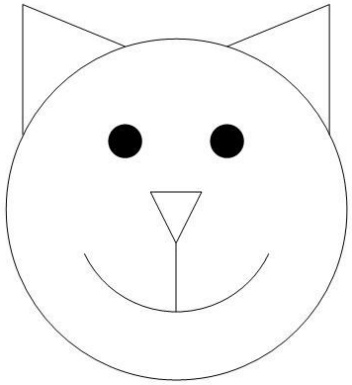
Group Theory



[1]

This course is designed to introduce group theory without any previous training in abstract algebra. The course will introduce the notion of groups with the intention of focusing on properties of Lie groups that have many applications to physics. A list of topics is shown below. At the conclusion of the course, students should be able answer questions like, “Why are there left handed and right handed fermions?,” “Why are there three quarks in a proton and not 2 or 4?,” or “Meow meow, meow meow meow meow?”

Instructor Information

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Useful References

Group Theory: A Physicist’s Survey Pierre Ramond
Lie Algebras in Particle Physics: From Isospin to Unified Theories Howard Georgi
Group Theory for Unified Model Building Richard Slansky

List of topics:

1. Discrete Groups: Group definitions, cyclic groups, product groups, permutation groups, subgroups, quotient groups.
2. Representations of discrete groups: Definitions, Schur's lemmas, characters, Kronecker products
3. Lie Groups Intro: Definitions, Lie algebras, SU(2), Casimirs, ladder operators, representations and products, Lorentz group and other spacetime symmetries
4. Lie Groups of Rank 2 and beyond: SU(3), roots, Cartan matrix, rank 2 Lie algebras, general classification and Dynkin diagrams, fundamental representations
5. Special Topics if time permits

[1] Has no relation to group theory