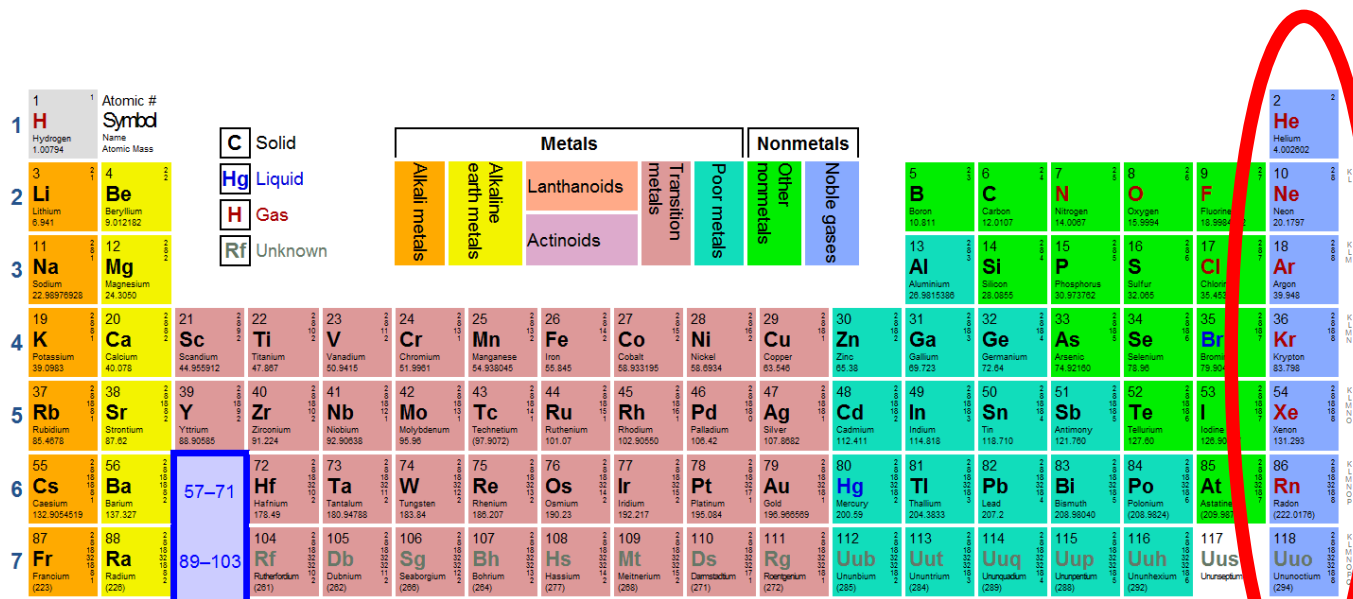


# Nuclear Shell Model & Spin-Orbit Coupling

## Motivation: Atomic Shell Model ... the periodic table



most chemically stable elements have filled shells

“magic” numbers:  
2, 10, 18, 36, 54, 86

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

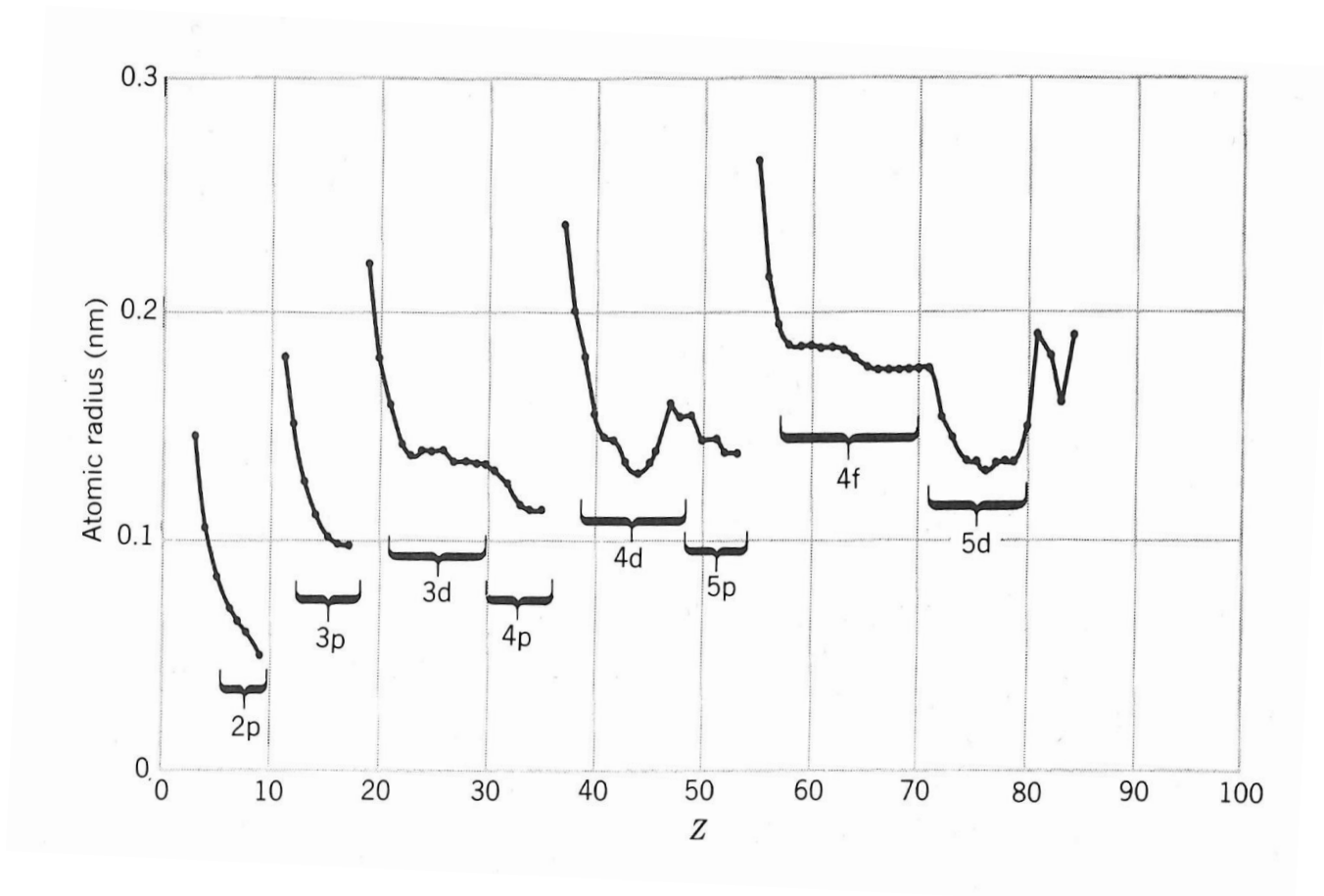
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57 La Lanthanum 138.90547	58 Ce Cerium 140.116	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.242	61 Pm Promethium (145)	62 Sm Samarium 151.964	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92535	66 Dy Dysprosium 162.500	67 Ho Holmium 164.93032	68 Er Erbium 167.259	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.9688
89 Ac Actinium (227)	90 Th Thorium 232.03806	91 Pa Protactinium 231.03688	92 U Uranium 238.02891	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

# *Nuclear Shell Model & Spin-Orbit Coupling*

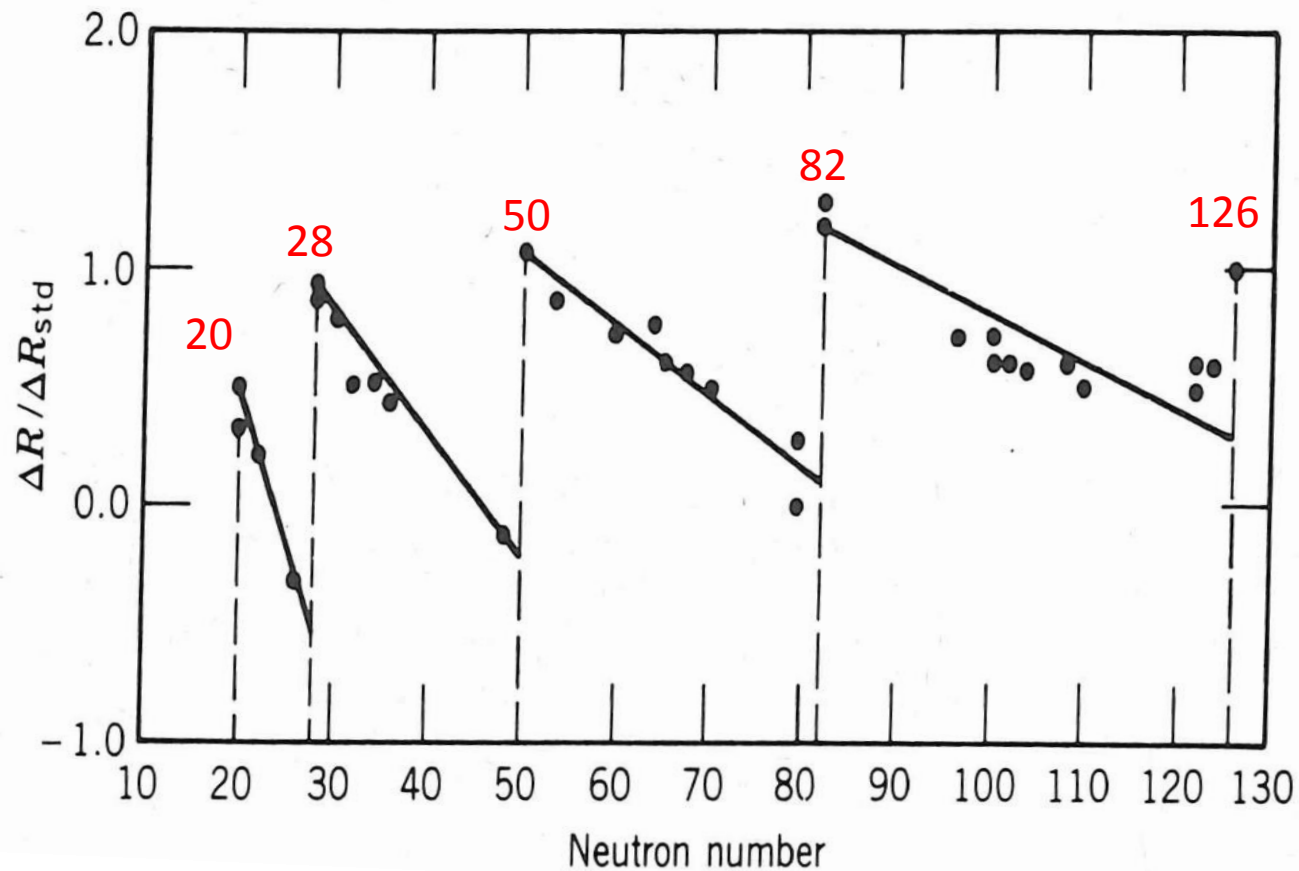
Atomic radius vs. electron number



[figure from *Introductory Nuclear Physics* by K. S. Krane]

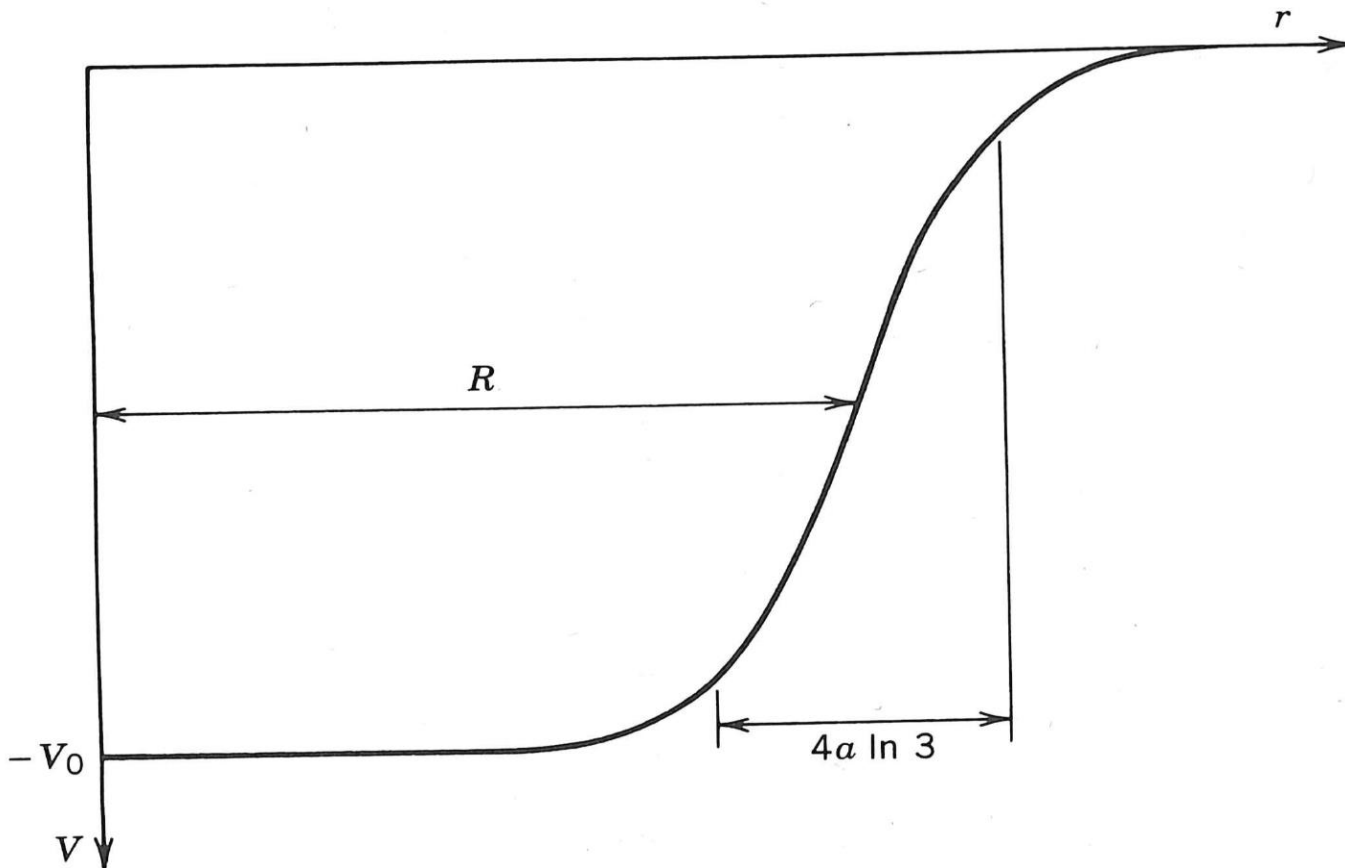
# Nuclear Shell Model & Spin-Orbit Coupling

nuclear radius change vs. neutron number



# Nuclear Shell Model & Spin-Orbit Coupling

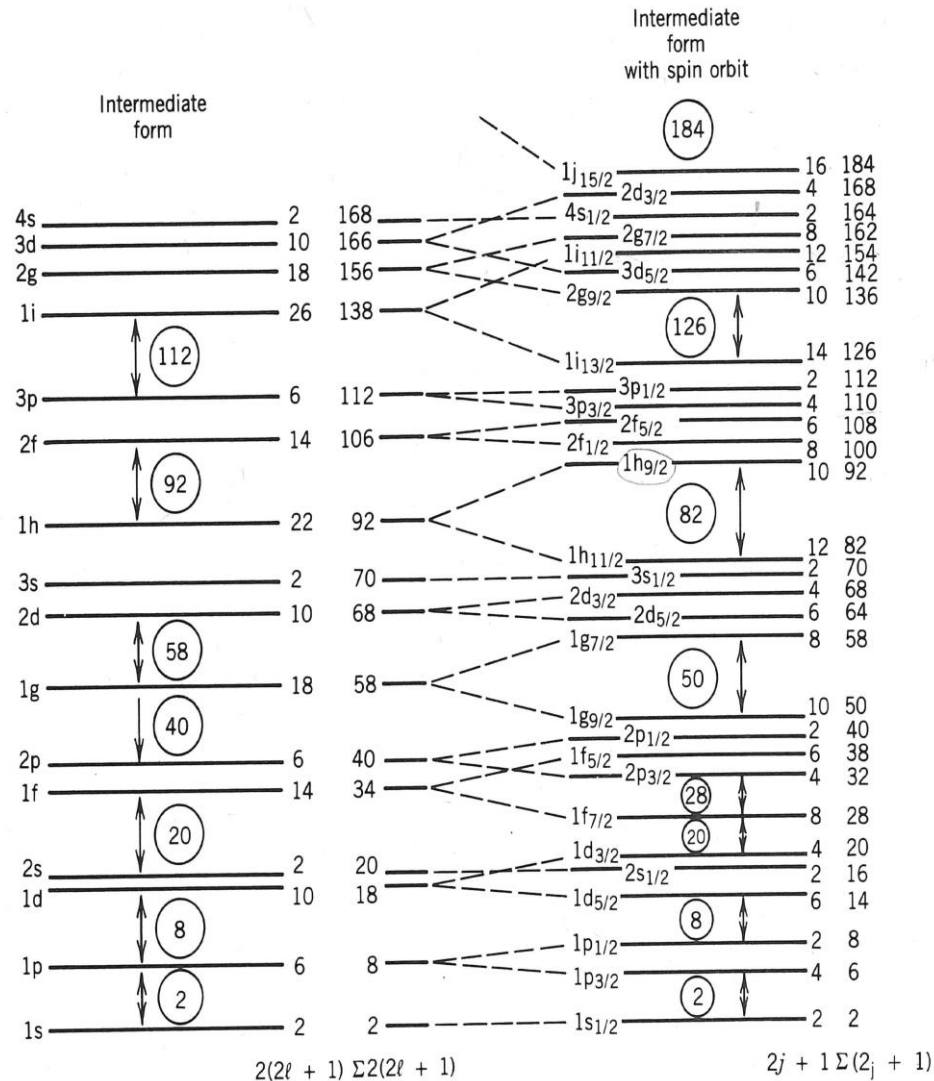
Nuclear shell model potential:  
self-consistent potential = nuclear density



[figure from *Introductory Nuclear Physics* by K. S. Krane]

# Nuclear Shell Model & Spin-Orbit Coupling

## Nuclear shell model filling: magic numbers



[figure from *Introductory Nuclear Physics* by K. S. Krane]