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Fundamental Orbit of the Electron in Hydrogen

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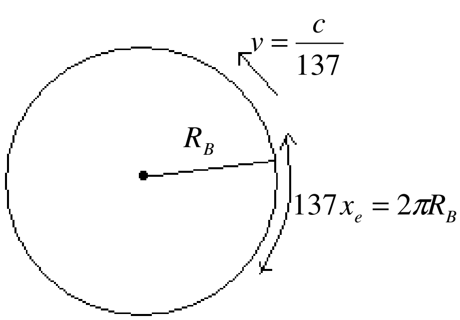

$x_e = 2.426 \times 10^{-12} m$; $R_B = \frac{137 x_e}{2\pi}$ -- Bohr radius

Kinetic energy:

$$E_k = \frac{1}{2} m_e \frac{c^2}{137^2} = 13.6eV$$

Momentum:

$$p = m_e \frac{c}{137} = 1.9935 \times 10^{-24} kgm/s$$

Magnetic moment:

$$\mu = 9.2848 \times 10^{-24} Am^2$$

$Am^2 = kgm/s$; $\frac{\mu}{p} = 4.6575$

The magnetic moment is only a momentum.
Something is wrong with the magnetic moment value.

Why 137? Because is the limit of the lowest total energy:

Potential energy:

$$E_P = m_e g R_B \quad \text{and} \quad g = \frac{q_e^{\ 2}}{4\pi.\varepsilon_0 R_B^{\ 2} m_e}$$

$$E_P = \frac{q_e^{\ 2}}{2\varepsilon_0 137 x_e}$$

Total energy:

$$E = \frac{q_e^{\ 2}}{2\varepsilon_0 x_e n} + \frac{m_e c^2}{2n^2}$$

For a minimum:

$$\frac{dE}{dn} = 0 \qquad \Leftrightarrow$$

$$\frac{dE}{dn} = \frac{-q_e^{\ 2}}{2\varepsilon_0 x_e n^2} - \frac{m_e c^2}{n^3} = 0 \qquad \Leftrightarrow$$

$$n = -\frac{2m_e c^2 \varepsilon_0 x_e}{q_e^{\ 2}} \quad ; \qquad n = -137.038$$

For a stable orbit the value must be an integer n = 137.0000