de Broglie and the Stability of the Atom

Say an electron in an atom, in order to lower its potential energy, sought to fall into the positively-charged nucleus. This would require the de Broglie wavelength of the electron to be similar to the diameter of the nucleus, which is around 10^{-15} m.

How fast must the electron travel to shorten its de Broglie wavelength to 10^{-15} m?

$$\lambda = \frac{h}{mv} \Rightarrow v = \frac{h}{m\lambda}$$

$$v = \left(\frac{6.626\times10^{-34}\,\text{J s}}{\text{particle}}\right)\left(\frac{\text{particle}}{9.109\times10^{-31}\,\text{kg}}\right)\left(\frac{1}{10^{-15}\,\text{m}}\right)\left(\frac{\text{kg m}^2\,\text{s}^{-2}}{1\,\text{J}}\right)$$

$v = 10^{12}$ m s^{-1}, which is greater than the speed of light ($c = 3\times10^{8}$ m s^{-1}). There is no experimental evidence that anything can move faster than light.

∴ an electron cannot move fast enough to collapse into the nucleus

Also note (since Kinetic energy (KE) = $\frac{1}{2}mv^2$) that shortening the de Broglie wavelength of a particle increases its kinetic energy.