Physics 618 Tenth Lecture Feb. 17, 2017

Last time we discussed in detail the irreducible finite-dimensional representations of SU(2). Then considering the tensor product of two of them, which represenatations appear in the direct sum, and how to calculate Clebsch-Gordon coefficients for SU(2), which are essentially the elements of the unitary matrix which gives the equivalence between the tensor product and the direct sum. Then we discussed the representation of the finite group elements, including the completeness and orthogonality integrals, and the relation to spherical harmonics and the Wigner-Eckhart theorem that separated the rotational dependence from the reduced matrix element which carries the interesting physics.

We then just mentioned isospin and field operators for proton and neutron creation in quantum field theory, which will lead to ...

Today

We will see that bilinears in these give rise to isospin and the idea that hadronic states form isotopic spin multiplets. We will see that applying the Wigner Eckhart theorem to the scattering amplitude will relate many different scattering processes that can be described by a much smaller number of reduced amplitudes, and we will also see that decomposing the scattering into their reduced elements displays the existance of resonant states. With a hint that larger symmetries might give even more impressive relationships, we take a break from data to ask what we can say about all symmetry groups of this type, which leads us to Chapter 5: Semisimple Compact Lie Groups and their representations. We will see that the kind of analysis we did for finite-dimensional representations of SU(2) will lead not only to how to construct all of these representations for larger groups but also what larger groups there are.

Reminders:

I intend to give you a midterm exam on Tuesday, March 7. I currently think this will cover the material from the beginning through Dynkin diagrams (Chapter 8), but we might modify that as we get closer to the exam.

Homework 5 is due Thursday, Feb. 23.