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Abstract Submitted

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Gravitational Interactions for Dirac Particles and Antiparticles¹

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— The coupling of the Dirac equation to gravity has been a matter of some debate over the last few decades. However, the development of the so-called spin-connection formalism which couples the Dirac particle to a curved space-time background seems to have settled the question. This formalism implies that it is not permissible in a fully relativistic theory to simply add the gravitational potential into the Dirac equation as one would otherwise add the Coulomb potential. Furthermore, the fact that the Dirac equation describes both particles and antiparticles simultaneously is sometimes under-appreciated by the community. In a series of recent papers [Phys. Rev. A 87 (2013) 032101; Phys. Rev. A 88 (2013) 022121; Phys Rev A 90 (2014) 022112; Phys. Rev. A 91 (2015) 022112; Phys. Rev. A 92 (2015) 012101], related questions have been studied in detail. A symmetry relation has been established for the interactions of particles versus antiparticles in relation to their gravitational interactions, firmly establishing the equivalence principle for antiparticles in the sense that if the mass term in the Dirac equation describes the inertial mass of particles and antiparticles (and they have tested to be equal to good accuracy), then the same.

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