Contribution ID: **546** Type: **Invited talk in the parallel session**

The point spectrum of the Dirac Hamiltonian on the zero-gravity Kerr-Newmann spacetime

Monday, July 5, 2021 4:30 PM (20 minutes)

In relativistic quantum mechanics, the point spectrum of the Dirac Hamiltonian with Coulomb potential famously agrees with Sommerfeld's fine structure formula for Hydrogen. In the Coulomb approximation, the proton is assumed to only have an electric charge. However, the physical proton also appears to have a magnetic moment. The resulting hyperfine structure of Hydrogen is computed perturbatively. Aiming towards a non-perturbative approach, Pekeris in 1987 proposed taking the Kerr-Newmann spacetime with its ring singularity as a source for the proton's electric charge and magnetic moment. Given the proton's mass and electric charge, the resulting Kerr-Newmann spacetime lies well within the naked singularity sector which possess closed timelike loops. In 2014 Tahvildar-Zadeh showed that the zero-gravity limit of the Kerr-Newmann spacetime (zGKN) produces a topologically nontrivial flat spacetime which is no longer plagued by closed timelike loops. In 2015 Tahvildar-Zadeh and Kiessling studied the Hydrogen problem with Dirac's equation on the zGKN spacetime and found that the Hamiltonian is essentially self-adjoint and contains a nonempty point spectrum. In this talk, we show how some of their ideas can be extended to classify the point spectrum.

Primary authors: LING, Eric (Rutgers University); TAHVILDAR-ZADEH, A. Shadi (Rutgers University); KIESSLING, Michael (Rutgers University, Dept. of Mathematics)

Presenter: LING, Eric (Rutgers University)

Session Classification: Mathematical Problems of Relativistic Physics: Classical and Quantum

Track Classification: Alternative Theories: Mathematical Problems of Relativistic Physics: Classical and Quantum