

216 (b): Comparison of Potentials for Gravitation
and for the H Atom.

The new universal force law is:

$$F(r) = -\frac{k}{r^2} \left(x^2 - (x^2 - 1) \frac{d}{dr} \right) \quad - (1)$$

and the new gravitational potential is:

$$U(r) = -\frac{kx^2}{r} + \frac{(x^2 - 1)kd}{2r^2} \quad - (2)$$

where $k = \frac{L^2}{dm} \quad - (3)$

The effective potential of the Schrodinger equation is:

$$U(r) = -\frac{e^2}{4\pi\epsilon_0 r} + \frac{l(l+1)\hbar^2}{2mr^2} \quad - (4)$$

The new gravitational potential (2) and the potential of the H atom Schrodinger equation have the same functional dependence on r :

$$U(r) = -\frac{A}{r} + \frac{B}{r^2} \quad - (5)$$

provided that $x > 1$.