Electron affinity (data page)

This page deals with the electron affinity as a property of isolated atoms or molecules (i.e. in the gas phase). Solid state electron affinities are not listed here.

Contents

Elements

Electron affinity can be defined in two equivalent ways. First, as the energy that is released by adding an electron to an isolated gaseous atom. The second (reverse) definition is that electron affinity is the energy required to remove an electron from a singly charged gaseous negative ion. The latter can be regarded as the ionization energy of the –1 ion or the *zeroeth* ionization energy.[1] Either convention can be used.[2]

Negative electron affinities can be used in those cases where electron capture requires energy, i.e. when capture can occur only if the impinging electron has a kinetic energy large enough to excite a resonance of the atom-plus-electron system. Conversely electron removal from the anion formed in this way releases energy, which is carried out by the freed electron as kinetic energy. Negative ions formed in these cases are always unstable. They may have lifetimes of the order of microseconds to milliseconds, and invariably autodetach after some time.

Z	Element	Name	Electron affinity (eV)	Electron affinity (kJ/mol)	References
1	^{1}H	Hydrogen	0.754 195(19)	72.769(2)	[3]
1	^{2}H	Deuterium	0.754 67(4)	72.814(4)	[4]
2	He	Helium	-0.5(2)	-48(20)	estimated (est.)[5]
3	Li	Lithium	0.618 049(22)	59.632 6(21)	[6]
4	Be	Beryllium	-0.5(2)	-48(20)	est.[5]
5	B	Boron	0.279 723(25)	26.989(3)	[7]
6	^{12}C	Carbon	1.262 122 6(11)	121.776 3(1)	[8]
6	^{13}C	Carbon	1.262 113 6(12)	121.775 5(2)	[8]
7	N	Nitrogen	-0.07	-6.8	[5]
8	^{16}O	Oxygen	1.461 113 4(9)	140.976 0(2)	[9]
8	^{17}O	Oxygen	1.461 108 (4)	140.975 5(3)	[10]
8	^{18}O	Oxygen	1.461 105(3)	140.975 2(3)	[10]
9	F	Fluorine	3.401 189 8(24)	328.164 9(3)	[11][12]
10	Ne	Neon	-1.2(2)	-116(19)	est.[5]
11	Na	Sodium	0.547 926(25)	52.867(3)	[13]
12	Mg	Magnesium	-0.4(2)	-40(19)	est.[5]
13	Al	Aluminium	0.432 83(5)	41.762(5)	[14]
14	Si	Silicon	1.389 521 2(8)	134.068 4(1)	[9]
15	P	Phosphorus	0.746 609(11)	72.037(1)	[15]
16	^{32}S	Sulfur	2.077 104 2(6)	200.410 1(1)	[9]
16	^{34}S	Sulfur	2.077 104 5(12)	200.410 1(2)	[16]
17	Cl	Chlorine	3.612 725(28)	348.575(3)	[17]
18	Ar	Argon	-1.0(2)	-96(20)	est.[5]
19	K	Potassium	0.501 459(13)	48.383(2)	[18]
20	Ca	Calcium	0.024 55(10)	2.37(1)	[19]
21	Sc	Scandium	0.188(20)	18(2)	[20]
22	Ti	Titanium	0.075 54(5)	7.289(5)	[21]
23	V	Vanadium	0.527 66(20)	50.911(20)	[22]
24	Cr	Chromium	0.675 84(12)	65.21(2)	[23]
25	Mn	Manganese	-0.5(2)	-50(19)	est.[5]
26	Fe	Iron	0.153 236(35)	14.785(4)	[24]
27	Co	Cobalt	0.662 26(5)	63.898(5)	[25]
28	Ni	Nickel	1.157 16(12)	111.65(2)	[26]
29	Cu	Copper	1.235 78(4)	119.235(4)	[23]
30	Zn	Zinc	-0.6(2)	-58(20)	est.[5]

31	Ga	Gallium	0.301 20(11)	29.061(12)	[27]
32	Ge	Germanium	1.232 676 4(13)	118.935 2(2)	[28]
33	As	Arsenic	0.804 8(2)	77.65(2)	[29]
34	Se	Selenium	2.020 604 7(12)	194.958 7(2)	[30]
35	Br	Bromine	3.363 588(3)	324.536 9(3)	[11]
36	Kr	Krypton	-1.0(2)	-96(20)	est.[5]
37	Rb	Rubidium	0.485 916(21)	46.884(3)	[31]
38	Sr	Strontium	0.052 06(6)	5.023(6)	[32]
39	Y	Yttrium	0.307(12)	29.6(12)	[20]
40	Zr	Zirconium	0.433 28(9)	41.806(9)	[33]
41	Nb	Niobium	0.917 40(7)	88.516(7)	[34]
42	Mo	Molybdenum	0.747 3(3)	72.10(3)	[23]
43	Tc	Technetium	0.55(20)	53(20)	est.[35]
44	Ru	Ruthenium	1.046 38(25)	100.96(3)	[36]
45	Rh	Rhodium	1.142 89(20)	110.27(2)	[26]
46	Pd	Palladium	0.562 14(12)	54.24(2)	[26]
47	Ag	Silver	1.304 47(3)	125.862(3)	[23]
48	Cd	Cadmium	-0.7(2)	-68(20)	est.[5]
49	In	Indium	0.383 92(6)	37.043(6)	[37]
50	Sn	Tin	1.112 070(2)	107.298 4(3)	[38]
51	Sb	Antimony	1.047 401(19)	101.059(2)	[39]
52	Te	Tellurium	1.970 875(7)	190.161(1)	[40]
53	^{127}I	Iodine	3.059 046 5(37)	295.153 1(4)	[41]
53	^{128}I	Iodine	3.059 052(38)	295.154(4)	[42]
54	Xe	Xenon	-0.8(2)	-77(20)	est.[5]
55	Cs	Caesium	0.471 630(25)	45.505(3)	[13][43]
56	Ba	Barium	0.144 62(6)	13.954(6)	[44]
57	La	Lanthanum	0.557 546(20)	53.795(2)	[45]
58	Ce	Cerium	0.57(2)	55(2)	[46]
59	Pr	Praseodymium	0.109 23(46)	10.539(45)	[47]
60	Nd	Neodymium	0.097 49(33)	9.406(32)	[47]
61	Pm	Promethium	0.129	12.45	[48]
62	Sm	Samarium	0.162	15.63	[48]
63	Eu	Europium	0.116(13)	11.2(13)	[49]
64	Gd	Gadolinium	0.137	13.22	[48]

65	Tb	Terbium	0.131 31(80)	12.670(77)	[47]
66	Dy	Dysprosium	0.352	33.96	min. value[35]
67	Ho	Holmium	0.338	32.61	[48]
68	Er	Erbium	0.312	30.10	[48]
69	Tm	Thulium	1.029(22)	99(3)	[50]
70	Yb	Ytterbium	-0.02	-1.93	est.[35]
71	Lu	Lutetium	0.238 8(7)	23.04(7)	[51]
72	Hf	Hafnium	0.178 0(7)	17.18(7)	[52]
73	Ta	Tantalum	0.323(12)	31(2)	[53]
74	W	Tungsten	0.816 26(8)	78.76(1)	[54]
75	Re	Rhenium	0.060 396(64)	5.827 3(62)	[55]
76	Os	Osmium	1.077 80(13)	103.99(2)	[56]
77	Ir	Iridium	1.564 057(12)	150.908 6(12)	[57]
78	Pt	Platinum	2.125 10(5)	205.041(5)	[58]
79	Au	Gold	2.308 610(25)	222.747(3)	[59]
80	Hg	Mercury	-0.5(2)	-48(20)	est.[5]
81	Tl	Thallium	0.320 053(19)	30.880 4(19)	[60]
82	Pb	Lead	0.356 721(2)	34.418 3(3)	[61]
83	Bi	Bismuth	0.942 362(13)	90.924(2)	[62]
84	Po	Polonium	1.40(7)	136(7)	calc.[63]
85	At	Astatine	2.415 78(7)	233.087(8)	[64]
86	Rn	Radon	-0.7(2)	-68(20)	est.[5]
87	Fr	Francium	0.486	46.89	est.[65][35]
88	Ra	Radium	0.10	9.648 5	est.[66][35]
89	Ac	Actinium	0.35	33.77	est.[35]
90	Th	Thorium	0.607 69(6)	58.633(6)	[67]
91	Pa	Protactinium	0.55	53.03	est.[68]
92	U	Uranium	0.314 97(9)	30.390(9)	[69]
93	Np	Neptunium	0.48	45.85	est.[68]
94	Pu	Plutonium	-0.50	-48.33	est.[68]
95	Am	Americium	0.10	9.93	est.[68]
96	Cm	Curium	0.28	27.17	est.[68]
97	Bk	Berkelium	-1.72	-165.24	est.[68]
98	Cf	Californium	-1.01	-97.31	est.[68]
99	Es	Einsteinium	-0.30	-28.60	est.[68]
100	Fm	Fermium	0.35	33.96	est.[68]

101	Md	Mendelevium	0.98	93.91	est.[68]
102	No	Nobelium	-2.33	-223.22	est.[68]
103	Lr	Lawrencium	-0.31	-30.04	est.[68]
111	Rg	Roentgenium	1.565	151.0	calc.[70]
113	Nh	Nihonium	0.69	66.6	calc.[71]
115	Mc	Moscovium	0.366	35.3	calc.[71]
116	Lv	Livermorium	0.776	74.9	calc.[71]
117	Ts	Tennessine	1.719	165.9	calc.[71]
118	Og	Oganesson	0.056(10)	5.403 18	calc.[72]
119	Uue	Ununennium	0.662	63.87	calc.[65]
120	Ubn	Unbinilium	0.021	2.03	calc.[73]
121	Ubu	Unbiunium	0.57	55	calc.[35]

Molecules

The electron affinities E_{ea} of some molecules are given in the table below, from the lightest to the heaviest. Many more have been listed by Rienstra-Kiracofe et al. (2002). The electron affinities of the radicals OH and SH are the most precisely known of all molecular electron affinities.

Molecule	Name	E_{ea} (eV)	E_{ea} (kJ/mol)	References
Diatomics				
^{16}OH	Hydroxyl	1.827 6488(11)	176.3413(2)	Goldfarb et al. (2005)
^{16}OD		1.825 53(4)	176.137(5)	Schulz et al. (1982)
C_2	Dicarbon	3.269(6)	315.4(6)	Ervin & Lineberger (1991)
BO	Boron oxide	2.508(8)	242.0(8)	Wenthold et al. (1997)
NO	Nitric oxide	0.026(5)	2.5(5)	Travers, Cowles & Ellison (1989)
O_2	Dioxygen	0.450(2)	43.42(20)	Schiedt & Weinkauf (1995)
^{32}SH	Sulfhydryl	2.314 7283(17)	223.3373(2)	Chaibi et al. (2006)
F_2	Difluorine	3.08(10)	297(10)	Janousek & Brauman (1979)
Cl_2	Dichlorine	2.35(8)	227(8)	Janousek & Brauman (1979)
Br_2	Dibromine	2.53(8)	244(8)	Janousek & Brauman (1979)
I_2	Diiodine	2.524(5)	243.5(5)	Zanni et al. (1997)
IBr	Iodine bromide	2.512(3)	242.4(4)	Sheps, Miller & Lineberger (2009)
LiCl	Lithium chloride	0.593(10)	57.2(10)	Miller et al. (1986)
FeO	Iron(II) oxide	1.4950(5)	144.25(6)	Kim, Weichman & Neumark (2015)
Triatomics				
NO_2	Nitrogen dioxide	2.273(5)	219.3(5)	Ervin, Ho & Lineberger (1988)
O_3	Ozone	2.1028(25)	202.89(25)	Novick et al. (1979)
SO_2	Sulfur dioxide	1.107(8)	106.8(8)	Nimlos & Ellison (1986)
Larger polyatomics				
CH_2CHO	Vinyloxy	1.8248(+2-6)	176.07(+3-7)	Rienstra-Kiracofe et al. (2002) after Mead et al. (1984)
C_6H_6	Benzene	-0.70(14)	−68(14)	Ruoff et al. (1995)
$C_6H_4O_2$	*p*-Benzoquinone	1.860(5)	179.5(6)	Schiedt & Weinkauf (1999)
BF_3	Boron trifluoride	2.65(10)	256(10)	Page & Goode (1969)
HNO_3	Nitric acid	0.57(15)	55(14)	Janousek & Brauman (1979)
CH_3NO_2	Nitromethane	0.172(6)	16.6(6)	Adams et al. (2009)
$POCl_3$	Phosphoryl chloride	1.41(20)	136(20)	Mathur et al. (1976)
SF_6	Sulfur hexafluoride	1.03(5)	99.4(49)	Troe, Miller & Viggiano (2012)
$C_2(CN)_4$	Tetracyanoethylene	3.17(20)	306(20)	Chowdhury & Kebarle (1986)
WF_6	Tungsten hexafluoride	3.5(1)	338(10)	George & Beauchamp (1979)
UF_6	Uranium hexafluoride	5.06(20)	488(20)	NIST chemistry webbook (http://webbook.nist.gov/cgi/cbook.cgi?ID=C7783815&Units=SI&Mask=18A1#Ion-Energetics) after Borshchevskii et al. (1988)

C_{60}	Buckminsterfullerene	2.6835(6)	258.92(6)	Huang et al. (2014)

Second and third electron affinity

Z	Element	Name	Electron affinity (eV)	Electron affinity (kJ/mol)	References
7	N^-	Nitrogen	-6.98	-673	[74]
7	N^{2-}	Nitrogen	-11.09	-1070	[74]
8	O^-	Oxygen	-7.71	-744	[74]
15	P^-	Phosphorus	-4.85	-468	[74]
15	P^{2-}	Phosphorus	-9.18	-886	[74]

Bibliography

- Janousek, Bruce K.; Brauman, John I. (1979), "Electron affinities" (https://books.google.com/books?id=N5j-BAAAQBAJ&pg=PA53), in Bowers, M. T. (ed.), *Gas Phase Ion Chemistry*, vol. 2, New York: Academic Press, p. 53.
- Rienstra-Kiracofe, J.C.; Tschumper, G.S.; Schaefer, H.F.; Nandi, S.; Ellison, G.B. (2002), "Atomic and molecular electron affinities: Photoelectron experiments and theoretical computations", *Chem. Rev.*, vol. 102, no. 1, pp. 231–282, doi:10.1021/cr990044u (https://doi.org/10.1021%2Fcr990044u), PMID 11782134 (https://pubmed.ncbi.nlm.nih.gov/11782134).
- Updated values can be found in the NIST chemistry webbook (http://webbook.nist.gov/chemistry/) for around three dozen elements and close to 400 compounds.

Specific molecules

- Adams, C.L.; Schneider, H.; Ervin, K.M.; Weber, J.M. (2009), "Low-energy photoelectron imaging spectroscopy of nitromethane anions: Electron affinity, vibrational features, anisotropies, and the dipole-bound state" (https://zenodo.org/record/1232039), *J. Chem. Phys.*, **130** (7): 074307, Bibcode:2009JChPh.130g4307A (https://ui.adsabs.harvard.edu/abs/2009JChPh.130g4307A), doi:10.1063/1.3076892 (https://doi.org/10.1063%2F1.3076892), PMID 19239294 (https://pubmed.ncbi.nlm.nih.gov/19239294)
- Borshchevskii, A.Ya.; Boltalina, O.V.; Sorokin, I.D.; Sidorov, L.N. (1988), "Thermochemical quantities for gas-phase iron, uranium, and molybdenum fluorides, and their negative ions", *J. Chem. Thermodyn.*, **20** (5): 523, doi:10.1016/0021-9614(88)90080-8 (https://doi.org/10.1016%2F0021-9614%2888%2990080-8)
- Chaibi, W.; Delsart, C.; Drag, C.; Blondel, C. (2006), "High precision measurement of the ^{32}SH electron affinity by laser detachment microscopy", *J. Mol. Spectrosc.*, **239** (1): 11, Bibcode:2006JMoSp.239...11C (https://ui.adsabs.harvard.edu/abs/2006JMoSp.239...11C), doi:10.1016/j.jms.2006.05.012 (https://doi.org/10.1016%2Fj.jms.2006.05.012)
- Chowdhury, S.; Kebarle, P. (1986), "Electron affinities of di- and tetracyanoethylene and cyanobenzenes based on measurements of gas-phase electron-transfer equilibria", *J. Am. Chem. Soc.*, **108** (18): 5453, doi:10.1021/ja00278a014 (https://doi.org/10.1021%2Fja00278a014)
- Ervin, K.M.; Ho, J.; Lineberger, W.C. (1988), "Ultraviolet photoelectron spectrum of nitrite anion", *J. Phys. Chem.*, **92** (19): 5405, doi:10.1021/j100330a017 (https://doi.org/10.1021%2Fj100330a017)

- Ervin, K.M.; Lineberger, W.C. (1991), "Photoelectron spectra of C_2^- and C_2H^-", *J. Phys. Chem.*, **95** (3): 1167, doi:10.1021/j100156a026 (https://doi.org/10.1021%2Fj100156a026)
- George, P.M.; Beauchamp, J.L. (1979), "The electron and fluoride affinities of tungsten hexafluoride by ion cyclotron resonance spectroscopy", *Chem. Phys.*, **36** (3): 345, Bibcode:1979CP.....36..345G (https://ui.adsabs.harvard.edu/abs/1979CP.....36..345G), doi:10.1016/0301-0104(79)85018-1 (https://doi.org/10.1016%2F0301-0104%2879%2985018-1)
- Goldfarb, F.; Drag, C.; Chaibi, W.; Kröger, S.; Blondel, C.; Delsart, C. (2005), "Photodetachment microscopy of the P, Q, and R branches of the OH^-(v=0) to OH(v=0) detachment threshold", *J. Chem. Phys.*, **122** (1): 014308, Bibcode:2005JChPh.122a4308G (https://ui.adsabs.harvard.edu/abs/2005JChPh.122a4308G), doi:10.1063/1.1824904 (https://doi.org/10.1063%2F1.1824904), PMID 15638660 (https://pubmed.ncbi.nlm.nih.gov/15638660)
- Huang, Dao-Ling; Dau, Phuong Diem; Liu, Hong-Tao; Wang, Lai-Sheng (2014), "High-resolution photoelectron imaging of cold C_{60}^- anions and accurate determination of the electron affinity of C_{60}", *J. Chem. Phys.*, **140** (22): 224315, Bibcode:2014JChPh.140v4315H (https://ui.adsabs.harvard.edu/abs/2014JChPh.140v4315H), doi:10.1063/1.4881421 (https://doi.org/10.1063%2F1.4881421), PMID 24929396 (https://pubmed.ncbi.nlm.nih.gov/24929396), S2CID 1061364 (https://api.semanticscholar.org/CorpusID:1061364)
- Kim, J.B.; Weichman, M.L.; Neumark, D.M. (2015), "Low-lying states of FeO and FeO^- by slow photoelectron spectroscopy", *Mol. Phys.*, **113** (15–16): 2105, Bibcode:2015MolPh.113.2105K (https://ui.adsabs.harvard.edu/abs/2015MolPh.113.2105K), doi:10.1080/00268976.2015.1005706 (https://doi.org/10.1080%2F00268976.2015.1005706)
- Mathur, B.P.; Rothe, E.W.; Tang, S.Y.; Reck, G.P. (1976), "Negative ions from phosphorus halides due to cesium charge exchange", *J. Chem. Phys.*, **65** (2): 565, Bibcode:1976JChPh..65..565M (https://ui.adsabs.harvard.edu/abs/1976JChPh..65..565M), doi:10.1063/1.433109 (https://doi.org/10.1063%2F1.433109)
- Mead, R.D.; Lykke, K.R.; Lineberger, W.C.; Marks, J.; Brauman, J.I. (1984), "Spectroscopy and dynamics of the dipole-bound state of acetaldehyde enolate", *J. Chem. Phys.*, **81** (11): 4883, Bibcode:1984JChPh..81.4883M (https://ui.adsabs.harvard.edu/abs/1984JChPh..81.4883M), doi:10.1063/1.447515 (https://doi.org/10.1063%2F1.447515)
- Miller, T.M.; Leopold, D.G.; Murray, K.K.; Lineberger, W.C. (1986), "Electron affinities of the alkali halides and the structure of their negative ions", *J. Chem. Phys.*, **85** (5): 2368, Bibcode:1986JChPh..85.2368M (https://ui.adsabs.harvard.edu/abs/1986JChPh..85.2368M), doi:10.1063/1.451091 (https://doi.org/10.1063%2F1.451091)
- Nimlos, Mark R.; Ellison, G. Barney (1986), "Photoelectron spectroscopy of sulfur-containing anions (SO_2^-, S_3^-, and S_2O^-)", *J. Phys. Chem.*, **90** (12): 2574, doi:10.1021/j100403a007 (https://doi.org/10.1021%2Fj100403a007)
- Novick, S.E.; Engelking, P.C.; Jones, P.L.; Futrell, J.H.; Lineberger, W.C. (1979), "Laser photoelectron, photodetachment, and photodestruction spectra of O_3^-", *J. Chem. Phys.*, **70** (6): 2652, Bibcode:1979JChPh..70.2652N (https://ui.adsabs.harvard.edu/abs/1979JChPh..70.2652N), doi:10.1063/1.437842 (https://doi.org/10.1063%2F1.437842)
- Page, F. M.; Goode, G. C. (1969), *Negative ions and the magnetron*, John Wiley & Sons[75]
- Ruoff, R.S.; Kadish, K.M.; Boulas, P.; Chen, E.C.M. (1995), "Relationship between the Electron Affinities and Half-Wave Reduction Potentials of Fullerenes, Aromatic Hydrocarbons, and Metal Complexes", *J. Phys. Chem.*, **99** (21): 8843, doi:10.1021/j100021a060 (https://doi.org/10.1021%2Fj100021a060)

- Schiedt, J.; Weinkauf, R. (1995), "Spin-orbit coupling in the O_2^- anion", *Z. Naturforsch. A*, **50** (11): 1041, Bibcode:1995ZNatA..50.1041S (https://ui.adsabs.harvard.edu/abs/1995ZNatA..50.1041S), doi:10.1515/zna-1995-1110 (https://doi.org/10.1515%2Fzna-1995-1110)
- Schiedt, J.; Weinkauf, R. (1999), "Resonant photodetachment via shape and Feshbach resonances: p-benzoquinone anions as a model system", *J. Chem. Phys.*, **110** (1): 304, Bibcode:1999JChPh.110..304S (https://ui.adsabs.harvard.edu/abs/1999JChPh.110..304S), doi:10.1063/1.478066 (https://doi.org/10.1063%2F1.478066)
- Schulz, P.A.; Mead, R.D.; Jones, P.L.; Lineberger, W.C. (1982), "OH^- and OD^- threshold photodetachment", *J. Chem. Phys.*, **77** (3): 1153, Bibcode:1982JChPh..77.1153S (https://ui.adsabs.harvard.edu/abs/1982JChPh..77.1153S), doi:10.1063/1.443980 (https://doi.org/10.1063%2F1.443980)
- Sheps, L.; Miller, E.M.; Lineberger, W.C. (2009), "Photoelectron spectroscopy of small $IBr^-(CO_2)_n$(n=0–3) cluster anions", *J. Chem. Phys.*, **131** (1): 064304, Bibcode:2009JChPh.131a4304G (https://ui.adsabs.harvard.edu/abs/2009JChPh.131a4304G), doi:10.1063/1.3157185 (https://doi.org/10.1063%2F1.3157185), hdl:20.500.11850/209930 (https://hdl.handle.net/20.500.11850%2F209930), PMID 19586102 (https://pubmed.ncbi.nlm.nih.gov/19586102)
- Travers, M.J.; Cowles, D.C.; Ellison, G.B. (1989), "Reinvestigation of the electron affinities of O_2 and NO", *Chem. Phys. Lett.*, **164** (5): 449, Bibcode:1989CPL...164..449T (https://ui.adsabs.harvard.edu/abs/1989CPL...164..449T), doi:10.1016/0009-2614(89)85237-6 (https://doi.org/10.1016%2F0009-2614%2889%2985237-6)
- Troe, J.; Miller, T.M.; Viggiano, A.A. (2012), "Communication:Revised electron affinity of SF_6 from kinetic data", *J. Chem. Phys.*, **136** (2): 121102, Bibcode:2012JChPh.136b1102G (https://ui.adsabs.harvard.edu/abs/2012JChPh.136b1102G), doi:10.1063/1.3698170 (https://doi.org/10.1063%2F1.3698170), PMID 22462826 (https://pubmed.ncbi.nlm.nih.gov/22462826)
- Wenthold, P.G.; Kim, J.B.; Jonas, K.-L.; Lineberger, W.C. (1997), "An Experimental and Computational Study of the Electron Affinity of Boron Oxide", *J. Phys. Chem. A*, **101** (24): 4472, Bibcode:1997JPCA..101.4472W (https://ui.adsabs.harvard.edu/abs/1997JPCA..101.4472W), CiteSeerX 10.1.1.497.1352 (https://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.497.1352), doi:10.1021/jp970645u (https://doi.org/10.1021%2Fjp970645u)
- Zanni, M.T.; Taylor, T.R.; Greenblatt, B.J.; Soep, B.; Neumark, D.M. (1997), "Characterization of the I_2^- anion ground state using conventional and femtosecond photoelectron spectroscopy", *J. Chem. Phys.*, **107** (19): 7613, Bibcode:1997JChPh.107.7613Z (https://ui.adsabs.harvard.edu/abs/1997JChPh.107.7613Z), doi:10.1063/1.475110 (https://doi.org/10.1063%2F1.475110)

References

1. Wulfsberg, G. P. (2018). *Foundations of Inorganic Chemistry*. California: University Science Books. p. 362. ISBN 978-1-891389-95-5.
2. IUPAC, *Compendium of Chemical Terminology*, 2nd ed. (the "Gold Book") (1997). Online corrected version: (2006–) "Electron affinity (https://goldbook.iupac.org/E01977.html)". doi:10.1351/goldbook.E01977 (https://doi.org/10.1351%2Fgoldbook.E01977)
3. Lykke, K.R.; Murray, K.K.; Lineberger, W.C. (1991). "Threshold Photodetachment of H^-" (https://zenodo.org/record/1233707). *Physical Review A*. **43** (11): 6104–7. doi:10.1103/PhysRevA.43.6104 (https://doi.org/10.1103%2FPhysRevA.43.6104). PMID 9904944 (https://pubmed.ncbi.nlm.nih.gov/9904944).

4. Beyer M. & Merkt F. (2018). "Communication: Heavy-Rydberg states of HD and the electron affinity of the deuterium atom". *J. Chem. Phys.* **149**, 031102 doi:10.1063/1.5043186 (https://doi.org/10.1063%2F1.5043186)
5. Bratsch, S.G.; Lagowski, J.J. (1986). "Predicted stabilities of monatomic anions in water and liquid ammonia at 298.15 K.". *Polyhedron*. **5** (11): 1763–1770. doi:10.1016/S0277-5387(00)84854-8 (https://doi.org/10.1016%2FS0277-5387%2800%2984854-8).
6. Haeffler, G.; Hanstorp, D.; Kiyan, I.; Klinkmüller, A.E.; Ljungblad, U.; Pegg, D.J. (1996). "Electron affinity of Li: A state-selective measurement". *Phys. Rev. A*. **53** (6): 4127–31. arXiv:physics/9703013 (https://arxiv.org/abs/physics/9703013). Bibcode:1996PhRvA..53.4127H (https://ui.adsabs.harvard.edu/abs/1996PhRvA..53.4127H). doi:10.1103/PhysRevA.53.4127 (https://doi.org/10.1103%2FPhysRevA.53.4127). PMID 9913377 (https://pubmed.ncbi.nlm.nih.gov/9913377).
7. Scheer, M.; Bilodeau, R.C.; Haugen, H.K. (1998). "Negative ion of boron: An experimental study of the ^3P ground state". *Phys. Rev. Lett.* **80** (12): 2562–65. Bibcode:1998PhRvL..80.2562S (https://ui.adsabs.harvard.edu/abs/1998PhRvL..80.2562S). doi:10.1103/PhysRevLett.80.2562 (https://doi.org/10.1103%2FPhysRevLett.80.2562).
8. Bresteau, D.; Drag, C.; Blondel, C. (2016). "Isotope shift of the electron affinity of carbon measured by photodetachment microscopy". *Phys. Rev. A*. **93** (1): 013414. Bibcode:2016PhRvA..93a3414B (https://ui.adsabs.harvard.edu/abs/2016PhRvA..93a3414B). doi:10.1103/PhysRevA.93.013414 (https://doi.org/10.1103%2FPhysRevA.93.013414).
9. Chaibi, W.; Peláez, R.J.; Blondel, C.; Drag, C.; Delsart, C. (2010). "Effect of a magnetic field in photodetachment microscopy". *Eur. Phys. J. D*. **58** (1): 29. Bibcode:2010EPJD...58...29C (https://ui.adsabs.harvard.edu/abs/2010EPJD...58...29C). doi:10.1140/epjd/e2010-00086-7 (https://doi.org/10.1140%2Fepjd%2Fe2010-00086-7).
10. Blondel, C.; Delsart, C.; Valli, C.; Yiou, S.; Godefroid, M.R.; Van Eck, S. (2001). "Electron affinities of ^{16}O, ^{17}O, ^{18}O, the fine structure of $^{16}O^-$, and the hyperfine structure of $^{17}O^-$". *Phys. Rev. A*. **64** (5): 052504. doi:10.1103/PhysRevA.64.052504 (https://doi.org/10.1103%2FPhysRevA.64.052504).
11. Blondel, C.; Cacciani, P.; Delsart, C.; Trainham, R. (1989). "High Resolution Determination of the Electron Affinity of Fluorine and Bromine using Crossed Ion and Laser Beams". *Phys. Rev. A*. **40** (7): 3698–3701. Bibcode:1989PhRvA..40.3698B (https://ui.adsabs.harvard.edu/abs/1989PhRvA..40.3698B). doi:10.1103/PhysRevA.40.3698 (https://doi.org/10.1103%2FPhysRevA.40.3698). PMID 9902584 (https://pubmed.ncbi.nlm.nih.gov/9902584).
12. Blondel, C.; Delsart, C.; Goldfarb, F. (2001). "Electron spectrometry at the μeV level and the electron affinities of Si and F". *Journal of Physics B*. **34**: L281–88. doi:10.1088/0953-4075/34/9/101 (https://doi.org/10.1088%2F0953-4075%2F34%2F9%2F101).
13. Hotop, H.; Lineberger, W.C. (1985). "Binding energies in atomic negative ions. II". *J. Phys. Chem. Ref. Data*. **14** (3): 731. Bibcode:1985JPCRD..14..731H (https://ui.adsabs.harvard.edu/abs/1985JPCRD..14..731H). doi:10.1063/1.555735 (https://doi.org/10.1063%2F1.555735).
14. Scheer, M.; Bilodeau, R.C.; Thøgersen, J.; Haugen, H.K. (1998). "Threshold Photodetachment of Al^-: Electron Affinity and Fine Structure". *Phys. Rev. A*. **57** (3): R1493–96. Bibcode:1998PhRvA..57.1493S (https://ui.adsabs.harvard.edu/abs/1998PhRvA..57.1493S). doi:10.1103/PhysRevA.57.R1493 (https://doi.org/10.1103%2FPhysRevA.57.R1493).
15. Peláez, R.J.; Blondel, C.; Vandevraye, M.; Drag, C.; Delsart, C. (2011). "Photodetachment microscopy to an excited spectral term and the electron affinity of phosphorus". *J. Phys. B: At. Mol. Opt. Phys*. **44** (19): 195009. Bibcode:2011JPhB...44s5009P (https://ui.adsabs.harvard.edu/abs/2011JPhB...44s5009P). doi:10.1088/0953-4075/44/19/195009 (https://doi.org/10.1088%2F0953-4075%2F44%2F19%2F195009). hdl:10261/62382 (https://hdl.handle.net/10261%2F62382).

16. Carette, T.; Drag, C.; Scharf, O.; Blondel, C.; Delsart, C.; Fischer, C. (2000). "F. & Godefroid M. (2010). Isotope shift in the sulfur electron affinity: Observation and theory". *Phys. Rev. A*. **81**: 042522. arXiv:1002.1297 (https://arxiv.org/abs/1002.1297). doi:10.1103/PhysRevA.81.042522 (https://doi.org/10.1103%2FPhysRevA.81.042522).
17. Berzinsh, U.; Gustafsson, M.; Hanstorp, D.; Klinkmüller, A.; Ljungblad, U.; Martensson-Pendrill, A.M. (1995). "Isotope shift in the electron affinity of chlorine". *Phys. Rev. A*. **51** (1): 231–238. arXiv:physics/9804028 (https://arxiv.org/abs/physics/9804028). Bibcode:1995PhRvA..51..231B (https://ui.adsabs.harvard.edu/abs/1995PhRvA..51..231B). doi:10.1103/PhysRevA.51.231 (https://doi.org/10.1103%2FPhysRevA.51.231). PMID 9911578 (https://pubmed.ncbi.nlm.nih.gov/9911578).
18. Andersson, K.T.; Sandstrom, J.; Kiyan, I.Y.; Hanstorp, D.; Pegg, D.J. (2000). "Measurement of the electron affinity of potassium". *Phys. Rev. A*. **62** (2): 022503. Bibcode:2000PhRvA..62b2503A (https://ui.adsabs.harvard.edu/abs/2000PhRvA..62b2503A). doi:10.1103/PhysRevA.62.022503 (https://doi.org/10.1103%2FPhysRevA.62.022503).
19. Petrunin, V.V.; Andersen, H.H.; Balling, P.; Andersen, T. (1996). "Structural Properties of the Negative Calcium Ion: Binding Energies and Fine-structure Splitting". *Phys. Rev. Lett*. **76** (5): 744–47. Bibcode:1996PhRvL..76..744P (https://ui.adsabs.harvard.edu/abs/1996PhRvL..76..744P). doi:10.1103/PhysRevLett.76.744 (https://doi.org/10.1103%2FPhysRevLett.76.744). PMID 10061539 (https://pubmed.ncbi.nlm.nih.gov/10061539).
20. Feigerle, C.S.; Herman, Z.; Lineberger, W.C. (1981). "Laser Photoelectron Spectroscopy of Sc^- and Y^-: A Determination of the Order of Electron Filling in Transition Metal Anions". *J. Electron Spectrosc*. **23**: 441–50. doi:10.1016/0368-2048(81)85050-5 (https://doi.org/10.1016%2F0368-2048%2881%2985050-5).
21. Tang, R.; Fu, X.; Ning, C. (2018). "Accurate electron affinity of Ti and fine structures of its anions". *J. Chem. Phys*. **149** (13): 134304. Bibcode:2018JChPh.149m4304T (https://ui.adsabs.harvard.edu/abs/2018JChPh.149m4304T). doi:10.1063/1.5049629 (https://doi.org/10.1063%2F1.5049629). PMID 30292212 (https://pubmed.ncbi.nlm.nih.gov/30292212).
22. Fu, X.; Luo, Z.; Chen, X.; Li, J.; Ning, C. (2016). "Accurate electron affinity of V and fine-structure splittings of V^- via slow-electron velocity-map imaging". *J. Chem. Phys*. **145** (16): 164307. Bibcode:2016JChPh.145p4307F (https://ui.adsabs.harvard.edu/abs/2016JChPh.145p4307F). doi:10.1063/1.4965928 (https://doi.org/10.1063%2F1.4965928). PMID 27802620 (https://pubmed.ncbi.nlm.nih.gov/27802620).
23. Bilodeau, R.C.; Scheer, M.; Haugen, H.K. (1998). "Infrared Laser Photodetachment of Transition Metal Negative Ions: Studies on Cr^-, Mo^-, Cu^-, and Ag^-". *Journal of Physics B*. **31**: 3885–91. doi:10.1088/0953-4075/31/17/013 (https://doi.org/10.1088%2F0953-4075%2F31%2F17%2F013).
24. Chen, X.; Luo, Z.; Li, J.; Ning, C. (2016). "Accurate Electron Affinity of Iron and Fine Structures of Negative Iron ions" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4853736). *Sci. Rep*. **6**: 24996. Bibcode:2016NatSR...624996C (https://ui.adsabs.harvard.edu/abs/2016NatSR...624996C). doi:10.1038/srep24996 (https://doi.org/10.1038%2Fsrep24996). PMC 4853736 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4853736). PMID 27138292 (https://pubmed.ncbi.nlm.nih.gov/27138292).
25. Chen, X.; Ning, C. (2016). "Accurate electron affinity of Co and fine-structure splittings of Co^- via slow-electron velocity-map imaging". *Phys. Rev. A*. **93** (5): 052508. Bibcode:2016PhRvA..93e2508C (https://ui.adsabs.harvard.edu/abs/2016PhRvA..93e2508C). doi:10.1103/PhysRevA.93.052508 (https://doi.org/10.1103%2FPhysRevA.93.052508).
26. Scheer, M.; Brodie, C.A.; Bilodeau, R.C.; Haugen, H.K. (1998). "Laser spectroscopic measurements of binding energies and fine-structure splittings of Co^-, Ni^-, Rh^-, and Pd^-". *Phys. Rev. A*. **58** (3): 2051–62. doi:10.1103/PhysRevA.58.2051 (https://doi.org/10.1103%2FPhysRevA.58.2051).

27. Gibson, N.D.; Walter, C.W; Crocker, C.; Wang, J.; Nakayama, W.; Yukich, J.; Eliav, E.; Kaldor, U. (2019). "Electron affinity of gallium and fine structure of Ga^-: Experiment and theory". *Phys. Rev. A*. **100** (5): 052512. doi:10.1103/PhysRevA.100.052512 (https://doi.org/10.1103%2FPhysRevA.100.052512).
28. Bresteau, D.; Babilotte, Ph.; Drag, C.; Blondel, C. (2015). "Intra-cavity photodetachment microscopy and the electron affinity of germanium". *J. Phys. B: At. Mol. Opt. Phys*. **48** (12): 125001. Bibcode:2015JPhB...48l5001B (https://ui.adsabs.harvard.edu/abs/2015JPhB...48l5001B). doi:10.1088/0953-4075/48/12/125001 (https://doi.org/10.1088%2F0953-4075%2F48%2F12%2F125001).
29. Walter, C. W.; Gibson, N. D.; Field, R. L.; Snedden, A. P.; Shapiro, J. Z.; Janczak, C. M.; Hanstorp, D. (2009). "Electron affinity of arsenic and the fine structure of As^- measured using infrared photodetachment threshold spectroscopy". *Phys. Rev. A*. **80** (1): 014501. Bibcode:2009PhRvA..80a4501W (https://ui.adsabs.harvard.edu/abs/2009PhRvA..80a4501W). doi:10.1103/physreva.80.014501 (https://doi.org/10.1103%2Fphysreva.80.014501).
30. Vandevraye, M.; Drag, C.; Blondel, C. (2012). "Electron affinity of selenium measured by photodetachment microscopy". *Phys. Rev. A*. **85** (1): 015401. Bibcode:2012PhRvA..85a5401V (https://ui.adsabs.harvard.edu/abs/2012PhRvA..85a5401V). doi:10.1103/PhysRevA.85.015401 (https://doi.org/10.1103%2FPhysRevA.85.015401).
31. Frey, P.; Breyer, F.; Hotop, H. (1978). "*High Resolution Photodetachment from the Rubidium Negative Ion around the Rb(5p$_{1/2}$) Threshold. Journal of Physics B*J. Phys. B: At. Mol. Phys". *Chinese Journal of Chemical Physics*. **11**: L589–94. doi:10.1088/0022-3700/11/19/005 (https://doi.org/10.1088%2F0022-3700%2F11%2F19%2F005).
32. Andersen, H.H.; Petrunin, V.V.; Kristensen, P.; Andersen, T. (1997). "Structural properties of the negative strontium ion: Binding energy and fine-structure splitting". *Phys. Rev. A*. **55** (4): 3247–49. Bibcode:1997PhRvA..55.3247A (https://ui.adsabs.harvard.edu/abs/1997PhRvA..55.3247A). doi:10.1103/PhysRevA.55.3247 (https://doi.org/10.1103%2FPhysRevA.55.3247).
33. Fu, X.; Li, J.; Luo, Z.; Chen, X.; Ning, C. (2017). "*Precision measurement of electron affinity of Zr and fine structures of its negative ions. Journal of Chemical Physics* J. Chem. Phys". *The Journal of Chemical Physics*. **147** (6): 064306. doi:10.1063/1.4986547 (https://doi.org/10.1063%2F1.4986547). PMID 28810756 (https://pubmed.ncbi.nlm.nih.gov/28810756).
34. Luo Z., Chen X., Li J. & Ning C. (2016). Precision measurement of the electron affinity of niobium. *Phys. Rev. A* **93**, 020501(R) doi:10.1103/PhysRevA.93.020501 (https://doi.org/10.1103%2FPhysRevA.93.020501)
35. *CRC Handbook of Chemistry and Physics* 92nd Edn. (2011–2012); W. M. Haynes. Boca Raton, FL: CRC Press. "Section 10, Atomic, Molecular, and Optical Physics; Electron Affinities".
36. Norquist, P.L.; Beck, D.R.; Bilodeau, R.C.; Scheer, M.; Srawley, R.A.; Haugen, H.K. (1999). "Theoretical and experimental binding energies for the $d^7s^2\ ^4F$ levels in Ru^-, including calculated hyperfine structure and *M*1 decay rates". *Phys. Rev. A*. **59** (3): 1896–1902. Bibcode:1999PhRvA..59.1896N (https://ui.adsabs.harvard.edu/abs/1999PhRvA..59.1896N). doi:10.1103/PhysRevA.59.1896 (https://doi.org/10.1103%2FPhysRevA.59.1896).
37. Walter, C.W.; Gibson, N.D.; Carman, D.J.; Li, Y.-G.; Matyas, D.J. (2010). "Electron affinity of indium and the fine structure of In^- measured using infrared photodetachment threshold spectroscopy". *Phys. Rev. A*. **82** (3): 032507. Bibcode:2010PhRvA..82c2507W (https://ui.adsabs.harvard.edu/abs/2010PhRvA..82c2507W). doi:10.1103/PhysRevA.82.032507 (https://doi.org/10.1103%2FPhysRevA.82.032507).

38. Vandevraye, M.; Drag, C.; Blondel, C. (2013). "Electron affinity of tin measured by photodetachment microscopy". *Journal of Physics B: Atomic, Molecular and Optical Physics*. **46** (12): 125002. Bibcode:2013JPhB...46l5002V (https://ui.adsabs.harvard.edu/abs/2013JPhB...46l5002V). doi:10.1088/0953-4075/46/12/125002 (https://doi.org/10.1088%2F0953-4075%2F46%2F12%2F125002).
39. Scheer, M.; Haugen, H.K.; Beck, D.R. (1997). "Single- and Multiphoton Infrared Laser Spectroscopy of Sb^-: A Case Study". *Phys. Rev. Lett*. **79** (21): 4104–7. Bibcode:1997PhRvL..79.4104S (https://ui.adsabs.harvard.edu/abs/1997PhRvL..79.4104S). doi:10.1103/PhysRevLett.79.4104 (https://doi.org/10.1103%2FPhysRevLett.79.4104).
40. Haeffler, G.; Klinkmüller, A.E.; Rangell, J.; Berzinsh, U.; Hanstorp, D. (1996). "The electron affinity of tellurium". *Z. Phys. D*. **38**: 211. arXiv:physics/9703012 (https://arxiv.org/abs/physics/9703012). doi:10.1007/s004600050085 (https://doi.org/10.1007%2Fs004600050085).
41. Peláez R.J., Blondel C., Delsart C. and Drag C. (2009) *J. Phys. B* **42** 125001 doi:10.1088/0953-4075/42/12/125001 (https://doi.org/10.1088%2F0953-4075%2F42%2F12%2F125001)
42. Rothe, S.; Sundberg, J.; Welander, J.; Chrysalidis, K.; Goodacre, T. (2017). "D., Fedosseev V., ... & Kron T. (2017). Laser photodetachment of radioactive $^{128}I^-$" (https://doi.org/10.1088%2F1361-6471%2Faa80aa). *J. Phys. G: Nucl. Part. Phys*. **44**: 104003. doi:10.1088/1361-6471/aa80aa (https://doi.org/10.1088%2F1361-6471%2Faa80aa).
43. Scheer, M.; Thøgersen, J.; Bilodeau, R.C.; Brodie, C.A.; Haugen, H.K. (1998). "Experimental Evidence that the 6s6p ^3P_J States of Cs^- are Shape Resonances". *Phys. Rev. Lett*. **80** (4): 684–87. Bibcode:1998PhRvL..80..684S (https://ui.adsabs.harvard.edu/abs/1998PhRvL..80..684S). doi:10.1103/PhysRevLett.80.684 (https://doi.org/10.1103%2FPhysRevLett.80.684).
44. Petrunin, V.V.; Volstad, J.D.; Balling, P.; Kristensen, K.; Andersen, T. (1995). "Resonant Ionization Spectroscopy of Ba^-: Metastable and Stable Ions". *Phys. Rev. Lett*. **75** (10): 1911–14. Bibcode:1995PhRvL..75.1911P (https://ui.adsabs.harvard.edu/abs/1995PhRvL..75.1911P). doi:10.1103/PhysRevLett.75.1911 (https://doi.org/10.1103%2FPhysRevLett.75.1911). PMID 10059160 (https://pubmed.ncbi.nlm.nih.gov/10059160).
45. Blondel, C. (2020). "Comment on "Measurement of the electron affinity of the lanthanum atom" " (https://hal.archives-ouvertes.fr/hal-02928751/file/AKK1015_rev.pdf) (PDF). *Phys. Rev. A*. **101** (1): 016501. Bibcode:2020PhRvA.101a6501B (https://ui.adsabs.harvard.edu/abs/2020PhRvA.101a6501B). doi:10.1103/PhysRevA.101.016501 (https://doi.org/10.1103%2FPhysRevA.101.016501).
46. Felton, J.; Ray, M.; Jarrold, C.C. (2014). "Measurement of the electron affinity of atomic Ce". *Phys. Rev. A*. **89** (3): 033407. Bibcode:2014PhRvA..89c3407F (https://ui.adsabs.harvard.edu/abs/2014PhRvA..89c3407F). doi:10.1103/PhysRevA.89.033407 (https://doi.org/10.1103%2FPhysRevA.89.033407).
47. Fu, X.; Lu, Y.; Tang, R.; Ning, C. (2020). "Electron affinity measurements of lanthanide atoms: Pr, Nd, and Tb". *Phys. Rev. A*. **101** (2): 022502. doi:10.1103/PhysRevA.101.022502 (https://doi.org/10.1103%2FPhysRevA.101.022502).
48. Felfli, Z.; Msezane, A.; Sokolovski, D. (2009). "Resonances in low-energy electron elastic cross sections for lanthanide atoms". *Phys. Rev. A*. **79** (1): 012714. Bibcode:2009PhRvA..79a2714F (https://ui.adsabs.harvard.edu/abs/2009PhRvA..79a2714F). doi:10.1103/PhysRevA.79.012714 (https://doi.org/10.1103%2FPhysRevA.79.012714).

49. Cheng, S.B.; Castleman, A. W. Jr (2015). "Direct experimental observation of weakly-bound character of the attached electron in europium anion" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4510523). *Sci. Rep*. **5**: 12414. Bibcode:2015NatSR...512414C (https://ui.adsabs.harvard.edu/abs/2015NatSR...512414C). doi:10.1038/srep12414 (https://doi.org/10.1038%2Fsrep12414). PMC 4510523 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4510523). PMID 26198741 (https://pubmed.ncbi.nlm.nih.gov/26198741).
50. Davis, V.T.; Thompson, J.S. (2001). "Measurement of the electron affinity of thulium" (https://zenodo.org/record/1233713). *Phys. Rev. A*. **65** (1): 010501. Bibcode:2002PhRvA..65a0501D (https://ui.adsabs.harvard.edu/abs/2002PhRvA..65a0501D). doi:10.1103/PhysRevA.65.010501 (https://doi.org/10.1103%2FPhysRevA.65.010501).
51. Fu, X. X.; Tang, R. L.; Lu, Y. Z.; Ning, C. G. (2019). "Measurement of electron affinity of atomic lutetium via the cryo-SEVI Method". *Chinese Journal of Chemical Physics*. **32** (2): 187. Bibcode:2019ChJCP..32..187F (https://ui.adsabs.harvard.edu/abs/2019ChJCP..32..187F). doi:10.1063/1674-0068/cjcp1812293 (https://doi.org/10.1063%2F1674-0068%2Fcjcp1812293).
52. Tang R., Chen X., Fu X., Wang H. and Ning C. (2018). Electron affinity of the hafnium atom. *Phys. Rev. A* **98** 020501(R) doi:10.1103/PhysRevA.98.020501 (https://doi.org/10.1103%2FPhysRevA.98.020501).
53. Feigerle, C.S.; Corderman, R.R.; Bobashev, S.V.; Lineberger, W.C. (1981). "Binding energies and structure of transition metal negative ions". *J. Chem. Phys*. **74** (3): 1580. Bibcode:1981JChPh..74.1580F (https://ui.adsabs.harvard.edu/abs/1981JChPh..74.1580F). doi:10.1063/1.441289 (https://doi.org/10.1063%2F1.441289).
54. Lindahl, A.O.; et al. (2010). "The electron affinity of tungsten". *Eur. Phys. J. D*. **60** (2): 219. Bibcode:2010EPJD...60..219L (https://ui.adsabs.harvard.edu/abs/2010EPJD...60..219L). doi:10.1140/epjd/e2010-00199-y (https://doi.org/10.1140%2Fepjd%2Fe2010-00199-y).
55. Chen, X.L.; Ning, C.G. (2017). "Observation of Rhenium Anion and Electron Affinity of Re". *J. Phys. Chem. Lett*. **8** (12): 2735–2738. doi:10.1021/acs.jpclett.7b01079 (https://doi.org/10.1021%2Facs.jpclett.7b01079). PMID 28581753 (https://pubmed.ncbi.nlm.nih.gov/28581753).
56. Bilodeau, R.C.; Haugen, H.K. (2000). "Experimental studies of Os^-: Observation of a bound-bound electric dipole transition in an atomic negative ion". *Phys. Rev. Lett*. **85** (3): 534–37. Bibcode:2000PhRvL..85..534B (https://ui.adsabs.harvard.edu/abs/2000PhRvL..85..534B). doi:10.1103/PhysRevLett.85.534 (https://doi.org/10.1103%2FPhysRevLett.85.534). PMID 10991333 (https://pubmed.ncbi.nlm.nih.gov/10991333).
57. Lu Y., Zhao J., Tang R., Fu X. & Ning C. (2020). "Measurement of electron affinity of iridium atom and photoelectron angular distributions of iridium anion". *J. Chem. Phys.* **152**, 034302 doi:10.1063/1.5134535 (https://doi.org/10.1063%2F1.5134535)
58. Bilodeau, R.C.; Scheer, M.; Haugen, H.K.; Brooks, R.L. (1999). "Near-threshold Laser Spectroscopy of Iridium and Platinum Negative Ions: Electron Affinities and the Threshold Law". *Phys. Rev. A*. **61**: 012505. doi:10.1103/PhysRevA.61.012505 (https://doi.org/10.1103%2FPhysRevA.61.012505).
59. Andersen, T.; Haugen, H.K.; Hotop, H. (1999). "Binding Energies in Atomic Negative Ions: III". *J. Phys. Chem. Ref. Data*. **28** (6): 1511. Bibcode:1999JPCRD..28.1511A (https://ui.adsabs.harvard.edu/abs/1999JPCRD..28.1511A). doi:10.1063/1.556047 (https://doi.org/10.1063%2F1.556047).
60. Walter, C.W.; Gibson, N.D.; Spielman, S.E. (2020). "Electron affinity of thallium measured with threshold spectroscopy". *Phys. Rev. A*. **101** (5): 052511. doi:10.1103/PhysRevA.101.052511 (https://doi.org/10.1103%2FPhysRevA.101.052511).

61. Bresteau, D.; Drag, C.; Blondel, C. (2019). "Electron affinity of lead". *J. Phys. B: At. Mol. Opt. Phys*. **52** (6): 065001. Bibcode:2019JPhB...52f5001B (https://ui.adsabs.harvard.edu/abs/2019JPhB...52f5001B). doi:10.1088/1361-6455/aaf685 (https://doi.org/10.1088%2F1361-6455%2Faaf685).
62. Bilodeau, R.C.; Haugen, H.K. (2001). "Electron affinity of Bi using infrared laser photodetachment threshold spectroscopy". *Phys. Rev. A*. **64** (2): 024501. Bibcode:2001PhRvA..64b4501B (https://ui.adsabs.harvard.edu/abs/2001PhRvA..64b4501B). doi:10.1103/PhysRevA.64.024501 (https://doi.org/10.1103%2FPhysRevA.64.024501).
63. Junqin, Li; Zilong, Zhao; Martin, Andersson; Xuemei, Zhang; Chongyang, Chen (2012). "Theoretical study for the electron affinities of negative ions with the MCDHF method". *J. Phys. B: At. Mol. Opt. Phys*. **45** (16): 165004. Bibcode:2012JPhB...45p5004L (https://ui.adsabs.harvard.edu/abs/2012JPhB...45p5004L). doi:10.1088/0953-4075/45/16/165004 (https://doi.org/10.1088%2F0953-4075%2F45%2F16%2F165004).
64. Leimbach, D.; et al. (2020). "The electron affinity of astatine" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7393155). *Nat. Commun*. **11** (1): 3824. doi:10.1038/s41467-020-17599-2 (https://doi.org/10.1038%2Fs41467-020-17599-2). PMC 7393155 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7393155). PMID 32733029 (https://pubmed.ncbi.nlm.nih.gov/32733029).
65. Landau, A.; Eliav, E.; Ishikawa, Y.; Kaldor, U. (2001). "Benchmark calculations of electron affinities of the alkali atoms sodium to eka-francium (element 119)". *J. Chem. Phys*. **115** (6): 2389. Bibcode:2001JChPh.115.2389L (https://ui.adsabs.harvard.edu/abs/2001JChPh.115.2389L). doi:10.1063/1.1386413 (https://doi.org/10.1063%2F1.1386413).
66. Andersen, T. (2004). "Atomic negative ions: Structure, dynamics and collisions". *Physics Reports*. **394** (4–5): 157–313. Bibcode:2004PhR...394..157A (https://ui.adsabs.harvard.edu/abs/2004PhR...394..157A). doi:10.1016/j.physrep.2004.01.001 (https://doi.org/10.1016%2Fj.physrep.2004.01.001).
67. Tang R., Si R., Fei Z., Fu X., Lu Y., Brage T., Liu H., Chen C. & Ning C. (2019). "Candidate for Laser Cooling of a Negative Ion: High-Resolution Photoelectron Imaging of Th^-". *Phys. Rev. Lett.* **123**, 203002 doi:10.1103/PhysRevLett.123.203002 (https://doi.org/10.1103%2FPhysRevLett.123.203002)
68. Guo, Y.; Whitehead, M.A. (1989). "*Electron affinities of alkaline-earth element calculated with the local-spin-density-functional theory".* Physical Review A. ***40*** *(1): 28–34. doi:10.1103/PhysRevA.40.28 (https://doi.org/10.1103%2FPhysRevA.40.28). PMID 9901864 (https://pubmed.ncbi.nlm.nih.gov/9901864).*
69. Tang R., Lu Y., Liu H. & Ning C. (2021). "Electron affinity of uranium and bound states of opposite parity in its anion". *Phys. Rev.* A **103**, L050801 doi:10.1103/PhysRevA.103.L050801 (https://doi.org/10.1103%2FPhysRevA.103.L050801)
70. Eliav, Ephraim; Fritzsche, Stephan; Kaldor, Uzi (2015). "Electronic structure theory of the superheavy elements". *Nucl. Phys. A*. **944**: 518–550. Bibcode:2015NuPhA.944..518E (https://ui.adsabs.harvard.edu/abs/2015NuPhA.944..518E). doi:10.1016/j.nuclphysa.2015.06.017 (https://doi.org/10.1016%2Fj.nuclphysa.2015.06.017).
71. Borschevsky, Anastasia; Pershina, Valeria; Kaldor, Uzi; Eliav, Ephraim. "Fully relativistic *ab initio* studies of superheavy elements" (https://web.archive.org/web/20180115184921/http://www.kernchemie.uni-mainz.de/downloads/che_7/presentations/borschevsky.pdf) (PDF). *www.kernchemie.uni-mainz.de*. Johannes Gutenberg University Mainz. Archived from the original (http://www.kernchemie.uni-mainz.de/downloads/che_7/presentations/borschevsky.pdf) (PDF) on 15 January 2018. Retrieved 15 January 2018.
72. Eliav, Ephraim; Kaldor, Uzi; Ishikawa, Y; Pyykkö, P (1996). "Element 118: The First Rare Gas with an Electron Affinity". *Phys. Rev. Lett*. **77** (27): 5350–5352. Bibcode:1996PhRvL..77.5350E (https://ui.adsabs.harvard.edu/abs/1996PhRvL..77.5350E). doi:10.1103/PhysRevLett.77.5350 (https://doi.org/10.1103%2FPhysRevLett.77.5350). PMID 10062781 (https://pubmed.ncbi.nlm.nih.gov/10062781).

73. Borschevsky, A.; Pershina, V.; Eliav, E.; Kaldor, U. (2013). "*Ab initio* predictions of atomic properties of element 120 and its lighter group-2 homologues". *Phys. Rev. A*. **87** (2): 022502–1–8. Bibcode:2013PhRvA..87b2502B (https://ui.adsabs.harvard.edu/abs/2013PhRvA..87b2502B). doi:10.1103/PhysRevA.87.022502 (https://doi.org/10.1103%2FPhysRevA.87.022502).
74. Rayner-Canham Appendix 5: Data summarised from J. E. Huheey et al., Inorganic Chemistry, 4th ed. (New York: HarperCollins, 1993) [1] (https://bcs.whfreeman.com/WebPub/Chemistry/raynercanham6e/Appendices/Rayner-Canham%205e%20Appendix%205%20-%20Electron%20Affi%20nities%20of%20Selected%20Nonmetals.pdf)
75. According to NIST as concerns Boron trifluoride (http://webbook.nist.gov/cgi/cbook.cgi?ID=C7637072&Mask=20#ref-1), the Magnetron method, lacking mass analysis, is not considered reliable.

See also