

General Relativity and Quantum Cosmology

Non-uniqueness of the Dirac theory in a curved spacetime

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We summarize a recent work on the subject title. The Dirac equation in a curved spacetime depends on a field of coefficients (essentially the Dirac matrices), for which a continuum of different choices are possible. We study the conditions under which a change of the coefficient fields leads to an equivalent Hamiltonian operator H , or to an equivalent energy operator E . In this paper, we focus on the standard version of the gravitational Dirac equation, but the non-uniqueness applies also to our alternative versions. We find that the changes which lead to an equivalent operator H , or respectively to an equivalent operator E , are determined by initial data, or respectively have to make some point-dependent antihermitian matrix vanish. Thus, the vast majority of the possible coefficient changes lead neither to an equivalent operator H , nor to an equivalent operator E , whence a lack of uniqueness. We show that even the Dirac energy spectrum is not unique.

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