COLLOQUIUM

The Tiger and the Magic Hoop: The Dirac Particle and the Kerr-Newman Spacetime

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In 1965 Ezra (Ted) Newman and a team of graduate students taking his General Relativity class at University of Pittsburgh discovered what is now known as the Kerr-Newman metric. It was the first rotating electrovacuum solution of Einstein-Maxwell system to be found, i.e. a stationary axisymmtric spacetime with mass, charge, and angular momentum. In this joint work with Michael Kiessling, we study Dirac's wave equation for a point electron in the topologically nontrivial, maximal-analytically extended Kerr-Newman spacetime, in the zero-gravity limit. Here, "zero-gravity" means $G \to 0$, where G is Newton's constant of universal gravitation. The following results are obtained: The formal Dirac Hamiltonian on the static spacelike slices is essentially self-adjoint; the spectrum of the self-adjoint extension is symmetric about zero, featuring a continuous spectrum with a gap about zero that, under two smallness conditions, contains a symmetric point spectrum. I will explain how this is connected with a new quantum-mechanical interpretation of the Dirac equation, proposed by us, in which the electron and the positron are not distinct individual particles, but merely two "topological-spin" states of a single, more fundamental particle. (Note: a physics background is not necessary in order to understand this talk!)

The lecture will take place in Thackeray 704 at 3:30pm.
Refreshments will start at 3:00pm.