Review topics for the final exam

April 25, 2013

1 Angular momentum

1. Demonstrate the fundamental commutation relations for a set of rotation generators

2. Rotate something; a vector and/or spinor, using SO(3) or SU(2)

3. Demonstrate relations among J^2, J_z, J_+, J_-; act on or normalize $|j, m\rangle$

4. ***Add angular momenta $|j_1, m_1\rangle|j_2, m_2\rangle \longrightarrow |j, m\rangle$ where $0 \leq j_1, j_2 \leq \frac{3}{2}$

5. **Know the constraints on j, m for any j_1, j_2, m_1, m_2.

6. Irreducible tensor operators; Wigner-Eckart theorem

2 Bell's theorem and quantum entanglement

1. Einstein's argument; Bell's inequality for systems with hidden variables; Mirman's example of a hidden variables device

2. QM/Stern-Gerlach calculation showing the violation of Bell's inequality

3. Explain why this is troubling

4. Show how the wave function encodes our knowledge without encoding things we don't know about the system

3 Symmetry

1. Show that a continuous symmetry of a quantum Hamiltonian leads to conservation of an observable

2. Parity

3. Time reversal (and antiunitary operators)