Title: Representations of noncompact lie groups and quantum groups and their applications in physics.

Outline: We will begin with a review of lie groups algebras and representation theory, starting at whatever level is appropriate for the class. Then we shall study how the noncompact case differs from the classical compact situation.

The goal of the course will be to understand how to use the unitary representations of the lorentz group and its quantum version to construct a model for the quantum theory of general relativity.

The interesting, and little known history of the theory will be covered as well. The work of Dirac and Gelfand will play a prominent role.

The fundamental groups in relativity, namely the lorentz and poincare groups are noncompact, so the representation theory taught in most mathematics courses is inappropriate for them. Thus there is a common gap in the knowledge of most working mathematicians concerning representation theory, which we will attempt to remedy.

The important work of Mackey on induced representations will also be covered.