Physics 402
Spring 2022
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Discussion Worksheet for October 10, 2022

1. The Slater determinant is a very handy way to construct antisymmetric wavefunctions of N-identical particle systems. Suppose you want to distribute particles into states *a*, *b*, *c*, etc. One forms rows of a determinant made up of $\psi_a(1) \quad \psi_b(1) \quad \psi_c(1) \ldots$ followed by the next row, written as $\psi_a(2) \quad \psi_b(2) \quad \psi_c(2) \ldots$, where "1" and "2" represent the coordinates of particle 1, particle 2, etc. Multiply the determinant by $1/\sqrt{N!}$ for normalization.

a) Form the antisymmetric wavefunction for two identical particles in states *a* and *b*.
b) Form the antisymmetric wavefunction for three identical particles in states *a, b* and *c*.
c) For the three identical particle case, see what happens if *a* and *c* are the same state.

2. Consider a spin-1/2 particle. It is known to be in the "up" state after a measurement of S_z. Show that in this state $\langle S_x \rangle = \langle S_y \rangle = 0$. Explain this result geometrically.