Graduate Student PhD Thesis Defense

Title: Diffeomorphisms in Quantum Black Hole Interiors
Speaker: Ian Bornhoeft

Abstract:
I begin with an introduction to canonical Loop Quantum Gravity. I then introduce a notion of residual diffeomorphism covariance in quantum Kantowski-Sachs (KS), describing the interior of a Schwarzschild black hole. Simultaneously, I extend the KS framework to include a Maxwell field. For the case without a Maxwell field, I then solve for the family of Hamiltonian constraint operators satisfying an associated covariance condition, as well as parity invariance, preservation of the Bohr Hilbert space of Loop Quantum KS and a correct (naïve) classical limit. I further explore imposing minimality of the number of terms, and compare the solution with other Hamiltonian constraints proposed for Loop Quantum KS in the literature. In particular, I discuss a lapse recently commonly chosen due to the resulting decoupling of evolution of the two degrees of freedom and exact solubility of the model. I show that such a lapse choice can indeed be quantized as an operator densely defined on the Bohr Hilbert space, and that any such operator, when written as a linear combination of shift operators in the triad representation, must include an infinite number of terms.

Thesis advisor: Dr. Jonathan Engle.