the general science journal

Helium and Lithium Energy Equations II

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If wave-particle duality is valid, there must exist a correct explanation for atomic physics with electrons as classical particles. This explanation is best and easier than the quantum mechanics one.
The microcosm is equal to the macrocosm, the atoms are just like solar systems.

For the helium atom, the orbits of the electrons are two minimums of the energy:

$$\frac{dE}{dN} = f(N)(N^2 - (N_1 + N_2)N + N_1 N_2) = 0$$

For the hydrogen N = 137.036, the inverse fine structure constant.
One partial energy (kinetic plus potential):

$$E_x = -\frac{m_e c^2}{2N^2} \quad \Leftrightarrow \quad \frac{dE_x}{dN} = \frac{m_e c^2}{N^3} \quad \Leftrightarrow \quad f(N) = \frac{m_e c^2}{N^5} \quad \Leftrightarrow$$

$$\Leftrightarrow \qquad \frac{dE}{dN} = \frac{m_e c^2}{N^3} - \frac{(N_1 + N_2) m_e c^2}{N^4} + \frac{N_1 N_2 m_e c^2}{N^5}$$

Ionization energies:

$$E = m_e c^2 \left(-\frac{1}{2N^2} + \frac{N_1 + N_2}{3N^3} - \frac{N_1 N_2}{4N^4} + C \right)$$

Counting from the nucleus:

$$E_1 = -8.72 \times 10^{-18} J \; ; \quad E_2 = -3.94 \times 10^{-18} J$$

$$\frac{E_1}{m_e c^2} = \frac{-6N_1 + 4(N_1 + N_2) - 3N_2}{12 N_1^{\,3}} + C_1 = -1.065 \times 10^{-4}$$

$$\frac{E_2}{m_e c^2} = \frac{-6N_2 + 4(N_1 + N_2) - 3N_1}{12 N_2^{\,3}} + C_2 = -4.812 \times 10^{-5}$$

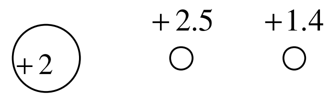
$$C_1 = 0 \; ; \qquad C_2 = -\frac{1}{2 \times 137^2} \; ; \qquad C_2 m_e c^2 = -13.6 eV$$

$$\begin{cases} -1.065\times10^{-4} = \dfrac{N_2 - 2N_1}{12{N_1}^3} \\ -4.812\times10^{-5} = \dfrac{N_1 - 2N_2}{12{N_2}^3} - \dfrac{1}{2\times137^2} \end{cases}$$

$$N_1 = 54.7\,; \quad N_2 = -99.4$$

Effective charge:

$$Z_{ef} = \frac{137}{N}$$



Orbital frequency of the exterior electron:

$$f_{OR} = \frac{c}{x_e {N_2}^2} = 1.25\times10^{16}\,Hz$$

c = light speed ; $x_e =$ Compton wavelength of the electron

Rydberg frequency for helium:

$$f_R = \frac{f_{OR}}{2} = 6.25\times10^{15}$$

The electron has a double orbit like in hydrogen

$$\frac{1}{\lambda_R} = \frac{f_R}{c} = 2.1\times10^7$$

One spectral wavelength:

$$\frac{1}{\lambda} = 2.1\times10^7\left(\frac{1}{3^2} - \frac{1}{8^2}\right) \quad ; \qquad \lambda = 498.7\times10^{-9}\,m$$

Experimental value:

$$\lambda = 501.5nm$$

Electron radius:

1º --- $\quad R_1 = \dfrac{N_1 x_e}{2\pi} = 2.1\times10^{-11}\,m$

2º --- $\quad R_2 = 3.8\times10^{-11}\,m$

The two electrons are not in the same orbit.

$$R = \frac{R_B}{Z_{ef}} \;;\qquad R_B = \text{ Bohr radius}$$

Lithium

$$\frac{dE}{dN} = f(N)(N^3 - (N_1 + N_2 + N_3)N^2 + (N_1N_2 + N_1N_3 + N_2N_3)N - N_1N_2N_3) = 0$$

$$-f(N)(N_1 + N_2 + N_3)N^2 = \frac{m_e c^2}{N^3} \qquad \Leftrightarrow$$

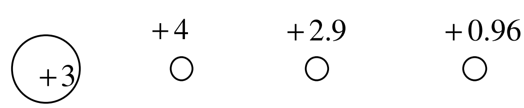
$$E_1 = -1.96\times10^{-17}\,J\;;\quad E_2 = -1.21\times10^{-17}\,J\;;\quad E_3 = -8.64\times10^{-19}\,J$$

$$\begin{cases} -2.4\times10^{-4} = \dfrac{6N_1^{\,2} - 2N_1N_2 - 2N_1N_3 + N_2N_3}{12N_1^{\,3}(N_1 + N_2 + N_3)} + C_1 \\ -1.48\times10^{-4} = \dfrac{6N_2^{\,2} - 2N_1N_2 - 2N_2N_3 + N_1N_3}{12N_2^{\,3}(N_1 + N_2 + N_3)} + C_2 \\ -1.06\times10^{-5} = \dfrac{6N_3^{\,2} - 2N_1N_3 - 2N_2N_3 + N_1N_2}{12N_3^{\,3}(N_1 + N_2 + N_3)} + C_3 \end{cases}$$

$$C_1 = 0\;;\quad C_2 = \frac{+3}{2\times137^2}\;;\qquad C_3 = \frac{-3}{2\times137^2}$$

$$N_1 = 48\;;\quad N_2 = 34.4\;;\quad N_3 = -143.1$$

Effective charge:



The inner electron has lower energy than the second one.