

9.18: Particle in an Infinite Spherical Potential Well

Reduced mass: $\mu = 1$

Angular momentum: $L = 2$

Integration limit: $r_{\max} = 1$

Solve Schrödinger's equation numerically. Use Mathcad's ODE solve block:

Given

$$\frac{-1}{2\mu} \frac{d^2}{dr^2} \psi(r) - \frac{1}{r\mu} \frac{d}{dr} \psi(r) + \left[\frac{L(L+1)}{2\mu r^2} \right] \psi(r) = E\psi(r) \quad \psi(.0001) = .1 \quad \psi'(.0001) = 0$$

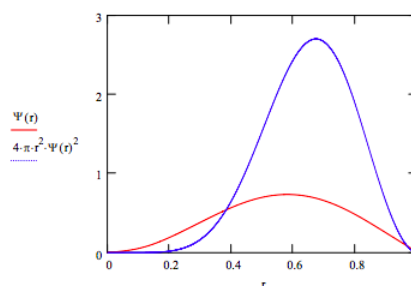
$$\psi = \text{Odesolve}(r, r_{\max})$$

Normalize the wavefunction:

$$\psi(r) = \left(\int_0^{r_{\max}} \psi(r)^2 4\pi r^2 dr \right)^{-\frac{1}{2}} \psi(r)$$

Energy guess: $E = 16.51$

$r = 0, .001 \dots r_{\max}$



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