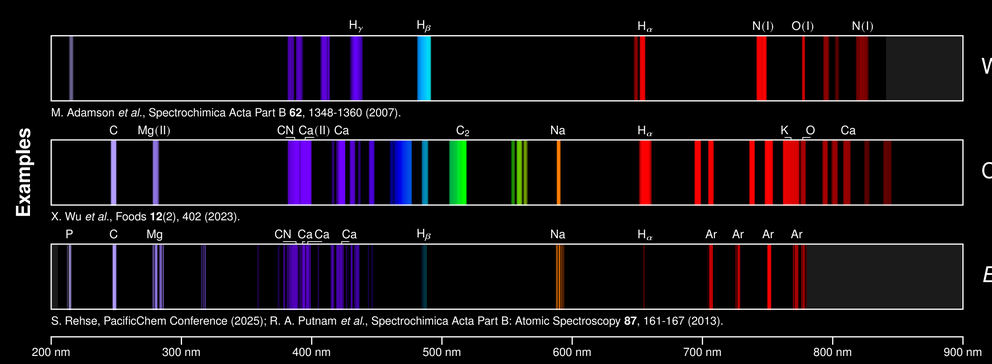
Periodic Table of LIBS Spectra

Laser-**I**nduced **B**reakdown **S**pectroscopy



Group

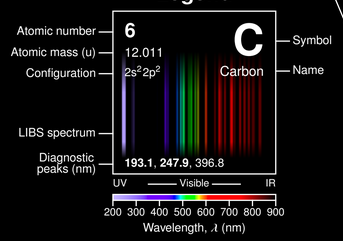
Period	1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIII	8	9 VIII	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	1 H 1.008 $1s^1$ Hydrogen 656.3																	2 He 4.0026 $1s^2$ Helium 587.6, 388.9
2	3 Li 6.94 $2s^1$ Lithium 670.8, 610.4, 323.3	4 Be 9.0122 $2s^2$ Beryllium 313.0, 234.9, 467.3											5 B 10.81 $2s^2 2p^1$ Boron 249.8, 345.1	6 C 12.011 $2s^2 2p^2$ Carbon 193.1, 247.9, 396.8	7 N 14.007 $2s^2 2p^3$ Nitrogen 746.8, 821.1, 500.5, 444.7	8 O 15.999 $2s^2 2p^4$ Oxygen 777.2, 777.4, 777.5	9 F 18.998 $2s^2 2p^5$ Fluorine 685.6, 690.2, 687.0, 691.0	10 Ne 20.180 $2s^2 2p^6$ Neon
3	11 Na 22.990 $3s^1$ Sodium 589.0, 589.6	12 Mg 24.305 $3s^2$ Magnesium 285.2, 279.6, 279.8, 280.3											13 Al 26.982 $3s^2 3p^1$ Aluminum 396.1, 309.3, 308.2, 394.4	14 Si 28.085 $3s^2 3p^2$ Silicon 251.6, 288.2, 243.5, 390.6	15 P 30.974 $3s^2 3p^3$ Phosphorus 213.6, 214.9, 253.6, 255.3	16 S 32.06 $3s^2 3p^4$ Sulfur 180.7, 545.4, 869.5	17 Cl 35.45 $3s^2 3p^5$ Chlorine 837.6	18 Ar 39.948 $3s^2 3p^6$ Argon 763.5, 706.7, 696.5
4	19 K 39.098 $4s^1$ Potassium 766.5, 769.9, 404.4	20 Ca 40.078 $4s^2$ Calcium 422.7, 393.0, 318.0, 315.9	21 Sc 44.956 $3d^1 4s^2$ Scandium 361.4	22 Ti 47.867 $3d^2 4s^2$ Titanium 334.9, 323.5, 498.2	23 V 50.942 $3d^3 4s^2$ Vanadium 437.9, 411.2	24 Cr 51.996 $3d^5 4s^1$ Chromium 425.4, 520.6, 427.5, 267.7	25 Mn 54.938 $3d^5 4s^2$ Manganese 403.1, 403.3, 403.4, 294.9	26 Fe 55.845 $3d^6 4s^2$ Iron 302.1, 404.6, 427.2	27 Co 58.933 $3d^7 4s^2$ Cobalt 345.4, 351.0, 241.6	28 Ni 58.693 $3d^8 4s^2$ Nickel 352.4, 341.5, 361.9, 349.3	29 Cu 63.546 $3d^{10} 4s^1$ Copper 324.7, 327.4, 521.8, 406.3	30 Zn 65.38 $3d^{10} 4s^2$ Zinc 334.5, 481.1, 330.2, 472.2	31 Ga 69.723 $4s^2 4p^1$ Gallium 294.4, 417.2, 287.4, 403.3	32 Ge 72.630 $4s^2 4p^2$ Germanium 265.1, 303.9, 271.0, 422.7	33 As 74.922 $4s^2 4p^3$ Arsenic 278.0, 286.0, 235.0	34 Se 78.971 $4s^2 4p^4$ Selenium	35 Br 79.904 $4s^2 4p^5$ Bromine 827.2	36 Kr 83.798 $4s^2 4p^6$ Krypton
5	37 Rb 85.468 $5s^1$ Rubidium 780.0	38 Sr 87.62 $5s^2$ Strontium 407.8, 421.6	39 Y 88.906 $4d^1 5s^2$ Yttrium 467.5, 371.0	40 Zr 91.224 $4d^2 5s^2$ Zirconium	41 Nb 92.906 $4d^4 5s^1$ Niobium 405.9	42 Mo 95.95 $4d^5 5s^1$ Molybdenum 386.4, 550.6, 384.4	43 Tc (98) $4d^5 5s^2$ Technetium 429.7	44 Ru 101.07 $4d^7 5s^1$ Ruthenium 290.9	45 Rh 102.91 $4d^8 5s^1$ Rhodium 343.5, 339.7	46 Pd 106.42 $4d^{10}$ Palladium 340.5, 351.7	47 Ag 107.87 $4d^{10} 5s^1$ Silver 328.1, 338.3, 546.6, 520.9	48 Cd 112.41 $4d^{10} 5s^2$ Cadmium 228.8, 361.1, 508.6, 326.1	49 In 114.82 $5s^2 5p^1$ Indium 451.1	50 Sn 118.71 $5s^2 5p^2$ Tin 284.0, 303.4, 286.4	51 Sb 121.76 $5s^2 5p^3$ Antimony 323.2, 259.8	52 Te 127.60 $5s^2 5p^4$ Tellurium 238.6, 238.3, 253.1	53 I 126.90 $5s^2 5p^5$ Iodine 746.9	54 Xe 131.29 $5s^2 5p^6$ Xenon
6	55 Cs 132.91 $6s^1$ Cesium 852.1	56 Ba 137.33 $6s^2$ Barium 553.5, 455.4, 413.1, 389.2	72 Hf 178.49 $4f^{14} 5d^2 6s^2$ Hafnium 368.2, 417.5	73 Ta 180.95 $4f^{14} 5d^3 6s^2$ Tantalum 240.1, 468.2	74 W 183.84 $4f^{14} 5d^4 6s^2$ Tungsten 429.5, 505.3, 259.9, 434.8	75 Re 186.21 $4f^{14} 5d^5 6s^2$ Rhenium 451.3, 346.1, 488.9, 527.6	76 Os 190.23 $4f^{14} 5d^6 6s^2$ Osmium	77 Ir 192.22 $4f^{14} 5d^7 6s^2$ Iridium	78 Pt 195.08 $4f^{14} 5d^9 6s^1$ Platinum 274.8, 396.6	79 Au 196.97 $4f^{14} 5d^{10} 6s^1$ Gold 242.8, 267.6, 312.3	80 Hg 200.59 $4f^{14} 5d^{10} 6s^2$ Mercury 253.7, 435.8	81 Tl 204.38 $6s^2 6p^1$ Thallium 535.0	82 Pb 207.2 $6s^2 6p^2$ Lead 405.8, 368.4	83 Bi 208.98 $6s^2 6p^3$ Bismuth 306.8, 302.5, 293.8, 298.9	84 Po (209) $6s^2 6p^4$ Polonium	85 At (210) $6s^2 6p^5$ Astatine	86 Rn (222) $6s^2 6p^6$ Radon
7	87 Fr (223) $7s^1$ Francium	88 Ra (226) $7s^2$ Radium	104 Rf (267) $6d^2 7s^2$ Rutherfordium	105 Db (268) $6d^3 7s^2$ Dubnium	106 Sg (269) $6d^4 7s^2$ Seaborgium	107 Bh (270) $6d^5 7s^2$ Bohrium	108 Hs (277) $6d^6 7s^2$ Hassium	109 Mt (278) $6d^7 7s^2$ Meitnerium	110 Ds (281) $6d^8 7s^2$ Darmstadtium	111 Rg (282) $6d^9 7s^2$ Roentgenium	112 Cn (285) $6d^{10} 7s^2$ Copernicium	113 Nh (286) $7s^2 7p^1$ Nihonium	114 Fl (289) $7s^2 7p^2$ Flerovium	115 Mc (290) $7s^2 7p^3$ Moscovium	116 Lv (293) $7s^2 7p^4$ Livermorium	117 Ts (294) $7s^2 7p^5$ Tennessine	118 Og (294) $7s^2 7p^6$ Oganesson	

Diagnostic peak data from AtomTrace LIBS Database.

Lanthanides and Actinides

57 La 138.91 $5d^1 6s^2$ Lanthanum 394.9, 333.8, 338.1	58 Ce 140.12 $4f^1 5d^1 6s^2$ Cerium 394.3, 560.1, 569.7, 457.2	59 Pr 140.91 $4f^3 6s^2$ Praseodymium 495.1, 410.1, 417.9, 391.9	60 Nd 144.24 $4f^4 6s^2$ Neodymium 488.4, 489.7, 430.4, 423.2	61 Pm (145) $4f^5 6s^2$ Promethium	62 Sm 150.36 $4f^6 6s^2$ Samarium 491.0, 551.6, 392.2, 476.0	63 Eu 151.96 $4f^7 6s^2$ Europium 462.7, 466.2, 397.2, 443.6	64 Gd 157.25 $4f^7 5d^1 6s^2$ Gadolinium 419.1, 409.9, 367.1	65 Tb 158.93 $4f^9 6s^2$ Terbium 384.9	66 Dy 162.50 $4f^{10} 6s^2$ Dysprosium 353.2	67 Ho 164.93 $4f^{11} 6s^2$ Holmium	68 Er 167.26 $4f^{12} 6s^2$ Erbium 349.9	69 Tm 168.93 $4f^{13} 6s^2$ Thulium 388.3	70 Yb 173.05 $4f^{14} 6s^2$ Ytterbium 398.8, 328.9, 369.4	71 Lu 174.97 $4f^{14} 5d^1 6s^2$ Lutetium 291.1
89 Ac (227) $6d^1 7s^2$ Actinium	90 Th 232.04 $6d^2 7s^2$ Thorium 438.2, 411.7, 439.1	91 Pa 231.04 $5f^2 6d^1 7s^2$ Protactinium	92 U 238.03 $5f^3 6d^1 7s^2$ Uranium 367.0, 409.0, 454.4	93 Np (237) $5f^4 6d^1 7s^2$ Neptunium	94 Pu (244) $5f^6 7s^2$ Plutonium	95 Am (243) $5f^7 7s^2$ Americium	96 Cm (247) $5f^7 6d^1 7s^2$ Curium	97 Bk (247) $5f^9 7s^2$ Berkelium	98 Cf (251) $5f^{10} 7s^2$ Californium	99 Es (252) $5f^{11} 7s^2$ Einsteinium	100 Fm (257) $5f^{12} 7s^2$ Fermium	101 Md (258) $5f^{13} 7s^2$ Mendelevium	102 No (259) $5f^{14} 7s^2$ Nobelium	103 Lr (266) $5f^{14} 7s^2 7p^1$ Lawrencium

Legend



Spectral data from Kramida, A., Olsen, K. and Ralchenko, Yu. LIBS Database. NIST, Gaithersburg, MD. Saha/LTE synthetic spectra. Parameters: λ = 200–900 nm; T_e = 1 eV; N_e=10^{17} cm^{-3}; R = 1000; q_{max} = 2; I_{min} = 0.01; s_{int} = 1 (photon count); $n_{display}$ = element; $f_{display}$ = asinh; c_{color} = hue; $c_{display}$ = 0.15; Δx_{FWHM} = 8 px; m_{edge} = 1; w_{UV} = 0.5; d_{IR} = 1; g = 80