Physics 618 Sixth Lecture Feb. 3, 2017

On Tuesday we completed our treatment of finite groups. We found many useful concepts, concentrating on those that helped us understand how these groups could be represented by finite dimensional matrices.

Today we make a major shift, looking at groups with an infinite number of elements, but quickly concentrating on groups whose elements are described by a finite number of continuous parameters. These are **Lie** or **topological** groups. The space of the parameters is a **manifold** of some dimension n, which we will take to be finite. The group properties will be largely determined by properties of the group elements close to the identity, so we will describe them in terms of the generators. Here generator means something different from what it meant in finite groups. Here they are the derivatives of the group elements with respect to the parameters, evaluated at the identity. These generators form a **Lie algebra**, whose basic bilinear operation is the commutator. The commutator of two basis vectors in the vector space of the algebra is a linear combination of the basis vectors given by the **structure constants**, and this determines the full multiplication law for the group, and also enables us to classify the possible groups and possible representations.

The material from now until roughly April will be taken from the book by Georgi.

Reminders:

- Homework 3, due Feb. 9, has been posted.