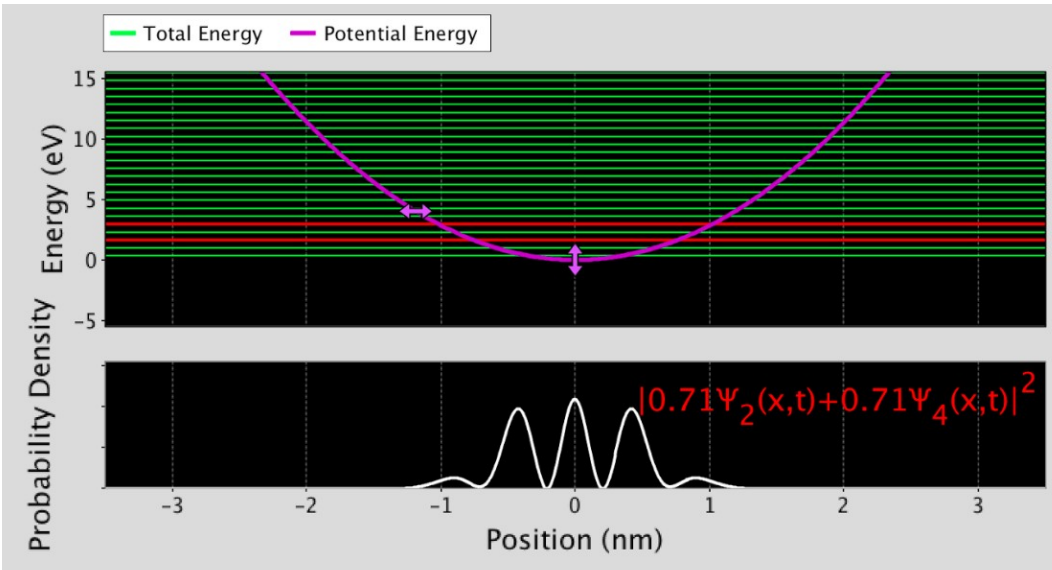
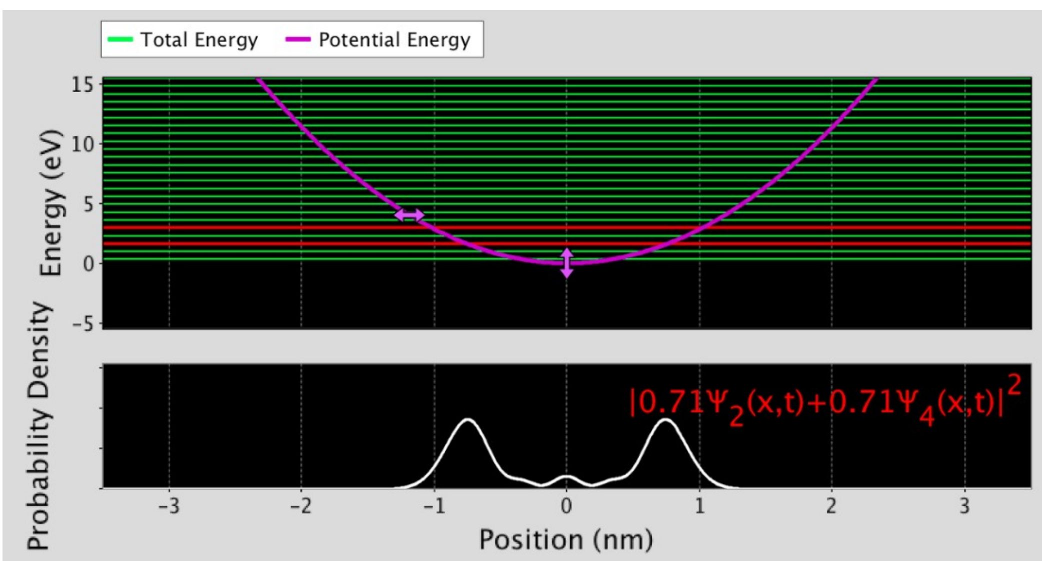
Psi> = 1/sqrt(2)|2> + 1/sqrt(2)|4>

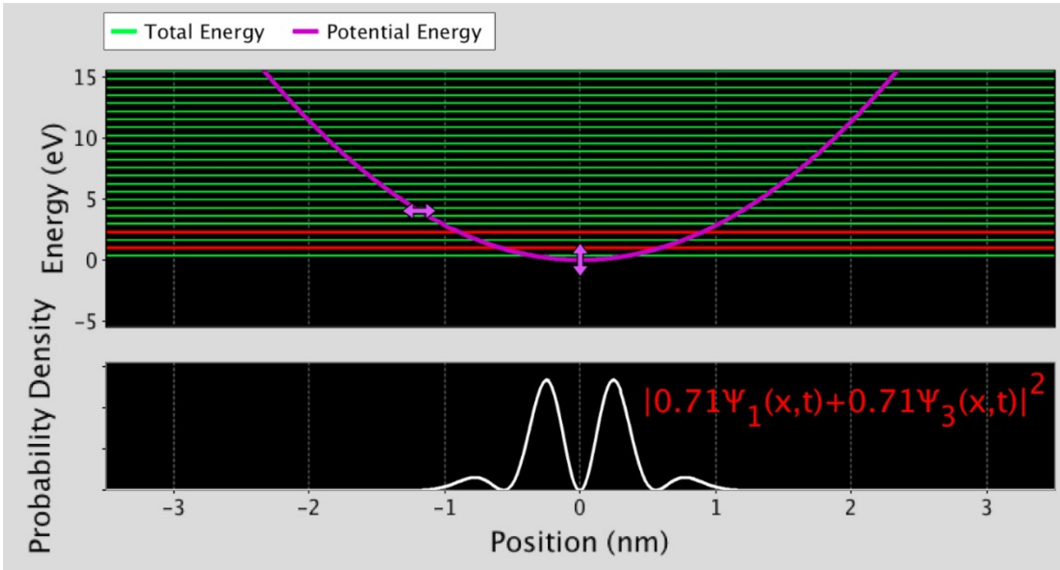
a) The oscillation of the probability density for an even superposition of even states was symmetric about x = 0. Thus we expect <x>=0. When the movie played, it looked like standing waves (i.e. no left or right motion) and the probability density was symmetric for all t. Thus we expect <p> = 0.

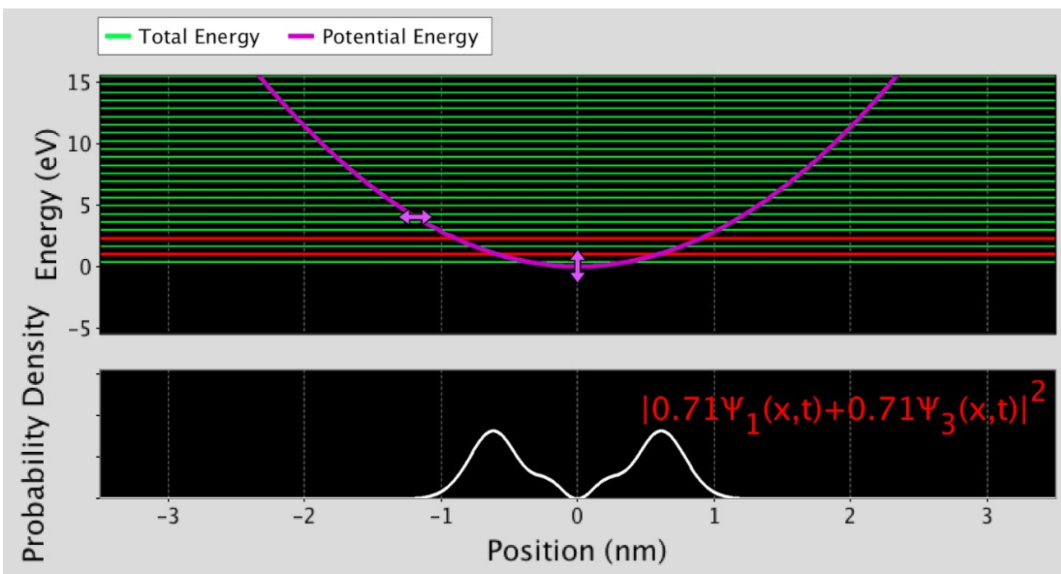




|Psi> = 1/sqrt(2)|1> + 1/sqrt(2)|3>

b) Expectation values again both appear zero as we see standing waves in the probability density. Thus <x> = 0, <p> = 0. This makes sense for <x> at least as x is an odd function and |1> and |3> are odd. Thus the integral is odd and an odd integral over all space is zero.





|Psi> = 1/sqrt(2)|2> + 1/sqrt(2)|3>

c) This has both nonzero <x> and <p>. Both expectation values are time dependent as evidenced by the asymmetric, back-and-forth nature of the probability density. The “envelope” of the wavefunction can be seen to move to the left and right.