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Relativistic Landau levels via Feynman-Gell-Mann formulation

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The planar motion of spin-1/2 fermions under the influence of a homogeneous magnetic field is described by the Feynman-Gell-Mann formulation of the Dirac equation. The axially symmetric gauge is used for the vector potential in such a way that the Dirac spinor is written in terms of eigenstates of the quiral operator and the third component of the total angular momentum operator. The spinors are split in eigenstates of the third component of the spin operator and the corresponding radial functions obey uncoupled second-order equations similar to the singular harmonic oscillator in the nonrelativistic theory.

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