Speaker: Joe Johnson

Title: An Integration of General Relativity with Quantum Theory and the Standard Model

Abstract: The presentation will begin with a 10-minute student level overview of Lie algebras and their associated transformation groups along with their finite dimensional representations as matrices acting on metric spaces, and their infinite dimensional representations on Hilbert spaces. We discuss how certain Lie algebras form the foundation of modern quantum theory and the current Standard Model in particle physics. Several examples are given. A philosophical basis for this specific mathematical framework is discussed by addressing the power of Lie algebras with differential equations. We propose (1) that the flat space-time metric that defines the traditional covariant Heisenberg algebra commutation rules of quantum theory between the four-vector position and momentum, be generalized to be the space-time dependent Riemann metric following Einsteins equations for general relativity, which determine the metric from the energy-momentum tensor. The metric is then a function of the four-vector position operators which are to be expressed in the position representation. This then allows one (2) to recast the Christoffel, Riemann, Ricci tensors, and Einsteins GR differential equations for the metric as an algebra of commutation relations among the four-vector position and momentum operators (a generalized Lie algebra). This then allows one (3) to generalize the structure constants of the rest of the Poincare algebra with the space-time dependent metric of general relativity tightly integrating it with quantum theory. Finally, (4) we propose that the four-mometum?operator be generalized (to be gauge covariant) to include the intermediate vector bosons of the standard model further generalizing this algebra of observables to include gauge observables. Then the generalized Poincare algebra, extended with a four-vector position operator, and the phenomenological operators of the non-Abelian gauge transformations of the standard model form a larger algebra of observables thus tightly integrating all three domains of fundamental physics. Ways in which this may lead to observable effects are discussed.