2. Consider two indistinguishable nonrelativistic **bosons** of mass m, constrained to move one-dimensionally around a circle of perimeter L. The particles each have **spin-1**, and they interact via a spin-independent potential that is a Dirac delta-function: $V(x_1, x_2) = g\delta(x_1 - x_2)$, where x_i is the position on the circle (in arc length) of particle i.

(a) First look at zero interaction, $g = 0$, being careful to only include states of the correct symmetry for these indistinguishable spin-1 bosons. What are the energies and the degeneracies of the ground state and of the lowest-energy excited state? In each case, say what value(s) of total spin these states may have.

(b) Add a weak interaction $g \neq 0$. Now what are the degeneracies of the ground state and of the lowest-energy excited state? For each sign of g, say what value(s) of total spin these states may have.

(c) Solve for a two-particle ground state wavefunction, including showing the spin state. Do this first at $g = 0$, and then all other $g \neq 0$. In the latter case you may leave one parameter in the wavefunction specified only as the solution to an equation that you will not be able to solve analytically.