Physics GEMS MAS490
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Homework #8
Due 4/15/99

1] In the absence of an external potential, the Schrödinger wave equation is given as

$$i\hbar \frac{\partial \psi}{\partial t} = \frac{-\hbar^2}{2m} \frac{\partial^2 \psi}{\partial x^2} \quad \text{where } \psi = \psi(x,t)$$

Find the most general solution $\psi(x,t)$. What happens to the wavefunction as a function of space and time?

2] Imagine that the Schrödinger Equation has an additional term arising from, say, a gravitational (energy-energy) interaction to give:

$$i\hbar \frac{\partial \psi}{\partial t} = \frac{-\hbar^2}{2m} \frac{\partial^2 \psi}{\partial x^2} - \kappa |\psi|^2 \psi$$

Find a solution to the ~~modified~~ nonlinear Schrödinger Equation.

3] What is the consequence to quantum mechanics, and to the solutions we find, of the additional term in problem 2.