Closed shells are extra stable because for a few particles outside a closed shell not much potential has been built up.

This works to explain the magic numbers 2, 8, 20.

We could explain this if the $j = \frac{3}{2}$, $n = 3$ state would be below the other $n = 3$ states.

From atomic physics we know that the spin-orbit force lifts the degeneracy of the different spin states.

10c) Spin-Orbit Force

\[ H_{LS} = \frac{1}{2m_e c^2} \frac{1}{r} \frac{dV_{e-cr}}{dr} L \cdot S \]

\[ \xi < 0 \]

\[ \equiv - \text{L} \cdot \text{S} \quad \text{L} \cdot \text{S} > 0 \]

\[ (L \cdot S) = \frac{1}{2} (L + S)^2 - \frac{1}{2} L^2 - \frac{1}{2} S^2 \]

\[ = \frac{1}{2} \frac{L^2}{2} - \frac{1}{2} \frac{L^2}{2} - \frac{1}{2} \frac{S^2}{2} \]