Dirac's electron and the Kerr-Newman spacetime

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In this talk I present results obtained jointly with A. Shadi Tahvildar- Zadeh. They concern Dirac's equation for a point electron in the maximal analytically extended Kerr--Newman spacetime in its "zero-gravity limit." In contrast to other "zero-gravity" works, our limit does not yield Minkowski's spacetime decorated with the Appell electromagnetic fields with a physically more-than-questionable ultra-singular "disk source", but instead we obtain a topologically nontrivial Sommerfeld space with meromorphic Appell-Sommerfeld fields that diverge mildly at a ring singularity (boundary of the above-mentioned disk). I explain that the Dirac equation is well-posed on this spacetime in the sense that its associated Hamiltonian is essentially self-adjoint, its spectrum is symmetric, consisting of a continuum with a gap centered at zero in which a discrete spectrum is located if two smallness conditions are met. Some generalizations are addressed also. Finally I explain why our work may reveal the enigmatic quantum-mechanical meaning of the Dirac equation.