

## High Energy Physics - Theory

# Projective Geometry and $\mathcal{PT}$ -Symmetric Dirac Hamiltonian

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The  $(3 + 1)$ -dimensional (generalized) Dirac equation is shown to have the same form as the equation expressing the condition that a given point lies on a given line in 3-dimensional projective space. The resulting Hamiltonian with a  $\gamma_5$  mass term is not Hermitian, but is invariant under the combined transformation of parity reflection  $\mathcal{P}$  and time reversal  $\mathcal{T}$ . When the  $\mathcal{PT}$  symmetry is unbroken, the energy spectrum of the free spin- $\frac{1}{2}$  theory is real, with an appropriately shifted mass.

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