Quantum Mechanics

Classical electron radius

We could get a classical estimate of the electron radius if we match the electrostatic energy due to its charge and the relativistic energy due to its mass:

$$C\frac{e^2}{4\pi\varepsilon_0 r} = mc^2$$

Here the value of C depends on the geometry of the distribution of charge. For example, if we imagine that the charge is all on the surface of a sphere, C = ½, but we can ignore that factor and take C = 1 for the estimation, which gives us:

$$\frac{e^2}{4\pi\varepsilon_0 r} = mc^2 \rightarrow r = \frac{e^2}{4\pi\varepsilon_0 mc^2} = 2.81\times10^{-15}\,\mathrm{m}$$

This is of the order of the size of nuclei.