

Is the chemistry of lawrencium peculiar?

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The Periodic Table (PT) is about chemistry. Lawrencium (Lr, $Z = 103$) is a short-lived man-made element. Its position in the PT had been debated for some time.[1] Recent experimental work [2] confirmed the theoretical predictions of its ground state,[3] which is different from that of its lanthanide counterpart lutetium. Lr is $7s^2(7p_{1/2})^1$, not $7s^26d^1$. In this study, we find that lawrencium atomic ionization potentials and molecular electronic structures are similar to lutetium in various regards. The molecular systems considered include hydrides, trichlorides, monocarbonyls and other organometallic molecules, from zero- to trivalent lawrencium[4].

We conclude that the peculiar atomic ground state of Lr does *not* lead to special chemistry, thus further supporting the current position of lawrencium in the PT.

Period 1 Periodic Table 1-172 18 Orbitals

1	1 H	2											13	14	15	16	17	2 He	1s
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne	2s2p
3	11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	3s3p
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	4s3d4p
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	5s4d5p
6	55 Cs	56 Ba	57- La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	6s5d6p
7	87 Fr	88 Ra	89- Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og	7s6d7p
8	119	120	121-	156	157	158	159	160	161	162	163	164	139	140	169	170	171	172	8s7d8p
9	165	166											167	168					9s9p

6	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	4f
7	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	5f
8	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	6f

8	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	5g
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[2] T. K. Sato, M. Asai, A. Borschevsky, T. Stora, N. Sato, Y. Kaneya, K. Tsukada, Ch. E. Düllmann, K., Eberhardt, E. Eliav, S. Ichikawa, U. Kaldor, J. V. Kratz, S. Miyashita, Y. Nagame, K. Ooe, A. Osa, D. Renisch, J. Runke, M. Schädel, O. Thörle-Pospiech, A. Toyoshima and N. Trautmann, *Nature*, 2015, **520**, 209-211.

[3] J. P. Desclaux, B. Fricke, *J. Physique*, 1980, **41**, 943-945.

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