	O			7.30E-12	0.00	0.0	MPNA28304	
2695	O2H+	N2	N2H+	O2			8.00E-10	0.00	0.0	MPTA17516	2755	C3H+	O2	C2HO+	CO			2.50E-12	0.00	0.0	MPNA28304	
2696	O2H+	HCO	H2CO+	O2			7.10E-10	0.00	0.0	PTA	2756	C3H+	O2	HCO+	CCO			1.50E-11	0.00	0.0	MPNA28304	
2697	O2H+	NO	HNO+	O2			7.70E-10	0.00	0.0	MPTA17517	2757	C3H+	H2S	HCS+	C2H2			7.56E-10	0.00	0.0	MPNA18304	
2698	O2H+	H2CO	H3CO+	O2			9.80E-10	0.00	0.0	PTA	2758	C3H+	H2S	C2H3+	CS			3.60E-10	0.00	0.0	MPNA18304	
2699	O2H+	CO2	HCO2+	O2			1.10E-09	0.00	0.0	MPTA17516	2759	C3H+	H2S	HC3S+	H2			8.40E-11	0.00	0.0	MCOA18304	
2700	SIH5+	C	SIH4+	H			2.00E-10	0.00	0.0	COA HM89	2760	C3H+	CO2	HC3O+	CO							

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
2761	C3H+	OCs	CS+	C3O	H		4.27E-10	0.00	0.0	MPNA18304
2762	C3H+	OCs	HC3O+	CS			1.22E-10	0.00	0.0	MPNA18304
2763	C3H+	OCs	HC3S+	CO			6.10E-11	0.00	0.0	MPNA18304
2764	C3H+	C4H2	C5H2+	C2H			1.00E-09	0.00	0.0	PNA HL89
2765	C3H+	C4H2	C5H+	C2H2			1.20E-10	0.00	0.0	PNA HL89
2766	CCN+	NE3	HCNH+	HCN			1.80E-09	0.00	0.0	MPNA18012
2767	CCN+	H2O	HCO+	HCN			2.30E-10	0.00	0.0	MPNA18301
2768	CCN+	H2O	C6NH+	OH			8.50E-11	0.00	0.0	MPNA18301A
2769	CCN+	C2H2	C3H+	HCN			8.00E-10	0.00	0.0	MPNA18301
2770	CCN+	C2H2	HC4N+	H			2.00E-10	0.00	0.0	MPNA18301
2771	CCN+	H2S	HCS+	HCN			1.20E-09	0.00	0.0	MPNA18012
2772	C3H2+	H2	C3H3+	H			1.50E-09	0.00	2000.0	MHAA18415
2773	C3H2+	C	C4+	H2			1.00E-09	0.00	0.0	CIA
2774	C3H2+	C	C4H+	H			1.00E-09	0.00	0.0	CIA
2775	C3H2+	N	HC3N+	H			1.00E-10	0.00	0.0	COA
2776	C3H2+	O	HCO+	C2H			2.00E-10	0.00	0.0	PNA
2777	C3H2+	SI	SiC3H+	H2			2.00E-10	0.00	0.0	COA HM89
2778	C3H2+	SI	SiC3H+	H			2.00E-10	0.00	0.0	COA HM89
2779	C3H2+	F	PC3H+	II			1.00E-09	0.00	0.0	COA
2780	C3H2+	S	HC3S+	H			1.00E-09	0.00	0.0	COA MH90
2781	C3H2+	C2H	C5H2+	H			1.00E-09	0.00	0.0	COA HL89
2782	C3H2+	C2H2	C5H3+	H			5.50E-10	0.00	0.0	MCOA18501
2783	C3H2+	C2H3	C5H3+	H2			6.00E-10	0.00	0.0	COA HL89
2784	C3H2+	C2H3	C5H4+	H			6.00E-10	0.00	0.0	COA HL89
2785	C3H2+	C2H4	C4H3+	CH3			3.00E-10	0.00	0.0	PNA HL89
2786	C3H2+	C2H4	C5H5+	H			3.00E-10	0.00	0.0	COA HL89
2787	C3H2+	C3H	C6H2+	H			2.50E-09	0.00	0.0	COA HL89
2788	C3H2+	C3H2	C6H2+	H2			1.00E-09	0.00	0.0	COA HL89
2789	C3H2+	C3H2	C6H3+	H			1.00E-09	0.00	0.0	COA HL89
2790	C3H2+	H2C3	C6H2+	H2			1.00E-09	0.00	0.0	COA HL89
2791	C3H2+	H2C3	C6H3+	H			1.00E-09	0.00	0.0	COA HL89
2792	C3H2+	C3H3	C6H4+	H			2.00E-09	0.00	0.0	COA HL89
2793	C3H2+	C3H4	H2C3H+	C3H3			3.00E-10	0.00	0.0	HAA HL89
2794	C3H2+	C3H4	C6H4+	H2			3.00E-10	0.00	0.0	COA HL89
2795	C3H2+	C4H	C7H2+	H			5.00E-10	0.00	0.0	COA HL89
2796	C3H2+	C4H	C7H+	H2			3.00E-10	0.00	0.0	COA HL89
2797	C3H2+	C4H2	C7H3+	H			3.00E-10	0.00	0.0	COA HL89
2798	C3H2+	C4H2	C7H2+	H2			3.00E-10	0.00	0.0	COA HL89
2799	C3H2+	C5H	C8H2+	H			1.30E-09	0.00	0.0	COA HL89
2801	C3H2+	C5H2	C8H3+	H			1.00E-09	0.00	0.0	COA HL89
2802	C3H2+	C5H2	C8H2+	H2			1.00E-09	0.00	0.0	COA HL89
2803	C3H2+	C6H	C9H2+	H			5.00E-10	0.00	0.0	COA HL89
2804	C3H2+	C6H	C9H+	H2			3.00E-10	0.00	0.0	COA HL89
2805	C3H2+	C6H2	C9H3+	H			3.00E-10	0.00	0.0	COA HL89
2806	C3H2+	C6H2	C9H2+	H2			3.00E-10	0.00	0.0	COA HL89
2807	C3H3+	C	C4H2+	H			1.00E-09	0.00	0.0	CIA
2808	C3H3+	C	C4H+	H2			1.00E-09	0.00	0.0	CIA
2809	C3H3+	N	H2C3N+	H			1.30E-10	0.00	0.0	MCOA FV86
2810	C3H3+	O	HCO+	C2H2			2.00E-10	0.00	0.0	PNA
2811	C3H3+	C2H	C5H3+	H			7.50E-10	0.00	0.0	COA HL89
2812	C3H3+	C2H	C5H2+	H2			7.50E-10	0.00	0.0	COA HL89
2813	C3H3+	C2H2	C5H3+	H2			1.10E-09	0.00	0.0	MCOA28712
2814	C3H3+	C2H3	C5H4+	H2			1.50E-09	0.00	0.0	COA HL89
2815	C3H3+	C2H4	C5H5+	H2			1.10E-09	0.00	0.0	COA HL89
2816	C3H3+	SI	SiC3H2+	H			2.00E-10	0.00	0.0	COA HM89
2817	C3H3+	SI	SiC3H+	H2			2.00E-10	0.00	0.0	COA HM89
2818	C3H3+	S	HC3S+	H2			1.00E-09	0.00	0.0	COA MH90
2819	C3H3+	C3H	C6H3+	H			1.50E-09	0.00	0.0	COA HL89
2820	C3H3+	C3H	C6H2+	H2			1.50E-09	0.00	0.0	COA HL89
2821	C3H3+	C3H2	C6H4+	H			1.00E-09	0.00	0.0	COA HL89
2822	C3H3+	C3H2	C6H3+	H2			1.00E-09	0.00	0.0	COA HL89
2823	C3H3+	H2C3	C6H4+	H			1.00E-09	0.00	0.0	COA HL89
2824	C3H3+	H2C3	C6H5+	H			1.00E-09	0.00	0.0	COA HL89
2825	C3H3+	H2C3	C6H5+	H			1.50E-09	0.00	0.0	COA HL89
2826	C3H3+	H2C3	C6H4+	H2			1.50E-09	0.00	0.0	COA HL89
2827	C3H3+	C3H4	C6H5+	H2			1.00E-09	0.00	0.0	COA HL89
2828	C3H3+	C4H	C7H2+	H			7.50E-10	0.00	0.0	COA HL89
2829	C3H3+	C4H	C7H2+	H2			7.50E-10	0.00	0.0	COA HL89
2830	C3H3+	C4H2	C7H3+	H2			1.00E-09	0.00	0.0	COA HL89
2831	C3H3+	C4H2	C7H5+	PHOTON			1.00E-13 - 2.50			RAA HL89
2832	C3H3+	C5H	C8H3+	H			1.50E-09	0.00	0.0	COA HL89
2833	C3H3+	C5H	C8H2+	H2			1.50E-09	0.00	0.0	COA HL89
2834	C3H3+	C5H2	C8H4+	H			1.00E-09	0.00	0.0	COA HL89
2835	C3H3+	C5H2	C8H3+	H2			1.00E-09	0.00	0.0	COA HL89
2836	C3H3+	C6H	C9H3+	H			7.50E-10	0.00	0.0	COA HL89
2837	C3H3+	C6H	C9H2+	H2			7.50E-10	0.00	0.0	COA HL89
2838	C3H3+	C6H2	C9H3+	H2			1.00E-09	0.00	0.0	COA HL89
2839	H2C3H+	C	C4H2+	H			1.00E-09	0.00	0.0	CIA
2840	H2C3H+	C	C4H+	H2			1.00E-09	0.00	0.0	CIA
2841	H2C3H+	N	H2C3N+	H			1.30E-10	0.00	0.0	MCOA FV86
2842	H2C3H+	O	HCO+	C2H2			2.00E-10	0.00	0.0	PNA
2843	H2C3H+	C2H	C5H3+	H			7.50E-10	0.00	0.0	COA HL89
2844	H2C3H+	C2H	C5H2+	H2			7.50E-10	0.00	0.0	COA HL89
2845	H2C3H+	C2H2	C5H3+	H2			2.50E-10	0.00	0.0	PNA 9041
2846	H2C3H+	C2H3	C5H4+	H2			1.50E-09	0.00	0.0	COA HL89
2847	H2C3H+	C2H4	C5H5+	H2			1.10E-09	0.00	0.0	COA HL89
2848	H2C3H+	SI	SiC3H2+	H			2.00E-10	0.00	0.0	COA HM89
2849	H2C3H+	SI	SiC3H+	H2			2.00E-10	0.00	0.0	COA HM89
2850	H2C3H+	S	HC3S+	H2			1.00E-09	0.00	0.0	COA MH90
2851	H2C3H+	C3H	C6H3+	H			1.50E-09	0.00	0.0	COA HL89
2852	H2C3H+	C3H	C6H2+	H2			1.50E-09	0.00	0.0	COA HL89
2853	H2C3H+	C3H2	C6H4+	II			1.00E-09	0.00	0.0	COA HL89
2854	H2C3H+	C3H2	C6H3+	H2			1.00E-09	0.00	0.0	COA HL89
2855	H2C3H+	H2C3	C6H4+	H			1.00E-09	0.00	0.0	COA HL89
2856	H2C3H+	H2C3	C6H3+	H2			1.00E-09	0.00	0.0	COA HL89
2857	H2C3H+	H2C3	C6H5+	H			1.50E-09	0.00	0.0	COA HL89
2858	H2C3H+	C3H3	C6H4+	H2			1.50E-09	0.00	0.0	COA HL89
2859	H2C3H+	C3H4	C6H5+	H2			1.00E-09	0.00	0.0	COA HL89
2860	H2C3H+	C4H	C7H2+	H			7.50E-10	0.00	0.0	COA HL89
2861	H2C3H+	C4H	C7H2+	H2			7.50E-10	0.00	0.0	COA HL89
2862	H2C3H+	C4H2	C7H3+	H2			1.00E-09	0.00	0.0	COA HL89
2863	H2C3H+	C4H2	C7H5+	PHOTON			1.00E-13 - 2.50			RAA HL89
2864	H2C3H+	C5H	C8H3+	H			1.50E-09	0.00	0.0	COA HL89
2865	H2C3H+	C5H	C8H2+	H2			1.50E-09	0.00	0.0	COA HL89
2866	H2C3H+	C5H2	C8H4+	H			1.00E-09	0.00	0.0	COA HL89
2867	H2C3H+	C5H2	C8H3+	H2			1.00E-09	0.00	0.0	COA HL89
2868	H2C3H+	C6H	C9H3+	H			7.50E-10	0.00	0.0	COA HL89
2869	H2C3H+	C6H	C9H2+	H2			7.50E-10	0.00	0.0	COA HL89
2870	H2C3H+	C6H2	C9H3+	H2			1.00E-09	0.00	0.0	COA HL89
2871	SiC+	N	Si+	CN			7.70E-10	0.00	0.0	PNA HM89
2872	SiC+	O	SiO+	C			6.00E-10	0.00	0.0	PNA HM89
2873	SiC+	H2	HC3S+	H			1.50E-09	0.00	0.0	HAA HM89
2874	C3H4+	C	C4H2+	H2			1.00E-09	0.00	0.0	CIA
2875	C3H4+	C	C4H3+	H			1.00E-09	0.00	0.0	CIA
2876	C3H4+	N	HCO+	C2H3			2.00E-10	0.00	0.0	PNA
2877	C3H4+	O	HCO+	C2H3			4.90E-10	0.00	0.0	MCOA18501
2878	C3H4+	C2H2	C5H5+	H			1.50E-09	0.00	0.0	HAA HM89
2879	HC3S+	H2	SiC4H2+	H			1.00E-09	0.00	0.0	CIA
2880	C3H5+	C	C4H3+	H2			1.00E-09	0.00	0.0	CIA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
2881	C3H5+	N	C2H4+	HCN			1.10E-10	0.00	0.0	MPNA FV86
2882	C3H5+	N	H4C3N+	H			7.00E-10	0.00	0.0	PNA MF84
2883	C3H5+	O	HCO+	C2H4			2.00E-10	0.00	0.0	PNA
2884	CH3CN+	O	HCO+	CH2CN			2.00E-09	0.00	0.0	PTA HL90
2885	SIN+	O	SIO+	N			1.00E-09	0.00	0.0	PNA HM89
2886	SiCH2+	C	Si+	C2H2			1.00E-09	0.00	0.0	PNA HM89
2887	SiCH2+	C	SiCH2+	H			1.00E-10	0.00	0.0	CIA HM89
2888	SiCH2+	C	SiCH2+	H2			1.00E-10	0.00	0.0	CIA HM89
2889	SiCH2+	N	Si+	HCN			7.60E-10	0.00	0.0	PNA HM89
2890	SiCH2+	O	Si+	H2CO			6.00E-10	0.00	0.0	PNA HM89
2891	SiCH2+	O	HCO+	SiH			3.00E-10	0.00	0.0	PNA HM89
2892	SiCH2+	S	Si+	H2CS			1.00E-09	0.00	0.0	PNA HM89
2893	CP+	O	P+	CO			2.00E-10	0.00	0.0	PNA
2894	CP+	H2	HCP+	H			1.00E-09	0.00	0.0	COA
2895	HCP+	O	PH+	CO			2.00E-10	0.00	0.0	PNA
2896	HCP+	C	CCP+	H			2.00E-10	0.00	0.0	CIA
2897	HCP+	H2	PCCH2+	H			1.00E-09	0.00	0.0	HAA
2898	HNSI+	H2	SINH2+	H			1.00E-09	0.00	0.0	HAA HM89
2899	HNSI+	H2O	H3O+	SiH			2.00E-09	0.00	0.0	PTA HM89
2900	HNSI+	CO	HCO+	SIN			2.00E-09	0.00	0.0	PTA HM89
2901	SiCH3+	C	SiCH2+	H			2.00E-10	0.00	0.0	CIA HM89
2902	SiCH3+	H2O	H3O+	SiCH2			2.00E-09	0.00	0.0	PTA HM89
2903	SIO+	C	Si+	CO			1.00E-09	0.00	0.0	PNA
2904	SIO+	N	NO+	Si			9.00E-11	0.00	0.0	MPNA16903
2905	SIO+	N	Si+	NO			2.10E-10	0.00	0.0	MPNA16903
2906	SIO+	O	Si+	O2			2.00E-10	0.00	0.0	CTA HM89
2907	SIO+	MG	MG+	SIO			1.00E-09	0.00	0.0	PNA
2908	SIO+	S	Si+	SO			1.00E-09	0.00	0.0	CTA
2909	SIO+	FE	FE+	SIO			1.00E-09	0.00	0.0	CTA
2910	SIO+	H2	SiOH+	H			3.20E-10	0.00	0.0	MHAA18111
2911	SIO+	CH	HCO+	Si			5.90E-10	0.00	0.0	PNA HM89
2912	SIO+	CH2	Si+	H2CO			8.20E-10	0.00	0.0	PNA HM89
2913	SIO+	C2	SiC+	CO			7.60E-10	0.00	0.0	PNA HM89
2914	SIO+	CO	Si+	CO2			7.90E-10	0.00	0.0	PNA HM89
2915	SIO+	HCO	HCO+	SIO			6.60E-10	0.00	0.0	CTA HM89
2916	SIO+	NO	NO+	SIO			7.20E-10	0.00	0.0	CTA HM89
2917	PN+	C	C+	PN			1.00E-09	0.00	0.0	CTA
2918	PN+	O	PO+	N			2.00E-10	0.00	0.0	PNA
2919	CS+	C	C+	CS			1.60E-09	0.00	0.0	CTA
2920	CS+	O	CO+	S			6.00E-11	0.00	0.0	PNA
2921	CS+	NA	NA+	CS			2.30E-10	0.00	0.0	CTA
2922	CS+	MG	MG+	CS			2.70E-10	0.00	0.0	CTA
2923	CS+	Si	Si+	CS			1.50E-10	0.00	0.0	CTA
2924	CS+	FE	FE+	CS			1.70E-10	0.00	0.0	CTA
2925	CS+	IL2	HCS+	H			4.80E-10	0.00	0.0	MHAA18401
2926	CS+	CH4	HCS+	CH3			5.00E-10	0.00	0.0	MHAA18303
2927	CS+	O2	OCS+	O			1.30E-10	0.00	0.0	MPNA18401
2928	CO2+	H	HCO+	O			2.90E-10	0.00	0.0	MCTA18417
2929	CO2+	O	O+	CO2			9.62E-11	0.00	0.0	MCTE17004
2930	CO2+	O	O2+	CO			1.64E-10	0.00	0.0	MPNE17004
2931	CO2+	H2	HCO2+	H			9.50E-10	0.00	0.0	MHAA18203
2932	CO2+	CH4	CH4+	CO2			5.50E-10	0.00	0.0	MCTE18203
2933	CO2+	CH3	HCO2+	CH3			5.50E-10	0.00	0.0	MCTE18203
2934	CO2+	NH3	NH3+	CO2			1.98E-09	0.00	0.0	MCTE18203
2935	CO2+	H2O	H2O+	CO2			2.04E-09	0.00	0.0	MCTE17802
2936	CO2+	H2O	HCO2+	OH			7.56E-10	0.00	0.0	MHAA17802
2937	CO2+	NO	NO+	CO2			1.20E-10	0.00	0.0	MCTE18203
2938	CO2+	O2	O2+	CO2			5.00E-11	0.00	0.0	MCTE17912
2939	CO2+	H2S	H2S+	CO2			1.40E-09	0.00	0.0	MCTE18203
2940	SINCH2+	C	SINCH2+	H			1.00E-10	0.00	0.0	CIA HM89
2941	SINCH2+	C	SINCH2+	H			1.00E-10	0.00	0.0	CIA HM89
2942	SINCH2+	C	SINCH2+	H			2.00E-10	0.00	0.0	CIA HM89
2943	CH3CO+	NH3	CH3CO+	CH3OH			5.00E-10	0.00	0.0	MPNA17M94
2944	CH3CO+	NH3	CH3CO+	CH3CHO			1.80E-09	0.00	0.0	MPNA17M94
2945	HCS+	O	HCO+	S			5.00E-12	0.00	0.0	PNA MH90
2946	HCS+	O	OCS+	H			5.00E-12	0.00	0.0	COA MH90
2947	HCS+	NH3	NH4+	CS			2.00E-09	0.00	0.0	MPTA18317
2948	HCO2+	C	CH+	CO2			1.00E-09	0.00	0.0	PTA
2949	HCO2+	O	HCO+	O2			1.00E-09	0.00	0.0	PNA
2950	HCO2+	CH4	CH5+	CO2			7.80E-10	0.00	0.0	MPTA18006
2951	HCO2+	NH3	NH4+	CO2			1.00E-09	0.00	0.0	PTA
2952	HCO2+	H2O	H3O+	CO2			2.30E-09	0.00	0.0	MPTA18208
2953	HCO2+	C2H2	C2H3+	CO2			1.37E-09	0.00	0.0	MPTA17713
2954	HCO2+	CO	HCO+	CO2			7.80E-10	0.00	0.0	PTA
2955	HCO2+	CH3CN	H4C2N+	CO2			4.10E-09	0.00	0.0	MPTA17605
2956	NS+	O	NO+	S			6.10E-10	0.00	0.0	PNA
2957	NO2+	H	NO+	OH			1.90E-10	0.00	0.0	PNA
2958	NO2+	H2	NO+	H2O			1.50E-10	0.00	0.0	PNA
2959	HPO+	O	PH+	O2			2.00E-10	0.00	0.0	PNA TA84
2960	SO+	N	NS+	O			5.00E-11	0.00	0.0	MPNA17302
2961	SO+	NA	NA+	SO			2.30E-09	0.00	0.0	CTA
2962	SO+	MG	MG+	SO			1.00E-10	0.00	0.0	CTA
2963	SO+	FE	FE+	SO			1.60E-09	0.00	0.0	CTA
2964	SO+	NH3	NH3+	SO			1.30E-09	0.00	0.0	MCTA17507
2965	SO+	H2S	S2+	H2O			1.10E-09	0.00	0.0	MPNA17507
2966	HO+	H2O	H3O+	PO			1.00E-09	0.00	0.0	PTA TA34
2967	C4+	I2	C4H+	H			3.00E-10	0.00	0.0	MHAA18309
2968	C4H+	O	HCO+	C3			2.00E-10	0.00	0.0	PNA HL89
2969	C4H+	H2	C4H2+	H			7.00E-10	0.00	0.0	MHAA18309
2970	C4H+	C	C5+	H			1.00E-09	0.00	0.0	CIA HL89
2971	C4H+	CH4	C5H3+	H2			1.10E-09	0.00	0.0	COA HL89
2972	C4H+	C2H	C6H+	H			6.00E-10	0.00	0.0	COA HL89
2973	C4H+	C2H	C6+	H2			6.00E-10	0.00	0.0	COA HL89
2974	C4H+	C2H2	C6H2+	H			1.50E-09	0.00	0.0	COA HL89
2975	C4H+	C2H3	C6H3+	H			2.00E-09	0.00	0.0	COA HL89
2976	C4H+	C2H4	C6H4+	C2H2			7.50E-10	0.00	0.0	HAA HL89
2977	C4H+	C3H	C7H+	H			7.50E-10	0.00	0.0	COA HL89
2978	C4H+	C3H	C7+	H			1.50E-09	0.00	0.0	COA HL89
2979	C4H+	H2C3	C7H2+	H			1.50E-09	0.00	0.0	COA HL89
2980	C4H+	C3H3	C7H3+	H			2.00E-09	0.00	0.0	COA HL89
2981	C4H+	C3H4	C7H4+	H			2.50E-09	0.00	0.0	COA HL89
2982	C4H+	C4H	C7H4+	C4			6.00E-10	0.00	0.0	HAA HL89
2983	C4H+	C4H	C8H+	H			6.00E-10	0.00	0.0	COA HL89
2984	C4H+	C4H	C8H2+	H			6.00E-10	0.00	0.0	COA HL89
2985	C4H+	C4H2	C8H2+	H			1.50E-09	0.00	0.0	COA HL89
2986	C4H+	C5H	C9H+	H			3.00E-09	0.00	0.0	COA HL89
2987	C4H+	C5H2	C9H2+	H			2.00E-09	0.00	0.0	COA HL89
2988	C3N+	H2	C9H3+	H			1.50E-09	0.00	0.0	MHAA18518
2989	C4H2+	C	C5H+	H			5.00E-10	0.00	0.0	CIA HL89
2990	C4H2+	C	C5+	H2			5.00E-10	0.00	0.0	CIA HL89
2991	C4H2+	N	HCO+	H			1.00E-18	0.00	0.0	COA
2992	C4H2+	O	HCO+	C3H			2.00E-10	0.00	0.0	PNA HL89
2993	C4H2+	CH4	C5H5+	H			5.00E-10	0.00	0.0	COA
2994	C4H2+	CH4	C6H4+	H			2.00E-10	0.00	0.0	COA HL89
2995	C4H2+	C2H	C6H2+	H			1.30E-09	0.00	0.0	COA HL89
2996	C4H2+	C2H2	C6H3+	H			7.00E-12	0.00	0.0	COA HL89
2997	C4H2+	C2H2	C6H4+	H			1.00E-09	0.00	0.0	RAA HL89
2998	C4H2+	C2H3	C6H4+	H			1.20E-09	0.00	0.0	COA HL89
2999	C4H2+	C2H3	C6H3+	H2			3.00E-10	0.00	0.0	COA HL89
3000	C4H2+	C2H4	C6H5+	H			8.00E-10	0.00	0.0	COA HL89

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
3001	C4H2+	C3H4	C6H4+	H2			2.00E-10	0.00	0.0	COA HL89
3002	C4H2+	SI	SiC4H+	H			2.00E-10	0.00	0.0	COA HL89
3003	C4H2+	SI	SiC4H+	H2			2.00E-10	0.00	0.0	COA HL89
3004	C4H2+	P	PC4H+	H			1.00E-09	0.00	0.0	COA
3005	C4H2+	S	HC4S+	H			1.00E-09	0.00	0.0	COA MH90
3006	C4H2+	C3H	C7H2+	H			2.50E-09	0.00	0.0	COA HL89
3007	C4H2+	H2C3	C7H3+	H			2.20E-09	0.00	0.0	COA HL89
3008	C4H2+	C3H3	C7H3+	H			2.20E-09	0.00	0.0	COA HL89
3009	C4H2+	C3H3	C7H4+	H			2.00E-09	0.00	0.0	COA HL89
3010	C4H2+	C3H3	C7H3+	H2			5.00E-10	0.00	0.0	COA HL89
3011	C4H2+	C3H4	C7H4+	H2			1.00E-09	0.00	0.0	COA HL89
3012	C4H2+	C4H	C8H2+	H			1.30E-09	0.00	0.0	COA HL89
3013	C4H2+	C4H2	C8H3+	H			1.00E-09	0.00	0.0	COA HL89
3014	C4H2+	C4H2	C6H2+	C2H2			1.30E-10	0.00	0.0	PNA HL89
3015	C4H2+	C4H2	C8H4+	PHOTON			1.00E-13	-2.00	0.0	RAA HL89
3016	C4H2+	HC3N	H3C7N+	PHOTON			2.00E-12	-2.50	0.0	RAA HL89
3017	C4H2+	C5H	C9H2+	H			2.50E-09	0.00	0.0	COA HL89
3018	C4H2+	C5H2	C9H3+	H			2.20E-09	0.00	0.0	COA HL89
3019	C4H2+	HC3N	H3C3N+	PHOTON			2.00E-12	-2.50	0.0	RAA HL89
3020	HC3N+	H2	H2C3N+	H			5.00E-12	0.00	0.0	MHAA18518
3021	HC3N+	H2	C2H2+	HCN			2.00E-12	0.00	0.0	MPNA18518
3022	HC3N+	CH4	C3H4+	HCN			3.30E-11	0.00	0.0	MPNA1P92
3023	HC3N+	CH4	C3H5+	CN			4.57E-10	0.00	0.0	MPNA1P92
3024	HC3N+	CH4	I2C3N+	CH3			2.91E-10	0.00	0.0	MPNA1P92
3025	HC3N+	NH3	NH3+	HC3N			1.70E-09	0.00	0.0	MCTA1P92
3026	C4H3+	C	C3H2+	H			5.00E-10	0.00	0.0	CIA HL89
3027	C4H3+	C	C5H+	H2			5.00E-10	0.00	0.0	CIA HL89
3028	C4H3+	N	H2C4N+	H			1.00E-18	0.00	0.0	COA
3029	C4H3+	O	HCO+	H2C3			2.00E-10	0.00	0.0	PNA HL89
3030	C4H3+	CH4	C5H5+	H2			5.00E-10	0.00	0.0	COA HL89
3031	C4H3+	C2H	C6H3+	H			1.00E-09	0.00	0.0	COA HL89
3032	C4H3+	C2H2	C6H5+	PHOTON			1.00E-09	0.00	0.0	RAA HL89
3033	C4H3+	C2H3	C6H6+	H			5.00E-10	0.00	0.0	COA HL89
3034	C4H3+	C2H3	C6H4+	H2			5.00E-10	0.00	0.0	COA HL89
3035	C4H3+	S	HC4S+	H2			1.00E-09	0.00	0.0	COA MH90
3036	C4H3+	C3H	C7H3+	C3H			2.00E-09	0.00	0.0	COA HL89
3037	C4H3+	C3H2	C7H4+	H			1.50E-09	0.00	0.0	COA HL89
3038	C4H3+	H2C3	C7H4+	H			1.50E-09	0.00	0.0	COA HL89
3039	C4H3+	C3H3	C7H5+	H			1.00E-09	0.00	0.0	COA HL89
3040	C4H3+	C3H4	C7H5+	H2			1.00E-09	0.00	0.0	COA HL89
3041	C4H3+	C4H	C8H3+	H			1.00E-09	0.00	0.0	COA HL89
3042	C4H3+	C4H2	C8H4+	H			5.00E-10	0.00	0.0	COA HL89
3043	C4H3+	C4H2	C8H4+	H2			5.00E-10	0.00	0.0	COA HL89
3044	C4H3+	C4H2	C8H3+	H2			5.00E-10	0.00	0.0	COA HL89
3045	C4H3+	C4H2	C8H3+	C2H2			1.00E-10	0.00	0.0	PNA HL89
3046	C4H3+	C4H2	C8H5+	PHOTON			1.00E-13	-2.50	0.0	RAA HL89
3047	C4H3+	C5H	C9H3+	H			2.00E-09	0.00	0.0	COA HL89
3048	C4H3+	C5H2	C9H4+	H			7.00E-10	0.00	0.0	COA HL89
3049	C4H3+	C5H2	C9H4+	H2			7.00E-10	0.00	0.0	COA HL89
3050	SiC2H+	H2	SiC3H+	H			1.50E-09	0.00	0.0	HAA HL89
3051	SiC2H+	C	SiC3+	H			3.00E-10	0.00	0.0	CIA HL89
3052	SiC2H+	H2	SiC2H3+	PHOTON			3.00E-16	-1.00	0.0	RAA HL89
3053	SiC2H+	C2H2	SiC4N+	H2			2.00E-11	0.00	0.0	MCOA1B90
3054	C4H6+	N	H4C4N+	H			1.00E-10	0.00	0.0	COA HL89
3055	SINC+	O	SIN+	CO			1.00E-10	0.00	0.0	PNA HL89
3056	SiC2H2+	C	SiC3H+	H			2.00E-10	0.00	0.0	CIA HL89
3057	SINC+	O	HC0+	SIN			2.00E-10	0.00	0.0	PNA HL89
3058	SiC2H6+	C	SiC3H2+	H			2.00E-10	0.00	0.0	CIA HL89
3059	PC2H+	C2H2	PC4H2+	H			9.10E-10	0.00	0.0	MCOA1SM89
3060	C2S+	H2	HC2S+	H			1.00E-09	0.00	0.0	COA SC92

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
3121	SiC3H2+	C	SiC4H+	H			2.00E-10	0.00	0.0	CIA HL89
3122	HC2S+	C	C3S+	H			1.00E-09	0.00	0.0	CIA SC92
3123	C6+	H2	C6H+	H			7.00E-11	0.00	0.0	MHAA1GA89
3124	C8+	H2	C8H2+	PHOTON			5.20E-14	-0.50	0.0	MRAA1HL90
3125	C8H+	H2	C8H2+	H			9.50E-13	0.00	0.0	HAA HL89
3126	C8H2+	C	C7H+	H			5.00E-10	0.00	0.0	CIA HL89
3127	C8H2+	C	C7+	H2			5.00E-10	0.00	0.0	CIA HL89
3128	C8H2+	O	HCO+	C3H			2.00E-10	0.00	0.0	PNA HL89
3129	C8H2+	CH4	C7H5+	H			8.00E-10	0.00	0.0	COA HL89
3130	C8H2+	CH4	C7H4+	H2			2.00E-10	0.00	0.0	COA HL89
3131	C8H2+	C2H	C8H2+	H			1.20E-09	0.00	0.0	COA HL89
3132	C8H2+	C2H2	C8H2+	PHOTON			1.00E-09	0.00	0.0	RAA IL80
3133	C8H2+	C2H3	C8H4+	H			4.00E-10	0.00	0.0	COA HL89
3134	C8H2+	C2H3	C8H3+	H2			8.00E-10	0.00	0.0	COA HL89
3135	C8H2+	C2H4	C8H4+	H2			1.00E-09	0.00	0.0	COA HL89
3136	C8H2+	C3H	C9H2+	H			2.00E-09	0.00	0.0	COA HL89
3137	C8H2+	C3H2	C9H3+	H			1.20E-09	0.00	0.0	COA HL89
3138	C8H2+	C3H2	C9H2+	H2			6.00E-10	0.00	0.0	COA HL89
3139	C8H2+	H2C3	C9H3+	H			1.20E-09	0.00	0.0	COA HL89
3140	C8H2+	H2C3	C9H2+	H2			6.00E-10	0.00	0.0	COA HL89
3141	C8H2+	C3H3	C9H4+	H			7.00E-10	0.00	0.0	COA HL89
3142	C8H2+	C3H3	C9H3+	H2			7.00E-10	0.00	0.0	COA HL89
3143	C8H2+	C3H4	C9H4+	H2			1.10E-09	0.00	0.0	COA HL89
3144	C8H3+	C	C7H2+	H			5.00E-10	0.00	0.0	CIA HL89
3145	C8H3+	C	C7H+	H2			5.00E-10	0.00	0.0	CIA HL89
3146	C8H3+	O	HCO+	C5H2			2.00E-10	0.00	0.0	PNA HL89
3147	HC5N+	H2	H2C5N+	H			1.00E-09	0.00	0.0	HAA
3148	C8H5+	N	H4C6N+	H			1.00E-10	0.00	0.0	COA HL89
3149	C7+	H2	C7H+	H			1.90E-10	0.00	0.0	HAA HL89
3150	C7H+	H2	C7H2+	H			1.00E-17	0.00	0.0	HAA HL89
3151	C7H+	C	C8+	H			2.00E-10	0.00	0.0	COA HL89
3152	C7H+	N	C7N+	H			2.00E-10	0.00	0.0	COA HL89
3153	C7H+	O	HCO+	C6			2.00E-10	0.00	0.0	PNA HL89
3154	C7H2+	C	C8H+	H			5.00E-10	0.00	0.0	CIA HL89
3155	C7H2+	C	C8+	H2			5.00E-10	0.00	0.0	CIA HL89
3156	C7H2+	N	HC7N+	H			2.00E-10	0.00	0.0	COA HL89
3157	C7H2+	O	HCO+	C6H			2.00E-10	0.00	0.0	PNA HL89
3158	C7H2+	CH4	C8H4+	H2			1.00E-09	0.00	0.0	COA HL89
3159	C7H2+	C2H	C9H2+	H			1.20E-09	0.00	0.0	COA HL89
3160	C7H2+	C2H2	C9H3+	H			7.00E-10	0.00	0.0	COA HL89
3161	C7H2+	C2H2	C9H2+	H2			3.00E-10	0.00	0.0	COA HL89
3162	C7H2+	C2H3	C9H4+	H			4.00E-10	0.00	0.0	COA HL89
3163	C7H2+	C2H3	C9H3+	H2			8.00E-10	0.00	0.0	COA HL89
3164	C7H3+	C2H4	C9H4+	H2			1.00E-09	0.00	0.0	COA HL89
3165	C7H3+	C	C8H2+	II			5.00E-10	0.00	0.0	CIA HL89
3166	C7H3+	C	C8H+	H2			5.00E-10	0.00	0.0	CIA HL89
3167	C7H3+	N	H2C7N+	H			2.00E-10	0.00	0.0	COA HL89
3168	C7H3+	O	HCO+	C8H2			2.00E-10	0.00	0.0	PNA HL89
3169	C7H4+	N	H3C7N+	H			1.00E-10	0.00	0.0	COA HL89
3170	C7H5+	N	H3C7N+	H2			1.00E-10	0.00	0.0	COA HL89
3171	H4C6N+	C	H3C7N+	H			1.00E-09	0.00	0.0	CIA HL89
3172	C8+	H2	C8H+	H			4.70E-12	0.00	0.0	HAA HL89
3173	C8H+	H2	C8H2+	H			1.00E-09	0.00	0.0	HAA HL89
3174	C8H2+	C	C9H+	H			5.00E-10	0.00	0.0	CIA HL89
3175	C8H2+	C	C9+	H2			5.00E-10	0.00	0.0	CIA HL89
3176	C8H2+	CH4	C9H4+	H2			1.00E-09	0.00	0.0	COA HL89
3177	C8H2+	O	HCO+	C7H			2.00E-10	0.00	0.0	PNA HL89
3178	C8H3+	C	C9H2+	H			5.00E-10	0.00	0.0	CIA HL89
3179	C8H3+	C	C9H+	H2			5.00E-10	0.00	0.0	CIA HL89
3180	C8H3+	O	HCO+	C7H2			2.00E-10	0.00	0.0	PNA HL89
3181			C9H+	H			4.10E-11	0.00	0.0	HAA HL89
3182			C9H2+	H			1.00E-17	0.00	0.0	HAA HL89
3183			C10+	H			1.00E-09	0.00	0.0	CIA HL89
3184			C9H+	H			2.00E-10	0.00	0.0	COA HL89
3185			C9H+	C8			2.00E-10	0.00	0.0	COA HL89
3186			C9H2+	C			1.00E-09	0.00	0.0	CIA HL89
3187			C9H2+	N			2.00E-10	0.00	0.0	COA HL89
3188			C9H2+	O			2.00E-10	0.00	0.0	COA HL89
3189			C9H3+	H			2.00E-10	0.00	0.0	COA HL89
3190			C9H3+	O			2.00E-10	0.00	0.0	COA HL89
3191			C9H4+	N			2.00E-10	0.00	0.0	COA HL89
3192			H4C8N+	C			1.00E-09	0.00	0.0	CIA HL89
3193			C5N+	H2			1.50E-09	0.00	0.0	HAA HL89
3194			C7N+	H			1.50E-09	0.00	0.0	HAA HL89
3195			C9N+	H			1.50E-09	0.00	0.0	HAA HL89
3196			HC7N+	H			5.00E-12	0.00	0.0	HAA HL89
3197			HC9N+	H			5.00E-12	0.00	0.0	HAA HL89
3198			H	PHOTON			5.57E-17	0.50	0.0	RMA RW88
3199			ELECTR C-	PHOTON			3.00E-15	0.00	0.0	RMA
3200			ELECTR O-	PHOTON			1.50E-15	0.00	0.0	RMA
3201			ELECTR S-	PHOTON			3.50E-12	-0.75	0.0	RAA
3202			ELECTR H	PHOTON			1.00E-08	-0.43	0.0	MDRAIM190
3203			ELECTR H2	H			1.50E-08	-0.50	0.0	MDRAISS93
3204			ELECTR H	H			1.50E-08	-0.50	0.0	MDRAISS93
3205			ELECTR H	PHOTON			2.30E-12	-0.64	0.0	RAA
3206			ELECTR HE	HE			1.00E-08	-0.60	0.0	MDRAIM190
3207			ELECTR H	PHOTON			4.40E-12	-0.61	0.0	RAA
3208			ELECTR C	H			1.50E-07	-0.42	0.0	MDRAIM190
3209			ELECTR C	PHOTON			3.80E-12	-0.62	0.0	RAA
3210			ELECTR N	H			1.25E-07	-0.50	0.0	MDRAIM190
3211			ELECTR C	H2			1.25E-07	-0.50	0.0	MDRAIM190
3212			ELECTR CH	H			1.25E-07	-0.50	0.0	MDRAIM190
3213			ELECTR N	H			4.30E-08	-0.50	0.0	MDRAIM190
3214			ELECTR CH2	H			7.75E-08	-0.50	0.0	MDRAIM190
3215			ELECTR CH	H2			1.95E-07	-0.50	0.0	MDRAIM190
3216			ELECTR CH3	H			7.75E-08	-0.50	0.0	MDRAIM190
3217			ELECTR CH	PHOTON			1.10E-10	-0.50	0.0	RAA
3218			ELECTR CH3	PHOTON			3.40E-12	-0.63	0.0	RAA
3219			ELECTR N	H			1.50E-07	-0.50	0.0	MDRAIM190
3220			ELECTR NH	H			1.50E-07	-0.50	0.0	MDRAIM190
3221			ELECTR CH3	H			1.75E-07	-0.50	0.0	MDRAIM190
3222			ELECTR CH2	H			1.75E-07	-0.50	0.0	MDRAIM190
3223			ELECTR O	H			3.75E-08	-0.50	0.0	MDRAIM190
3224			ELECTR NH2	H			1.55E-07	-0.50	0.0	MDRAIM190
3225			ELECTR NH3	H			1.55E-07	-0.50	0.0	MDRAIM190
3226			ELECTR CH4	H			5.50E-07	-0.30	0.0	MDRAISA84
3227			ELECTR CH3	H2			5.50E-07	-0.30	0.0	MDRAISA84
3228			ELECTR OII	H			1.60E-07	-0.50	0.0	MDRAIM190
3229			ELECTR O	H2			2.00E-07	-0.50	0.0	MDRAIM190
3230			ELECTR NH3	H			6.80E-07	-0.60	0.0	MDRAIAA83
3231			ELECTR NH2	H			3.50E-07	-0.50	0.0	MDRAIAA90
3232			ELECTR H2O	H			3.50E-07	-0.50	0.0	MDRAIAA90
3233			ELECTR OH	H			2.70E-12	-0.69	0.0	RAA
3234			ELECTR NA	PHOTON			2.80E-12	-0.86	0.0	RAA
3235			ELECTR MG	C			3.00E-07	-0.50	0.0	MDRAIM190
3236			ELECTR C2+	H			1.35E-07	-0.50	0.0	MDRAIM190
3237			C2H+	C			1.35E-07	-0.50	0.0	MDRAIM190
3238			C2H+	C			1.80E-07	-0.50	0.0	MDRAIM190
3239			CN+	N			9.00E-08	-0.50	0.0	MDRAIM190
3240			C2H2+	H						

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
3241	C2H2+	ELECTR	CH	CH			9.00E-08	-0.50	0.0	MDRAIM190
3242	C2H2+	ELECTR	C2	H	H		9.00E-08	-0.50	0.0	MDRAIM190
3243	HCN+	ELECTR	CN	H			2.00E-07	-0.50	0.0	DRA
3244	C2H3+	ELECTR	C2H2	H			4.50E-07	-0.50	0.0	MDRAIM190
3245	Si+	ELECTR	Si	PHOTON			4.90E-12	-0.60	0.0	RRA
3246	N2+	ELECTR	N	N			3.60E-08	-0.42	0.0	MDRAIM190
3247	CO+	ELECTR	O	C			1.00E-07	-0.46	0.0	MDRAIM190
3248	HCNH+	ELECTR	CN	H			1.80E-07	-0.50	0.0	MDRAIM190
3249	HCNH+	ELECTR	HCN	H	II		9.00E-08	-0.50	0.0	MDRAIM190
3250	HCNH+	ELECTR	HNC	H			9.00E-08	-0.50	0.0	MDRAIM190
3251	H2NC+	ELECTR	CN	H2			1.80E-08	-0.50	0.0	DRA
3252	H2NC+	ELECTR	HNC	H			1.80E-07	-0.50	0.0	DRA
3253	C2H4+	ELECTR	C2H2	H			3.00E-07	-0.50	0.0	DRA
3254	SiH+	ELECTR	Si	H			2.00E-07	-0.50	0.0	DRA
3255	HCO+	ELECTR	CO	H			1.10E-07	-1.00	0.0	MDRAIM190
3256	HOC+	ELECTR	CO	H			1.10E-07	-1.00	0.0	DRA
3257	N2H+	ELECTR	N2	H			1.70E-07	-0.90	0.0	MDRAIM190
3258	C2H5+	ELECTR	C2H2	H2	H		3.00E-07	-0.50	0.0	MDRAIM190
3259	C2H5+	ELECTR	C2H2	H2			1.50E-07	-0.50	0.0	MDRAIM190
3260	C2H5+	ELECTR	C2H4	H			1.50E-07	-0.50	0.0	MDRAIM190
3261	C2H5+	ELECTR	C2H3	H2			1.50E-07	-0.50	0.0	MDRAIM190
3262	P+	ELECTR	P	PHOTON			3.00E-12	-0.50	0.0	RRA
3263	NO+	ELECTR	N	O			4.30E-07	-0.37	0.0	MDRAIM190
3264	SiH2+	ELECTR	Si	H	H		2.00E-07	-0.50	0.0	DRA
3265	SiH2+	ELECTR	SiH	H			1.50E-07	-0.50	0.0	DRA
3266	SiH2+	ELECTR	Si	H2			1.50E-07	-0.50	0.0	DRA
3267	H2CO+	ELECTR	HCO	H			1.00E-07	-0.50	0.0	DRA
3268	H2CO+	ELECTR	CO	H	H		5.00E-07	-0.50	0.0	DRA
3269	H2CO+	ELECTR	H2CO	PHOTON			1.10E-10	-0.70	0.0	RRA
3270	CH4N+	ELECTR	CHN	H2			3.00E-07	-0.50	0.0	DRA
3271	CH4N+	ELECTR	CHN	H			3.00E-07	-0.50	0.0	DRA
3272	CH2NH2+	ELECTR	CH2	NH2			1.50E-07	-0.50	0.0	DRA
3273	CH2NH2+	ELECTR	CH2NH	H			1.50E-07	-0.50	0.0	DRA
3274	C2H6+	ELECTR	C2H5	H			1.50E-07	-0.50	0.0	DRA
3275	C2H6+	ELECTR	C2H4	H2			1.50E-07	-0.50	0.0	DRA
3276	C2H7+	ELECTR	C2H6	H			1.50E-07	-0.50	0.0	DRA
3277	C2H7+	ELECTR	C2H5	H2			1.50E-07	-0.50	0.0	DRA
3278	IINO+	ELECTR	NO	H			3.00E-07	-0.50	0.0	DRA
3279	SiH3+	ELECTR	SiH2	H			1.50E-07	-0.50	0.0	DRA
3280	SiH3+	ELECTR	SiH	H2			1.50E-07	-0.50	0.0	DRA
3281	H3CO+	ELECTR	CO	H			2.00E-07	-0.50	0.0	DRA
3282	H3CO+	ELECTR	HCO	H	H		2.00E-07	-0.50	0.0	DRA
3283	H3CO+	ELECTR	H2CO	H			2.00E-07	-0.50	0.0	DRA
3284	S+	ELECTR	S	PHOTON			3.90E-12	-0.63	0.0	RRA
3285	O2+	ELECTR	O	O			1.98E-07	-0.70	0.0	MDRAIM190
3286	PH+	ELECTR	P	II			1.00E-07	-0.50	0.0	DRA
3287	H2NO+	ELECTR	NO	H2			1.50E-07	-0.50	0.0	DRA
3288	H2NO+	ELECTR	HNO	H			1.50E-07	-0.50	0.0	DRA
3289	SiH4+	ELECTR	SiH3	H			1.50E-07	-0.50	0.0	DRA
3290	SiH4+	ELECTR	SiH2	H2			1.50E-07	-0.50	0.0	DRA
3291	CH3OH+	ELECTR	CH3	OH			3.00E-07	-0.50	0.0	DRA
3292	H5+	ELECTR	S	H			2.00E-07	-0.50	0.0	DRA
3293	O2H+	ELECTR	O2	H			3.00E-07	-0.50	0.0	DRA
3294	PH2+	ELECTR	P	H2			1.50E-07	-0.50	0.0	DRA
3295	PH2+	ELECTR	PH	H			1.50E-07	-0.50	0.0	DRA
3296	SiH5+	ELECTR	SiH4	H			1.50E-07	-0.50	0.0	DRA
3297	SiH5+	ELECTR	SiH3	H2			1.50E-07	-0.50	0.0	DRA
3298	CH3OH2+	ELECTR	CH3OH	H			3.00E-07	-0.50	0.0	DRA
3299	H2S+	ELECTR	S	H	H		1.50E-07	-0.50	0.0	DRA
3300	H2S+	ELECTR	IIS	H			1.50E-07	-0.50	0.0	DRA
3301	H2S+	ELECTR	P	CH			1.50E-07	-0.50	0.0	DRA
3302	H2S+	ELECTR	PH	H2			1.50E-07	-0.50	0.0	DRA
3303	PH2+	ELECTR	PH2	H			1.50E-07	-0.50	0.0	DRA
3304	CL+	ELECTR	CL	PHOTON			1.13E-10	-0.70	0.0	RRA
3305	H2S+	ELECTR	H2S	H			1.85E-07	-0.50	0.0	MDRAIM190
3306	H2S+	ELECTR	H2S	H	H		1.85E-07	-0.50	0.0	MDRAIM190
3307	HCL+	ELECTR	H	CL			3.00E-07	-0.50	0.0	DRA
3308	C3+	ELECTR	C2	C			2.70E-07	-0.50	0.0	DRA
3309	H2CL+	ELECTR	CL	H	H		3.00E-08	-0.50	0.0	DRA
3310	H2CL+	ELECTR	HCN	H			1.50E-07	-0.50	0.0	DRA
3311	C3H+	ELECTR	C3H	C			1.50E-07	-0.50	0.0	DRA
3312	C3H+	ELECTR	C2H	C			1.50E-07	-0.50	0.0	DRA
3313	C3H+	ELECTR	C2	C			1.50E-07	-0.50	0.0	DRA
3314	C3H+	ELECTR	C2H	C			3.00E-08	-0.50	0.0	DRA
3315	C3H2+	ELECTR	C2H2	C			6.00E-08	-0.50	0.0	DRA
3316	C3H2+	ELECTR	C3	H2			3.00E-08	-0.50	0.0	DRA
3317	C3H2+	ELECTR	C3	H			3.00E-08	-0.50	0.0	DRA
3318	C3H2+	ELECTR	C2	CH2			3.00E-08	-0.50	0.0	DRA
3319	C3H2+	ELECTR	C3H	H			3.00E-07	-0.50	0.0	DRA
3320	C3H3+	ELECTR	C3H2	H			5.00E-08	-0.50	0.0	MDRAIM190
3321	H2C3H+	ELECTR	H2C3	H			5.00E-08	-0.50	0.0	MDRAIM190
3322	H2C3H+	ELECTR	C2H2	CH			5.00E-08	-0.50	0.0	MDRAIM190
3323	CNC+	ELECTR	CN	C			3.00E-07	-0.50	0.0	DRA
3324	CNC+	ELECTR	CNC	H			3.00E-07	-0.50	0.0	DRA
3325	SiC+	ELECTR	Si	C			2.00E-07	-0.50	0.0	DRA
3326	C2O+	ELECTR	CO	C			3.00E-07	-0.50	0.0	DRA
3327	CH2CN+	ELECTR	CN	CH2			1.50E-07	-0.50	0.0	DRA
3328	CH2CN+	ELECTR	CH	HCN			1.50E-07	-0.50	0.0	DRA
3329	C3H4+	ELECTR	H2C3	H2			2.00E-07	-0.50	0.0	DRA
3330	C3H4+	ELECTR	C3H3	H			2.00E-07	-0.50	0.0	DRA
3331	HC2O+	ELECTR	CCO	H			1.00E-07	-0.50	0.0	DRA
3332	HC2O+	ELECTR	CO	CH			1.00E-07	-0.50	0.0	DRA
3333	HC2O+	ELECTR	Si	CH			1.50E-07	-0.50	0.0	DRA
3334	HC2O+	ELECTR	SiC	H			1.50E-07	-0.50	0.0	DRA
3335	C3H5+	ELECTR	C3H3	H2			1.50E-07	-0.50	0.0	DRA
3336	C3H5+	ELECTR	C3H4	H			1.50E-07	-0.50	0.0	DRA
3337	C2HO+	ELECTR	CO	C			1.50E-07	-0.50	0.0	DRA
3338	C2HO+	ELECTR	C2H	O			1.50E-07	-0.50	0.0	DRA
3339	CH3CN+	ELECTR	CH2CN	H			1.50E-07	-0.50	0.0	DRA
3340	CH3CN+	ELECTR	CH2	HCN			1.50E-07	-0.50	0.0	DRA
3341	SiN+	ELECTR	Si	N			2.00E-07	-0.50	0.0	DRA
3342	SiCH2+	ELECTR	Si	CH2			2.00E-07	-0.50	0.0	DRA
3343	SiCH2+	ELECTR	HCN	H			1.50E-07	-0.50	0.0	DRA
3344	SiCH2+	ELECTR	SiC	H2			1.50E-07	-0.50	0.0	DRA
3345	NCO+	ELECTR	CO	N			3.00E-07	-0.50	0.0	DRA
3346	CP+	ELECTR	P	C			1.00E-07	-0.50	0.0	DRA
3347	CH2CO+	ELECTR	C2	H2O			2.00E-07	-0.50	0.0	DRA
3348	CH2CO+	ELECTR	CH2	O			2.00E-07	-0.50	0.0	DRA
3349	CH2CO+	ELECTR	CH2	CO			2.00E-07	-0.50	0.0	DRA
3350	H4C2N+	ELECTR	CH3CN	H			1.50E-07	-0.50	0.0	DRA
3351	H4C2N+	ELECTR	CH2CN	H2			1.50E-07	-0.50	0.0	DRA
3352	HNS+	ELECTR	SiN	H			1.50E-07	-0.50	0.0	DRA
3353	HNS+	ELECTR	NH	Si			1.50E-07	-0.50	0.0	DRA
3354	HNS+	ELECTR	CO	NH			3.00E-07	-0.50	0.0	DRA
3355	SiCH3+	ELECTR	SiCH2	H			1.50E-07	-0.50	0.0	DRA
3356	SiCH3+	ELECTR	HCN	H2			1.50E-07	-0.50	0.0	DRA
3357	CH3CO+	ELECTR	CH2CO	H			3.00E-07	-0.50	0.0	DRA
3358	CH3CO+	ELECTR	CH3	CO			3.00E-07	-0.50	0.0	DRA
3359	HCP+	ELECTR	CP	II			1.50E-07	-0.50	0.0	DRA
3360	HCP+	ELECTR	P	CH			1.50E-07	-0.50	0.0	DRA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
3361	SiO+	ELECTR	Si	O			2.00E-07	-0.50	0.0	DRA
3362	CO2+	ELECTR	C	S			2.00E-07	-0.50	0.0	DRA
3363	SiNH2+	ELECTR	O	CO			3.80E-07	-0.50	0.0	MDRA1M190
3364	SINH2+	ELECTR	HNS1	H			1.50E-07	-0.50	0.0	DRA
3365	SINH2+	ELECTR	SIN	H2			1.50E-07	-0.50	0.0	DRA
3366	SiCH4+	ELECTR	SiCH3	H			1.50E-07	-0.50	0.0	DRA
3367	SiCH4+	ELECTR	SiCH2	H2			1.50E-07	-0.50	0.0	DRA
3368	CH3CHO+	ELECTR	SiCH3	HCO			1.50E-07	-0.50	0.0	DRA
3369	CH3CHO+	ELECTR	CH2CO	H			1.50E-07	-0.50	0.0	DRA
3370	PC2H2+	ELECTR	HCP	H			1.50E-07	-0.50	0.0	DRA
3371	PC2H2+	ELECTR	CP	H2			1.50E-07	-0.50	0.0	DRA
3372	HCS+	ELECTR	CS	H			5.00E-08	-0.75	0.0	MDRA1MA85
3373	HCO2+	ELECTR	CO2	H			2.40E-07	-0.50	0.0	MDRA1HA90
3374	HCO2+	ELECTR	CO	OH			1.00E-07	-0.50	0.0	MDRA1HA90
3375	PC4H4+	ELECTR	CH2PH	H			1.50E-07	-0.50	0.0	DRA
3376	PC4H4+	ELECTR	HCP	H2			1.50E-07	-0.50	0.0	DRA
3377	PN+	ELECTR	P	N			1.80E-07	-0.50	0.0	DRA
3378	SiOH+	ELECTR	SiO	H			1.50E-07	-0.50	0.0	DRA
3379	SiOH+	ELECTR	Si	OH			1.50E-07	-0.50	0.0	DRA
3380	C2H5O+	ELECTR	CH4	CO			3.00E-07	-0.50	0.0	DRA
3381	C2H5O+	ELECTR	CH3CHO	H			1.50E-07	-0.50	0.0	DRA
3382	C2H5O+	ELECTR	H2CO	CH3			1.50E-07	-0.50	0.0	DRA
3383	NS+	ELECTR	N	S			2.00E-07	-0.50	0.0	DRA
3384	NO2+	ELECTR	O	NO			3.00E-07	-0.50	0.0	DRA
3385	HPN+	ELECTR	PN	H			1.00E-07	-0.50	0.0	DRA
3386	HPN+	ELECTR	PH	N			1.00E-07	-0.50	0.0	DRA
3387	HPN+	ELECTR	NH	P			1.00E-07	-0.50	0.0	DRA
3388	PC3H3+	ELECTR	CH3	P			3.00E-07	-0.50	0.0	DRA
3389	PC3H3+	ELECTR	HCP	H2			1.50E-07	-0.50	0.0	DRA
3390	PC3H3+	ELECTR	CP	H2			1.50E-07	-0.50	0.0	DRA
3391	PNH2+	ELECTR	PN	H2			1.50E-07	-0.50	0.0	DRA
3392	PNH2+	ELECTR	PH	NH			1.50E-07	-0.50	0.0	DRA
3393	PNH3+	ELECTR	PN	H2			1.50E-07	-0.50	0.0	DRA
3394	PNH3+	ELECTR	PH	NH2			1.50E-07	-0.50	0.0	DRA
3395	H2CS+	ELECTR	CS	H			3.00E-07	-0.50	0.0	DRA
3396	H2CS+	ELECTR	HCS	H			3.00E-07	-0.50	0.0	DRA
3397	H2CS+	ELECTR	H2CS	H			1.10E-10	-0.70	0.0	RRR
3398	H2SO+	ELECTR	SiO	H2			1.50E-07	-0.50	0.0	DRA
3399	H2SO+	ELECTR	SiH	OH			1.50E-07	-0.50	0.0	DRA
3400	C2H5OH+	ELECTR	CH4	H2CO			1.50E-07	-0.50	0.0	DRA
3401	C2H5OH+	ELECTR	C2H5	OH			1.50E-07	-0.50	0.0	DRA
3402	H5C2O+	ELECTR	CH3	H2CO			1.50E-07	-0.50	0.0	DRA
3403	H5C2O+	ELECTR	CH3CHO	H			1.50E-07	-0.50	0.0	DRA
3404	C2H6O+	ELECTR	CH3OH	CH2			1.50E-07	-0.50	0.0	DRA
3405	C2H6O+	ELECTR	CH3	CH3			1.50E-07	-0.50	0.0	DRA
3406	CCL+	ELECTR	C	CL			3.00E-07	-0.50	0.0	DRA
3407	PO+	ELECTR	P	O			1.80E-07	-0.50	0.0	DRA
3408	HNS+	ELECTR	NS	H			3.00E-07	-0.50	0.0	DRA
3409	PC4H4+	ELECTR	CH4	P			3.00E-07	-0.50	0.0	DRA
3410	PNH2+	ELECTR	NH2	P			3.00E-07	-0.50	0.0	DRA
3411	H3CS+	ELECTR	CS	H			3.00E-07	-0.50	0.0	DRA
3412	H3CS+	ELECTR	H3CS	H			3.00E-07	-0.50	0.0	DRA
3413	H2SO+	ELECTR	H2SO	H			1.50E-07	-0.50	0.0	DRA
3414	H2SO+	ELECTR	SiO	H2			1.50E-07	-0.50	0.0	DRA
3415	CH3OH+	ELECTR	CH3OH	H			3.00E-07	-0.50	0.0	DRA
3416	C2H6OH+	ELECTR	CH3OCH3	H			1.50E-07	-0.50	0.0	DRA
3417	C2H6OH+	ELECTR	CH3OH	CH3			1.50E-07	-0.50	0.0	DRA
3418	C2H7O+	ELECTR	C2H5OH	H			1.50E-07	-0.50	0.0	DRA
3419	C2H7O+	ELECTR	C2H4	H2O			1.50E-07	-0.50	0.0	DRA
3420	SO+	ELECTR	S	O			2.00E-07	-0.50	0.0	DRA
3421	HPO+	ELECTR	PO	H			1.50E-07	-0.50	0.0	DRA
3422	HPO+	ELECTR	PH	O			1.50E-07	-0.50	0.0	DRA
3423	HPO+	ELECTR	P	O			1.50E-07	-0.50	0.0	DRA
3424	C4+	ELECTR	C2	C2			3.00E-07	-0.50	0.0	DRA
3425	PNH3+	ELECTR	NH3	P			3.00E-07	-0.50	0.0	DRA
3426	C4H+	ELECTR	C4	H			3.00E-07	-0.50	0.0	DRA
3427	H2O+	ELECTR	SO	H			2.00E-07	-0.50	0.0	DRA
3428	H2O+	ELECTR	HPO	H			1.50E-07	-0.50	0.0	DRA
3429	H2O+	ELECTR	PH	OH			1.50E-07	-0.50	0.0	DRA
3430	H2CO+	ELECTR	CCL	H			3.00E-07	-0.50	0.0	DRA
3431	C3N+	ELECTR	C2	CN			3.00E-07	-0.50	0.0	DRA
3432	C4H2+	ELECTR	C4H	H			3.00E-07	-0.50	0.0	DRA
3433	CLO+	ELECTR	CL	O			2.00E-07	-0.50	0.0	DRA
3434	HC3N+	ELECTR	C2	HCN			3.00E-07	-0.50	0.0	DRA
3435	HC3N+	ELECTR	C2H	CN			3.00E-07	-0.50	0.0	DRA
3436	C4H3+	ELECTR	C4H	H2			3.10E-07	-0.50	0.0	MDRA1M190
3437	C4H3+	ELECTR	C4H2	H			3.10E-07	-0.50	0.0	MDRA1M190
3438	SiC2+	ELECTR	SiC	C			1.50E-07	-0.50	0.0	DRA
3439	SiC2+	ELECTR	Si	C2			1.50E-07	-0.50	0.0	DRA
3440	C2N2+	ELECTR	CCN	CN			1.50E-07	-0.50	0.0	DRA
3441	C2N2+	ELECTR	CN	CN			1.50E-07	-0.50	0.0	DRA
3442	HC3N+	ELECTR	C3N	H2			2.00E-08	-0.50	0.0	DRA
3443	HC3N+	ELECTR	C2H2	CN			3.00E-07	-0.50	0.0	DRA
3444	HC3N+	ELECTR	HC3N	H			3.00E-07	-0.50	0.0	DRA
3445	C3O+	ELECTR	C2	CO			3.00E-07	-0.50	0.0	DRA
3446	SiC2H+	ELECTR	SiC2	H			1.50E-07	-0.50	0.0	DRA
3447	SiC2H+	ELECTR	C2H	Si			1.50E-07	-0.50	0.0	DRA
3448	HC3O+	ELECTR	C3O	H			1.50E-07	-0.50	0.0	DRA
3449	C4H5+	ELECTR	C3H4	CH			3.00E-07	-0.50	0.0	DRA
3450	C4H5+	ELECTR	C4H2	H2			1.50E-07	-0.50	0.0	DRA
3451	SINC+	ELECTR	Si	CN			1.50E-07	-0.50	0.0	DRA
3452	SiC2H2+	ELECTR	SiC2H	CN			3.00E-07	-0.50	0.0	DRA
3453	SiC2H2+	ELECTR	SiC2	H2			1.50E-07	-0.50	0.0	DRA
3454	H4C3N+	ELECTR	H3C3N	H			1.50E-07	-0.50	0.0	DRA
3455	H4C3N+	ELECTR	HC3N	H2			1.00E-06	-0.30	0.0	DRA
3456	C3H2O+	ELECTR	C3O	H			1.50E-07	-0.50	0.0	DRA
3457	C3H2O+	ELECTR	C2H2	CO			1.50E-07	-0.50	0.0	DRA
3458	CCP+	ELECTR	CP	C			1.50E-07	-0.50	0.0	DRA
3459	CCP+	ELECTR	P	C2			1.50E-07	-0.50	0.0	DRA
3460	SINCH+	ELECTR	SINC	H			1.50E-07	-0.50	0.0	DRA
3461	SINCH+	ELECTR	SIN	CH			1.50E-07	-0.50	0.0	DRA
3462	SiC2H3+	ELECTR	SiC2H2	H			1.50E-07	-0.50	0.0	DRA
3463	SiC2H3+	ELECTR	SiC2H	H2			1.50E-07	-0.50	0.0	DRA
3464	H3C3O+	ELECTR	C3O	H2			1.50E-07	-0.50	0.0	DRA
3465	PC2H+	ELECTR	CP	H			1.50E-07	-0.50	0.0	DRA
3466	PC2H+	ELECTR	CP	CH			1.50E-07	-0.50	0.0	DRA
3467	PC2H4+	ELECTR	HCCP	H2			1.00E-07	-0.50	0.0	DRA
3468	PC2H4+	ELECTR	CCP	H2			1.00E-07	-0.50	0.0	DRA
3469	FE+	ELECTR	FE	PHOTON			3.70E-12	-0.65	0.0	RRR
3470	C2S+	ELECTR	CS	C			1.50E-07	-0.50	0.0	DRA
3471	C2S+	ELECTR	C2	S			1.50E-07	-0.50	0.0	DRA
3472	PC2H2+	ELECTR	HCCP	H			1.00E-07	-0.50	0.0	DRA
3473	PC2H2+	ELECTR	CCP	H2			1.00E-07	-0.50	0.0	DRA
3474	PC2H2+	ELECTR	P	C2H2			1.00E-07	-0.50	0.0	DRA
3475	PC2H3+	ELECTR	HCCP	C2H2			1.00E-07	-0.50	0.0	DRA
3476	PC2H3+	ELECTR	CCP	H2			1.00E-07	-0.50	0.0	DRA
3477	PC2H3+	ELECTR	PH	C2H2			1.00E-07	-0.50	0.0	DRA
3478	HC2S+	ELECTR	C2S	H			1.50E-07	-0.50	0.0	DRA
3479	HC2S+	ELECTR	CS	CH			1.50E-07	-0.50	0.0	DRA
3480	PC2H4+	ELECTR	P	C2H4			1.00E-07	-0.50	0.0	DRA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
3481	C ₂ H ₆ CO+	ELECTR	CH ₃ CHO	CH ₂			1.50E-07	-0.50	0.0	DRA
3482	C ₂ H ₆ CO+	ELECTR	CH ₃	CH ₃	CO		1.50E-07	-0.50	0.0	DRA
3483	C ₃ H ₆ OH+	ELECTR	C ₂ H ₆ CO	H			1.50E-07	-0.50	0.0	DRA
3484	C ₃ H ₆ OH+	ELECTR	CH ₃ CHO	CH ₃			1.50E-07	-0.50	0.0	DRA
3485	OC ₃ +	ELECTR	CO	S			1.50E-07	-0.50	0.0	DRA
3486	OC ₃ +	ELECTR	CS	O			1.50E-07	-0.50	0.0	DRA
3487	SIS+	ELECTR	SI	S			2.00E-07	-0.50	0.0	DRA
3488	C ₃ +	ELECTR	C ₃	C ₂			3.00E-07	-0.50	0.0	DRA
3489	COOCH ₄ +	ELECTR	CH ₃	CO ₂	H		1.50E-07	-0.50	0.0	DRA
3490	COOCH ₄ +	ELECTR	CH ₃ OH	CO			1.50E-07	-0.50	0.0	DRA
3491	IIIS+	ELECTR	SIS	H			1.50E-07	-0.50	0.0	DRA
3492	IIIS+	ELECTR	SI	HS			1.50E-07	-0.50	0.0	DRA
3493	HOC ₃ +	ELECTR	OH	CS			2.00E-07	-0.50	0.0	DRA
3494	HOC ₃ +	ELECTR	OC ₃	H			2.00E-07	-0.50	0.0	DRA
3495	HSIO ₂ +	ELECTR	SIO ₂	H			1.50E-07	-0.50	0.0	DRA
3496	HSIO ₂ +	ELECTR	SIO	OH			1.50E-07	-0.50	0.0	DRA
3497	C ₃ H+	ELECTR	C ₃	H			3.00E-07	-0.50	0.0	DRA
3498	C ₃ H+	ELECTR	CAII	C			1.00E-06	-0.30	0.0	DRA
3499	H ₂ C ₂ O ₂ +	ELECTR	IIICOCH ₃	H			1.50E-07	-0.50	0.0	DRA
3500	H ₂ C ₂ O ₂ +	ELECTR	CH ₃ OH	HCO			1.50E-07	-0.50	0.0	DRA
3501	C ₄ N+	ELECTR	C ₃ N	C			1.50E-07	-0.50	0.0	DRA
3502	C ₄ N+	ELECTR	CCN	C ₂			1.50E-07	-0.50	0.0	DRA
3503	HC ₄ N+	ELECTR	C ₃ N	CH			3.00E-07	-0.50	0.0	DRA
3504	C ₃ H ₂ +	ELECTR	C ₃ H	H			1.50E-07	-0.50	0.0	DRA
3505	C ₃ H ₂ +	ELECTR	C ₅	H ₂			1.50E-07	-0.50	0.0	DRA
3506	C ₃ H ₃ +	ELECTR	C ₃ H	H ₂			1.50E-07	-0.50	0.0	DRA
3507	C ₃ H ₃ +	ELECTR	C ₃ H ₂	H			1.50E-07	-0.50	0.0	DRA
3508	C ₃ H ₄ +	ELECTR	C ₃ H	H			1.00E-06	-0.30	0.0	DRA
3509	C ₃ H ₄ +	ELECTR	C ₃ H ₂	H ₂			1.00E-06	-0.30	0.0	DRA
3510	S ₂ +	ELECTR	S	O			2.00E-07	-0.50	0.0	MDRALM90
3511	S ₂ +	ELECTR	SO	O			2.50E-07	-0.50	0.0	DRA
3512	SIC ₃ +	ELECTR	SIC ₂	C			1.50E-07	-0.50	0.0	DRA
3513	SIC ₃ +	ELECTR	SIC	C ₂			1.50E-07	-0.50	0.0	DRA
3514	H ₂ C ₄ N+	ELECTR	HC ₃ N	CH			3.00E-07	-0.50	0.0	DRA
3515	S ₂ H+	ELECTR	S ₂	H			1.50E-07	-0.50	0.0	DRA
3516	S ₂ H+	ELECTR	HS	S			1.50E-07	-0.50	0.0	DRA
3517	HSO ₂ +	ELECTR	SO ₂	H			2.00E-07	-0.50	0.0	DRA
3518	HSO ₂ +	ELECTR	SO	H		O	1.00E-07	-0.50	0.0	DRA
3519	HSO ₂ +	ELECTR	SO	OH			1.00E-07	-0.50	0.0	DRA
3520	SIC ₃ H+	ELECTR	SIC ₃	H			1.50E-07	-0.50	0.0	DRA
3521	SIC ₃ H+	ELECTR	SI	C ₃ H			1.50E-07	-0.50	0.0	DRA
3522	H ₃ C ₄ N+	ELECTR	HC ₃ N	CH ₂			3.00E-07	-0.50	0.0	DRA
3523	C ₃ H ₅ +	ELECTR	C ₃ H ₂	H ₂			1.00E-06	-0.30	0.0	DRA
3524	C ₃ H ₅ +	ELECTR	C ₃ H ₄	H			3.00E-07	-0.50	0.0	DRA
3525	H ₂ S ₂ +	ELECTR	HS	HS			1.50E-07	-0.50	0.0	DRA
3526	H ₂ S ₂ +	ELECTR	HS ₂	H			1.50E-07	-0.50	0.0	DRA
3527	H ₄ C ₄ N+	ELECTR	H ₃ C ₄ N	H			3.00E-07	-0.50	0.0	DRA
3528	H ₄ C ₄ N+	ELECTR	CH ₃	HC ₃ N			1.00E-06	-0.30	0.0	DRA
3529	SIC ₃ H ₂ +	ELECTR	SIC ₃ H	II			1.50E-07	-0.50	0.0	DRA
3530	SIC ₃ H ₂ +	ELECTR	SIC ₃	II ₂			1.50E-07	-0.50	0.0	DRA
3531	HS ₂ +	ELECTR	HS ₂	H ₂			1.50E-07	-0.50	0.0	DRA
3532	HS ₂ +	ELECTR	HS ₂	H ₂			1.50E-07	-0.50	0.0	DRA
3533	PC ₃ H+	ELECTR	CCP	CH			1.00E-07	-0.50	0.0	DRA
3534	PC ₃ H+	ELECTR	CCP	CH			1.00E-07	-0.50	0.0	DRA
3535	PC ₃ H+	ELECTR	C ₂ S	C			1.00E-07	-0.50	0.0	DRA
3536	C ₃ S+	ELECTR	C ₂	CS			1.00E-07	-0.50	0.0	DRA
3537	C ₃ S+	ELECTR	C ₂	CS			1.00E-07	-0.50	0.0	DRA
3538	C ₃ S+	ELECTR	C ₃	S			1.00E-07	-0.50	0.0	DRA
3539	HC ₃ S+	ELECTR	C ₃ S	H			1.50E-07	-0.50	0.0	DRA
3540	HC ₃ S+	ELECTR	C ₂ S	CH			1.50E-07	-0.50	0.0	DRA
3541	C ₆ +	ELECTR	C ₅	C			1.00E-06	-0.30	0.0	DRA
3542	C ₆ +	ELECTR	C ₄	C ₂			1.00E-06	-0.30	0.0	DRA
3543	C ₆ H+	ELECTR	C ₆	H			1.00E-06	-0.30	0.0	DRA
3544	C ₆ H+	ELECTR	C ₅ H	C			1.00E-06	-0.30	0.0	DRA
3545	C ₆ H ₂ +	ELECTR	C ₆ H	H			1.00E-06	-0.30	0.0	DRA
3546	C ₆ H ₂ +	ELECTR	C ₈	H ₂			1.00E-06	-0.30	0.0	DRA
3547	C ₅ N+	ELECTR	C ₂	C ₃ N			3.00E-07	-0.50	0.0	DRA
3548	C ₆ H ₃ +	ELECTR	C ₆ H ₂	H			1.00E-06	-0.30	0.0	DRA
3549	C ₆ H ₃ +	ELECTR	C ₆ H	H ₂			1.00E-06	-0.30	0.0	DRA
3550	HC ₅ N+	ELECTR	C ₅ N	H			1.50E-07	-0.50	0.0	DRA
3551	HC ₅ N+	ELECTR	C ₃ N	C ₂ H			1.50E-07	-0.50	0.0	DRA
3552	SIC ₄ +	ELECTR	SIC ₃	C			1.50E-07	-0.50	0.0	DRA
3553	SIC ₄ +	ELECTR	SIC ₂	C ₂			1.50E-07	-0.50	0.0	DRA
3554	H ₂ C ₃ N+	ELECTR	HC ₅ N	H			1.50E-07	-0.50	0.0	DRA
3555	H ₂ C ₃ N+	ELECTR	C ₅ N	H ₂			1.50E-07	-0.50	0.0	DRA
3556	C ₆ H ₄ +	ELECTR	C ₆ H ₂	H ₂			1.00E-06	-0.30	0.0	DRA
3557	C ₆ H ₄ +	ELECTR	C ₆ H	H ₂			1.00E-06	-0.30	0.0	DRA
3558	C ₆ H ₅ +	ELECTR	C ₆ H ₂	H ₂			1.00E-06	-0.30	0.0	DRA
3559	C ₆ H ₅ +	ELECTR	C ₆ H	H ₂			1.00E-06	-0.30	0.0	DRA
3560	H ₃ C ₃ N+	ELECTR	HC ₅ N	H ₂			1.00E-06	-0.30	0.0	DRA
3561	H ₃ C ₃ N+	ELECTR	C ₅ N	H ₂			1.00E-06	-0.30	0.0	DRA
3562	SIC ₄ H+	ELECTR	SIC ₄	H			1.50E-07	-0.50	0.0	DRA
3563	SIC ₄ H+	ELECTR	SIC ₃	CH			1.50E-07	-0.50	0.0	DRA
3564	C ₄ P+	ELECTR	C ₃ P	C			1.50E-07	-0.50	0.0	DRA
3565	C ₄ P+	ELECTR	CCP	C ₂			1.50E-07	-0.50	0.0	DRA
3566	PC ₄ H+	ELECTR	C ₄ P	H			7.50E-08	-0.50	0.0	DRA
3567	PC ₄ H+	ELECTR	CCP	C ₂ H			7.50E-08	-0.50	0.0	DRA
3568	PC ₄ H+	ELECTR	CP	C ₃ H			7.50E-08	-0.50	0.0	DRA
3569	PC ₄ H+	ELECTR	C ₃ P	CH			7.50E-08	0.00	0.0	DRA
3570	PC ₄ H ₂ +	ELECTR	C ₄ P	H ₂			1.50E-07	-0.50	0.0	DRA
3571	PC ₄ H ₂ +	ELECTR	CCP	C ₂ H ₂			1.50E-07	-0.50	0.0	DRA
3572	C ₄ S+	ELECTR	C ₃ S	C			1.00E-07	-0.50	0.0	DRA
3573	C ₄ S+	ELECTR	C ₂ S	C ₂			1.00E-07	-0.50	0.0	DRA
3574	C ₄ S+	ELECTR	C ₃	CS			1.00E-07	-0.50	0.0	DRA
3575	HC ₄ S+	ELECTR	C ₄ S	H			1.00E-07	-0.50	0.0	DRA
3576	HC ₄ S+	ELECTR	C ₃ S	CH			1.00E-07	-0.50	0.0	DRA
3577	HC ₄ S+	ELECTR	C ₂ S	C ₂ H			1.00E-07	-0.50	0.0	DRA
3578	C ₇ -	ELECTR	C ₄	C ₃			3.00E-07	-0.50	0.0	DRA
3579	C ₇ -	ELECTR	C ₆	C			1.00E-06	-0.30	0.0	DRA
3580	C ₇ -	ELECTR	C ₅	C ₂			1.00E-06	-0.30	0.0	DRA
3581	C ₇ H+	ELECTR	C ₇	H			1.00E-06	-0.30	0.0	DRA
3582	C ₇ H+	ELECTR	C ₆ H	C			1.00E-06	-0.30	0.0	DRA
3583	C ₇ H ₂ +	ELECTR	C ₇ H	H			1.00E-06	-0.30	0.0	DRA
3584	C ₇ H ₂ +	ELECTR	C ₇	H ₂			1.00E-06	-0.30	0.0	DRA
3585	C ₇ H ₃ +	ELECTR	C ₇ H ₂	H			1.00E-06	-0.30	0.0	DRA
3586	C ₇ H ₃ +	ELECTR	C ₇ H	H ₂			1.00E-06	-0.30	0.0	DRA
3587	C ₇ H ₄ +	ELECTR	C ₇ H ₂	H ₂			1.00E-06	-0.30	0.0	DRA
3588	C ₇ H ₄ +	ELECTR	C ₇ H	H			1.00E-06	-0.30	0.0	DRA
3589	C ₇ H ₅ +	ELECTR	C ₇ H ₄	H			1.00E-06	-0.30	0.0	DRA
3590	C ₇ H ₅ +	ELECTR	C ₇ H ₂	H			1.00E-06	-0.30	0.0	DRA
3591	H ₄ C ₆ N+	ELECTR	H ₃ C ₆ N	H			1.00E-06	-0.30	0.0	DRA
3592	H ₄ C ₆ N+	ELECTR	CH ₃	HC ₅ N			1.00E-06	-0.30	0.0	DRA
3593	C ₈ +	ELECTR	C ₇	C			1.00E-06	-0.30	0.0	DRA
3594	C ₈ +	ELECTR	C ₆	C ₂			1.00E-06	-0.30	0.0	DRA
3595	C ₈ H+	ELECTR	C ₈	H			1.00E-06	-0.30	0.0	DRA
3596	C ₈ H+	ELECTR	C ₇ H	C			1.00E-06	-0.30	0.0	DRA
3597	C ₈ H ₂ +	ELECTR	C ₈ H	H			1.00E-06	-0.30	0.0	DRA
3598	C ₈ H ₂ +	ELECTR	C ₈	H ₂			1.00E-06	-0.30	0.0	DRA
3599	C ₈ H ₃ +	ELECTR	C ₈ H ₂	H			1.00E-06	-0.30	0.0	DRA
3600	C ₈ H ₃ +	ELECTR	C ₈ H	H ₂			1.00E-06	-0.30	0.0	DRA

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
3601	C8H4+	ELECTR	C8H2	H2			1.00E-06	-0.30	0.0	DRA HL89
3602	C8H4+	ELECTR	C8H	H2			1.00E-06	-0.30	0.0	DRA HL89
3603	C8H5+	ELECTR	C8H	H2			1.50E-07	-0.50	0.0	DRA HL89
3604	C8H5+	ELECTR	C8H2	H			1.50E-07	-0.50	0.0	DRA HL89
3605	C7N+	ELECTR	C2	C8N			3.00E-07	-0.50	0.0	DRA HL89
3606	HCTN+	ELECTR	C7N	H			1.00E-06	-0.30	0.0	DRA HL89
3607	HCTN+	ELECTR	CN	C6H			1.00E-06	-0.30	0.0	DRA HL89
3608	H2C7N+	ELECTR	HCTN	H			1.00E-06	-0.30	0.0	DRA HL89
3609	H2C7N+	ELECTR	C7N	H2			1.00E-06	-0.30	0.0	DRA HL89
3610	H3C7N+	ELECTR	HCTN	H2			1.00E-06	-0.30	0.0	DRA HL89
3611	H3C7N+	ELECTR	C7N	H2			1.00E-06	-0.30	0.0	DRA HL89
3612	C9+	ELECTR	C8	C			1.00E-06	-0.30	0.0	DRA HL89
3613	C9+	ELECTR	C7	C2			1.00E-06	-0.30	0.0	DRA HL89
3614	C9H+	ELECTR	C9	H			1.00E-06	-0.30	0.0	DRA HL89
3615	C9H+	ELECTR	C8H	C			1.00E-06	-0.30	0.0	DRA HL89
3616	C9H2+	ELECTR	C9H	H			1.00E-06	-0.30	0.0	DRA HL89
3617	C9H2+	ELECTR	C9	H2			1.00E-06	-0.30	0.0	DRA HL89
3618	C9H3+	ELECTR	C9H2	H			1.00E-06	-0.30	0.0	DRA HL89
3619	C9H3+	ELECTR	C9H	H2			1.00E-06	-0.30	0.0	DRA HL89
3620	C9H4+	ELECTR	C9H2	H2			1.00E-06	-0.30	0.0	DRA HL89
3621	C9H4+	ELECTR	C9H	H2			1.00E-06	-0.30	0.0	DRA HL89
3622	C9H5+	ELECTR	C9H	H2			1.00E-06	-0.30	0.0	DRA HL89
3623	C9H5+	ELECTR	C9H2	H			1.50E-07	-0.50	0.0	DRA HL89
3624	H4C8N+	ELECTR	H3C8N	H			1.00E-06	-0.30	0.0	DRA HL89
3625	H4C8N+	ELECTR	C8H3	HCTN			1.00E-06	-0.30	0.0	DRA HL89
3626	C10+	ELECTR	C9	C			1.00E-06	-0.30	0.0	DRA HL89
3627	C10+	ELECTR	C8	C2			1.00E-06	-0.30	0.0	DRA HL89
3628	C9N+	ELECTR	C2	C7N			3.00E-07	-0.50	0.0	DRA HL89
3629	H2C9N+	ELECTR	C9N	H			1.00E-06	-0.30	0.0	DRA HL89
3630	H2C9N+	ELECTR	C9N	C8H			1.00E-06	-0.30	0.0	DRA HL89
3631	H2C9N+	ELECTR	H2C9N	H			1.00E-06	-0.30	0.0	DRA HL89
3632	H2C9N+	ELECTR	C9N	H2			1.00E-06	-0.30	0.0	DRA HL89
3633	H3C9N+	ELECTR	H2C9N	H2			1.00E-06	-0.30	0.0	DRA HL89
3634	H3C9N+	ELECTR	C9N	H2			1.00E-06	-0.30	0.0	DRA HL89
3635	H	CRP	H+	ELECTR			5.98E-18	0.00	0.0	CRA
3636	HE	CRP	IIB+	ELECTR			6.50E-18	0.00	0.0	CRA
3637	C	CRP	C+	ELECTR			2.30E-17	0.00	0.0	CRA
3638	N	CRP	N+	ELECTR			2.70E-17	0.00	0.0	CRA
3639	O	CRP	O+	ELECTR			3.40E-17	0.00	0.0	CRA
3640	CL	CRP	CL+	ELECTR			3.90E-17	0.00	0.0	CRA
3641	H2	CRP	H+	ELECTR			2.20E-19	0.00	0.0	CRA
3642	H2	CRP	H2+	ELECTR			1.20E-17	0.00	0.0	CRA
3643	H2	CRP	H	H			1.30E-18	0.00	0.0	CRA
3644	H2	CRP	H+	H-			3.90E-21	0.00	0.0	CRA
3645	CO	CRP	CO+	ELECTR			3.90E-17	0.00	0.0	CRA
3646	C	PHOTON	C+	ELECTR			3.00E-10	0.00	3.0	PIA VD88
3647	NA	PHOTON	NA+	ELECTR			1.90E-11	0.00	1.8	PIA VD88
3648	MG	PHOTON	MG+	ELECTR			7.90E-11	0.00	1.7	PIA VD88
3649	SI	PHOTON	SI+	ELECTR			3.10E-09	0.00	1.9	PIA VD88
3650	P	PHOTON	P+	ELECTR			1.00E-09	0.00	2.7	PIA VD88
3651	S	PHOTON	S+	ELECTR			5.90E-10	0.00	2.6	PIA VD88
3652	CL	PHOTON	CL+	ELECTR			9.50E-11	0.00	4.0	PIA VD88
3653	FE	PHOTON	FE+	ELECTR			2.80E-10	0.00	1.9	PIA VD88
3654	II-	PHOTON	H	ELECTR			2.40E-07	0.00	0.5	PMA
3655	II3+	PHOTON	H2+	H			5.70E-10	0.00	1.9	PDA VD88
3656	II3+	PHOTON	H+	H			5.00E-13	0.00	2.3	PDA2VD87
3657	H3+	PHOTON	H+	II2			5.00E-13	0.00	1.8	PDA2VD87
3658	C-	PHOTON	C	ELECTR			2.40E-07	0.00	0.9	PMA
3659	CH	PHOTON	CH+	ELECTR			7.60E-10	0.00	2.8	PIA VD89
3660	CH	PHOTON	C	H			8.60E-10	0.00	1.2	PDA3RJ91
3661	CH+	PHOTON	CH2+	H			2.50E-10	0.00	2.5	PDA2RJ91
3662	CH2	PHOTON	CH2+	ELECTR			1.00E-09	0.00	2.3	PIA
3663	CH2	PHOTON	CH	H			7.20E-10	0.00	1.7	PDA3VD88
3664	CH2+	PHOTON	CH+	H			1.70E-09	0.00	1.7	PDA
3665	NH	PHOTON	N	H			5.00E-10	0.00	2.0	PDA3VD88
3666	NH	PHOTON	NH+	ELECTR			1.00E-11	0.00	2.0	PIA
3667	CH3	PHOTON	CH	H2			2.50E-10	0.00	1.9	PDA VD88
3668	CH3	PHOTON	CH2	H			2.50E-10	0.00	1.9	PDA VD88
3669	CH3	PHOTON	CH3+	ELECTR			1.00E-10	0.00	2.1	PIA
3670	CH3+	PHOTON	CH2+	H			1.00E-09	0.00	1.7	PDA
3671	CH3+	PHOTON	CH+	H2			1.00E-09	0.00	1.7	PDA
3672	NH2	PHOTON	NH	H			3.90E-10	0.00	1.6	PDA3RJ91
3673	NH2	PHOTON	NH2+	ELECTR			1.73E-10	0.00	2.6	PIA HL86
3674	O-	PHOTON	O	ELECTR			2.40E-07	0.00	0.5	PMA
3675	CH4	PHOTON	CH3	H			2.20E-10	0.00	2.2	PDA2VD87
3676	CH4	PHOTON	CH2	H2			9.80E-10	0.00	2.2	PDA2RJ91
3677	CH4	PHOTON	CH	H			2.20E-10	0.00	2.2	PDA2VD87
3678	OH	PHOTON	O	II			3.50E-10	0.00	1.7	PDA2RJ91
3679	OH	PHOTON	OH+	ELECTR			1.60E-12	0.00	3.1	PIA
3680	OH+	PHOTON	H+	O			1.00E-12	0.00	1.8	PDA2VD87
3681	OH-	PHOTON	OH	ELECTR			2.40E-07	0.00	0.9	PMA
3682	NH3	PHOTON	NH2	H			1.10E-09	0.00	1.8	PDA2RJ91
3683	NH3	PHOTON	NH	H2			3.30E-10	0.00	1.8	PDA2VD88
3684	NH3	PHOTON	NH3+	ELECTR			1.80E-10	0.00	2.7	PIA RJ91
3685	H2O	PHOTON	OH	H			5.90E-10	0.00	1.7	PDA2RJ91
3686	H2O	PHOTON	H2O+	ELECTR			3.30E-11	0.00	3.9	PIA VD88
3687	C2	PHOTON	C	C			1.50E-10	0.00	2.1	PDA3RJ91
3688	C2	PHOTON	C2+	ELECTR			4.10E-10	0.00	3.5	PIA VD88
3689	C2+	PHOTON	C+	C			1.00E-11	0.00	1.7	PDA
3690	C2H	PHOTON	C2	H			5.10E-10	0.00	1.9	PDA4VD88
3691	C2H	PHOTON	C2H+	ELECTR			1.00E-11	0.00	2.0	PIA
3692	C2H+	PHOTON	C2+	H			1.00E-11	0.00	2.0	PDA
3693	C2H2	PHOTON	C2H2	ELECTR			7.30E-09	0.00	1.8	PDA3RJ91
3694	C2H2	PHOTON	C2H2+	ELECTR			4.60E-10	0.00	3.1	PIA RJ91
3695	CN	PHOTON	C	N			1.10E-09	0.00	3.1	PDA3RJ91
3696	CN-	PHOTON	CN	ELECTR			2.40E-07	0.00	0.9	PMA
3697	HCN	PHOTON	CN	H			1.30E-09	0.00	2.1	PDA2RJ91
3698	HCN	PHOTON	CN	H			1.50E-09	0.00	2.1	PDA3
3699	C2H3	PHOTON	C2H2	H			1.00E-09	0.00	1.7	PDA IIL86
3700	C2H3	PHOTON	C2H3+	ELECTR			3.00E-10	0.00	2.3	PIA HL86
3701	CO	PHOTON	C	O			2.00E-10	0.00	2.5	PDA4VD88
3702	C2H4	PHOTON	C2H2	H2			3.00E-09	0.00	1.7	PDA VD88
3703	C2H4	PHOTON	C2H4+	ELECTR			2.60E-10	0.00	2.8	PIA RJ91
3704	N2	PHOTON	N	N			2.30E-10	0.00	3.8	PDA4VD88
3705	SiH	PHOTON	Si	H			2.80E-09	0.00	1.1	PDA3VD88
3706	SiH+	PHOTON	Si+	H			2.60E-09	0.00	0.9	PDA2VD88
3707	HCO	PHOTON	CO	H			1.10E-09	0.00	0.8	PDA VD88
3708	HCO	PHOTON	HCO+	ELECTR			5.60E-10	0.00	2.1	PIA RJ91
3709	NO	PHOTON	N	O			4.30E-10	0.00	1.7	PDA3RJ91
3710	NO	PHOTON	NO+	ELECTR			2.60E-10	0.00	2.3	PIA VD88
3711	CH2NH	PHOTON	HNC	H2			1.70E-09	0.00	1.6	PDA
3712	H2CO	PHOTON	CO	II2			7.00E-10	0.00	1.7	PDA RJ91
3713	H2CO	PHOTON	CO	II			4.70E-10	0.00	1.7	PDA RJ91
3714	H2CO	PHOTON	H2CO+	ELECTR			7.00E-10	0.00	2.8	PIA VD88
3715	H2CO	PHOTON	HCO+	ELECTR			1.40E-11	0.00	3.1	PIA
3716	HNO	PHOTON	NO	H			1.70E-10	0.00	0.5	PDA HL86
3717	O2	PHOTON	O	O			6.90E-10	0.00	1.8	PDA2RJ91
3718	O2	PHOTON	O2+	ELECTR			5.60E-11	0.00	3.7	PIA RJ91
3719	C13OH	PHOTON	H2CO	H2			6.00E-10	0.00	1.8	PDA RJ91
3720	C13OH	PHOTON	CH3	OH			6.00E-10	0.00	1.8	PDA RJ91

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
3721	CH3OH	PHOTON	CH3OH+	ELECTR			1.30E-10	0.00	2.6	PIA RJ91
3722	CH3OH	PHOTON	H3CO+	ELECTR			1.30E-10	0.00	2.6	PIA RJ91
3723	H2O2	PHOTON	OH	OH			8.30E-10	0.00	1.8	PDA RJ91
3724	S-	PHOTON	S	ELECTR			2.40E-07	0.00	0.9	PMA
3725	HS	PHOTON	S	H			9.70E-10	0.00	1.4	PDA VD88
3726	HS+	PHOTON	S+	H			3.00E-10	0.00	1.8	PDA VD88
3727	H2S	PHOTON	HS	H			1.45E-09	0.00	1.9	PDA RJ91
3728	H2S	PHOTON	S	H2			1.45E-09	0.00	1.9	PDA RJ91
3729	H2S	PHOTON	IHS+	ELECTR			6.30E-10	0.00	2.7	PIA RJ91
3730	HCL	PHOTON	CL	H			1.10E-10	0.00	1.8	PDA RJ91
3731	C3	PHOTON	C2	C			3.80E-09	0.00	1.8	PDA4VD88
3732	C3H	PHOTON	C3	H			1.00E-09	0.00	1.7	PDA HL86
3733	C3H2	PHOTON	C3H	H			1.00E-09	0.00	1.8	PDA VD88
3734	H2C3	PHOTON	C3	H2			1.00E-09	0.00	1.8	PDA VD88
3735	H2C3	PHOTON	C3H	H			1.00E-09	0.00	1.8	PDA VD88
3736	CCN	PHOTON	CN	C			5.00E-10	0.00	1.7	PDA HL86
3737	CCN	PHOTON	C2	N			5.00E-10	0.00	1.7	PDA HL86
3738	C3H3	PHOTON	C3H	H2			1.00E-09	0.00	1.7	PDA HL86
3739	C3H3	PHOTON	C3H2	C			1.00E-09	0.00	1.7	PDA HL86
3740	SIC	PHOTON	SI	H			1.00E-10	0.00	2.3	PDA
3741	C3H4	PHOTON	H2C3	H2			2.25E-10	0.00	1.7	PDA HL86
3742	C3H4	PHOTON	C3H3	H			3.30E-09	0.00	1.7	PDA RJ91
3743	C3H4	PHOTON	C3H4+	ELECTR			2.20E-09	0.00	2.4	PIA RJ91
3744	CH3CN	PHOTON	CH3	CN			3.40E-09	0.00	2.0	PDA3RJ91
3745	CH3CN	PHOTON	CH3CN+	ELECTR			6.20E-10	0.00	3.1	PIA RJ91
3746	CCN	PHOTON	CN	CN			1.00E-11	0.00	2.0	PDA
3747	CH2CO	PHOTON	CH2	CO			1.40E-09	0.00	2.7	PDA RJ91
3748	CH2CO	PHOTON	CH2CO+	ELECTR			6.60E-10	0.00	2.8	PIA RJ91
3749	SIO	PHOTON	SI	O			1.00E-10	0.00	2.3	PDA
3750	CS	PHOTON	C	S			9.70E-10	0.00	2.0	PDA VD88
3751	CS	PHOTON	CS+	ELECTR			2.00E-10	0.00	3.0	PIA PF86
3752	CS+	PHOTON	S+	C			2.00E-10	0.00	2.0	PDA
3753	CO2	PHOTON	CO	O			1.40E-09	0.00	2.5	PDA RJ91
3754	NS	PHOTON	N	S			1.00E-11	0.00	2.0	PDA
3755	H2CS	PHOTON	CS	H2			1.00E-09	0.00	1.7	PDA HL86
3756	NO2	PHOTON	NO	O			1.20E-09	0.00	1.7	PDA RJ91
3757	CHOOH	PHOTON	HCO	OH			1.40E-10	0.00	1.8	PDA RJ91
3758	C2H5OH	PHOTON	C2H5	OH			2.90E-09	0.00	1.7	PDA RJ91
3759	C2H5OH	PHOTON	C2H5OH+	ELECTR			1.00E-09	0.00	2.4	PIA RJ91
3760	CH3OCH3	PHOTON	H2CO	CH4			1.50E-09	0.00	1.6	PDA RJ91
3761	CCL	PHOTON	CL	C			1.00E-10	0.00	2.0	PDA
3762	SO	PHOTON	O	S			3.70E-09	0.00	2.0	PDA VD88
3763	NO	PHOTON	SO+	ELECTR			6.00E-10	0.00	2.5	PIA VD88
3764	C4	PHOTON	C2	C2			2.00E-10	0.00	2.3	PDA HL86
3765	C4	PHOTON	C3	C			2.00E-10	0.00	2.3	PDA HL86
3766	CAH	PHOTON	C4	H			1.00E-09	0.00	1.7	PDA HL86
3767	CAH	PHOTON	C2H	C2			1.00E-09	0.00	1.7	PDA HL86
3768	C3N	PHOTON	C2	CN			5.00E-10	0.00	1.8	PDA HL86
3769	CAH2	PHOTON	C4H	H			1.90E-09	0.00	1.6	PDA RJ91
3770	CAH2	PHOTON	C2H	C2H			1.90E-09	0.00	1.6	PDA RJ91
3771	CAH2	PHOTON	CAH2+	ELECTR			4.60E-10	0.00	2.3	PIA RJ91
3772	HC3N	PHOTON	C2H	CN			7.40E-09	0.00	1.8	PDA3RJ91
3773	CLO	PHOTON	CL	O			1.00E-10	0.00	2.0	PDA
3774	C3O	PHOTON	C2	CO			1.00E-10	0.00	1.6	PDA RJ91
3775	HOC3N	PHOTON	C2H3	CN			7.00E-10	0.00	1.7	PDA MF84
3776	C2S	PHOTON	C2	S			1.00E-10	0.00	2.0	PDA
3777	SIS	PHOTON	SI	S			1.00E-10	0.00	2.3	PDA
3778	OCS	PHOTON	CO	S			3.70E-09	0.00	1.7	PDA VD88
3779	OCS	PHOTON	OCS+	ELECTR			4.20E-10	0.00	3.0	PIA RJ91
3780	C5	PHOTON	C3	C2			1.00E-11	0.00	1.7	PDA
3781	C5H	PHOTON	C5	H			1.00E-11	0.00	1.7	PDA
3782	C5H	PHOTON	C3H	C2			1.00E-11	0.00	1.7	PDA
3783	C5H	PHOTON	C2H	C3			1.00E-11	0.00	1.7	PDA
3784	C5H2	PHOTON	C5H	H			1.00E-11	0.00	1.7	PDA
3785	C5H2	PHOTON	C3H	C2H			1.00E-11	0.00	1.7	PDA
3786	C5H4	PHOTON	C4H	CH3			2.00E-11	0.00	1.7	PDA
3787	SO2	PHOTON	SO	O			1.90E-09	0.00	1.9	PDA VD88
3788	H3C4N	PHOTON	C3N	CH3			2.00E-11	0.00	1.7	PDA
3789	C5S	PHOTON	C2	CS			1.00E-10	0.00	2.0	PDA
3790	C6H	PHOTON	C2H	C3			5.00E-12	0.00	1.7	PDA
3791	C6H	PHOTON	C3H	C4			5.00E-12	0.00	1.7	PDA
3792	C5N	PHOTON	C4	CN			5.00E-10	0.00	1.8	PDA HL86
3793	HC5N	PHOTON	C5N	H			5.00E-10	0.00	1.8	PDA HL86
3794	HC5N	PHOTON	C4H	CN			5.00E-10	0.00	1.8	PDA HL86
3795	C4S	PHOTON	C3	CS			1.00E-10	0.00	2.0	PDA
3796	C	CRPHOT	C+	ELECTR			1.30E-17	0.00	510.0	CPA GL87
3797	NA	CRPHOT	NA+	ELECTR			1.30E-17	0.00	17.0	CPA R92
3798	MG	CRPHOT	MG+	ELECTR			1.30E-17	0.00	113.0	CPA R92
3799	SI	CRPHOT	SI+	ELECTR			1.30E-17	0.00	4230.0	CPA R92
3800	S	CRPHOT	S+	ELECTR			1.30E-17	0.00	960.0	CPA R92
3801	CH	CRPHOT	C	H			1.30E-17	0.00	730.0	CPA GL89
3802	CH+	CRPHOT	C+	H			1.30E-17	0.00	176.0	CPA GL89
3803	NH2	CRPHOT	NH	H			1.30E-17	0.00	80.0	CPA GL89
3804	NH2	CRPHOT	NH2+	ELECTR			1.30E-17	0.00	648.0	CPA GL89
3805	CH4	CRPHOT	CH2	H2			1.30E-17	0.00	2339.0	CPA GL89
3806	OH	CRPHOT	O	H			1.30E-17	0.00	509.0	CPA GL89
3807	NH3	CRPHOT	NH2	H			1.30E-17	0.00	1315.0	CPA GL89
3808	NH3	CRPHOT	NH	H2			1.30E-17	0.00	541.0	CPA GL89
3809	NH3	CRPHOT	NH3+	ELECTR			1.30E-17	0.00	576.0	CPA GL89
3810	H2O	CRPHOT	OH	H			1.30E-17	0.00	971.0	CPA GL89
3811	C2	CRPHOT	C	C			1.30E-17	0.00	239.0	CPA GL89
3812	CN	CRPHOT	C	N			1.30E-17	0.00	16580.0	CPA GL89
3813	C2H2	CRPHOT	C2H	H			1.30E-17	0.00	5155.0	CPA GL89
3814	C2H2	CRPHOT	C2H2+	ELECTR			1.30E-17	0.00	1309.0	CPA GL89
3815	HCN	CRPHOT	C2H	H			1.30E-17	0.00	3114.0	CPA GL89
3816	CO	CRPHOT	C	O			1.30E-17	1.17	210.0	CPA GL87
3817	HCO	CRPHOT	H	CO			1.30E-17	0.00	421.0	CPA GL89
3818	HCO	CRPHOT	HCO+	ELECTR			1.30E-17	0.00	1169.0	CPA GL89
3819	H2CO	CRPHOT	CO	H2			1.30E-17	0.00	2659.0	CPA GL89
3820	C2H4	CRPHOT	C2H2	H2			1.30E-17	0.00	3762.0	CPA GL89
3821	C2H4	CRPHOT	C2H4+	ELECTR			1.30E-17	0.00	778.0	CPA GL89
3822	CH2NH	CRPHOT	CH2	NH			1.30E-17	0.00	1000.0	CPA
3823	C2H5	CRPHOT	C2H3	H2			1.30E-17	0.00	3762.0	CPA
3824	C2H5	CRPHOT	C2H5+	ELECTR			1.30E-17	0.00	778.0	CPA
3825	C2H6	CRPHOT	C2H4	H2			1.30E-17	0.00	3762.0	CPA
3826	C2H6	CRPHOT	C2H6+	ELECTR			1.30E-17	0.00	778.0	CPA
3827	NO	CRPHOT	N	O			1.30E-17	0.00	462.0	CPA GL89
3828	NO	CRPHOT	NO+	ELECTR			1.30E-17	0.00	494.0	CPA GL89
3829	O2	CRPHOT	O	O			1.30E-17	0.00	751.0	CPA GL89
3830	O2	CRPHOT	O2+	ELECTR			1.30E-17	0.00	117.0	CPA GL89
3831	CH3OH	CRPHOT	H2CO	H2			1.30E-17	0.00	3168.0	CPA GL89
3832	CH3OH	CRPHOT	CH3	OH			1.30E-17	0.00	1504.0	CPA GL89
3833	CH3OH	CRPHOT	CH3OH+	ELECTR			1.30E-17	0.00	1433.0	CPA GL89
3834	H2S	CRPHOT	S	H2			1.30E-17	0.00	5154.0	CPA GL89
3835	H2S	CRPHOT	H2S+	ELECTR			1.30E-17	0.00	1696.0	CPA GL89
3836	ICL	CRPHOT	CL	H			1.30E-17	0.00	610.0	CPA GL89
3837	C3	CRPHOT	C2	C			1.30E-17	0.00	1119.0	CPA GL89
3838	C3H4	CRPHOT	C3H3	H			1.30E-17	0.00	3284.0	CPA GL89
3839	C3H4	CRPHOT	C3H4+	ELECTR			1.30E-17	0.00	5305.0	CPA GL89
3840	CH3CN	CRPHOT	CH3	CN			1.30E-17	0.00	4756.0	CPA GL89

Table 4. continued

Index	R1	R2	P1	P2	P3	P4	α	β	γ	Note
3841	CH3CN	CRPHOT	CH3CN+	ELECTR			1.30E-17	0.00	2245.0	CPA GL89
3842	CO2	CRPHOT	CO	O			1.30E-17	0.00	1708.0	CPA GL89
3843	CH2CO	CRPHOT	CH2	CO			1.30E-17	0.00	913.0	CPA GL89
3844	CH2CO	CRPHOT	CH2CO+	ELECTR			1.30E-17	0.00	1218.0	CPA GL89
3845	CHOOH	CRPHOT	HCO	OH			1.30E-17	0.00	249.0	CPA GL89
3846	CH3CHO	CRPHOT	CH3	HCO			1.30E-17	0.00	527.0	CPA GL89
3847	CH3CHO	CRPHOT	CH4	CO			1.30E-17	0.00	527.0	CPA GL89
3848	CH3CHO	CRPHOT	CH3CHO+	ELECTR			1.30E-17	0.00	1119.0	CPA GL89
3849	CH3OCH3	CRPHOT	H2CO	CH4			1.30E-17	0.00	1714.0	CPA GL89
3850	CH3OCH3	CRPHOT	C2H6O+	ELECTR			1.30E-17	0.00	1119.0	CPA GL89
3851	C2H5OH	CRPHOT	C2H5	OH			1.30E-17	0.00	4307.0	CPA GL89
3852	C2H5OH	CRPHOT	C2H5OH+	ELECTR			1.30E-17	0.00	2736.0	CPA GL89
3853	HC3N	CRPHOT	C2H	CN			1.30E-17	0.00	1727.0	CPA GL89
3854	C3O	CRPHOT	C2	CO			1.30E-17	0.00	6609.0	CPA GL89
3855	C4H2	CRPHOT	C4H	H			1.30E-17	0.00	1730.0	CPA GL89
3856	C4H2	CRPHOT	C2H	C2H			1.30E-17	0.00	1730.0	CPA GL89
3857	C4H2	CRPHOT	C4H2+	ELECTR			1.30E-17	0.00	1119.0	CPA GL89
3858	OCS	CRPHOT	CO	S			1.30E-17	0.00	5360.0	CPA GL89
3859	OCS	CRPHOT	OCS+	ELECTR			1.30E-17	0.00	1444.0	CPA GL89
3860	HCOOCH3	CRPHOT	CH4	CO2			1.30E-17	0.00	2000.0	CPA
3861	HCOOCH3	CRPHOT	COOCH4+	ELECTR			1.30E-17	0.00	1000.0	CPA
3862	C2H6CO	CRPHOT	C2H6CO+	ELECTR			1.30E-17	0.00	1000.0	CPA
3863	C2H6CO	CRPHOT	CH3	CH3	CO		1.30E-17	0.00	2000.0	CPA
3864	SO2	CRPHOT	SO	O			1.30E-17	0.00	1844.0	CPA GL89

Labels used in the ratefile: A483, Alge, Adams & Smith 1983; AG92, Adams et al. (1992); AM390, Adams et al. (1990);

AS84, Adams et al. (1984); B84, Barlow (1984); B90, Bohme (1990); BC92, Baulch et al. (1992);

BH83, Becker & Hong (1983); BW87, Bohme et al. (1987); CH94, Clary et al. (1994); DD90, Dalgarno et al. (1990);

DF86, Dheeranano et al. (1986); DS92, Smith et al. (1992); FS91, Frost et al. (1991); FV86, Federer et al. (1986); G90, Giles

(1990); CA89, Giles et al. (1989); GH92, Gerlich & Horning (1992); GL87, Gredel et al. (1987); H85, Herbst (1985);

H87, Herbst (1987); H89, Herbst et al. (1989b); HA89, Herbst et al. (1989a); HA90, Herd et al. (1990); HA93, Haider & Hasain

(1993a); IG90, Herbst et al. (1990); HH93, Haider & Husain (1993b); HL86, Herbst & Leung (1986); HL89, Herbst & Leung

(1989); HL90, Herbst & Leung (1990); HM89, Herbst et al. (1989); HN79, Husain & Norris (1979); ISS9, Smith (1989);

KD83, Kimura & Dalgarno (1983); KM89, Karpas & Meot-ner (1989); LG88, Leen & Graff (1988); LH84, Leung et al. (1984);

M86, Millar et al. (1986); M91, Millar (1991); MA85, Millar et al. (1985); MB84, Mitchell (1984); MB87, Millar et al. (1987);

MC90, Millar et al. (1991a); MD83, Mitchell & Deveau (1983); ME90, Millar & Herbst (1990); M90, Mitchell (1990);

MM93, Maluendes et al. (1993); MN85, Millar & Nejad (1985); MN89, Marston et al. (1989); NIST, Mallard et al. (1994);

NM90, Nesbitt et al. (1990); PF92, Petric et al. (1992); PH80, Prasad & Huntress (1980);

PH82, Prasad & Huntress (1982); PR90, Pincus des Forêts et al. (1990); R92, Rawlings (1992);

RJ91, Roberge et al. (1991); RW88, Rawlings et al. (1988); SA84, Smith & Adams (1984); SA92, Sen et al. (1992);

SA93, Sims et al. (1993b); SG92, Suzuki et al. (1992); SH88, Smith et al. (1988); SM89, Smith et al.

(1993); SM93, Smith (1993); SS93, Smith & Spinel (1993); SS94, Smith et al. (1994); ST88, Stief et al. (1988); TA84, Thorne

et al. (1984); TH86, Tsang & Hampson (1986); VD87, van Dishoeck (1987); VD88, van Dishoeck (1988);

WB88, Wlodek et al. (1988); WN94, Wilson et al. (1994).