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Physics of singular self-adjoint extensions of one-dimensional Dirac operator

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We consider boundary conditions (self-adjoint extensions) corresponding to point-like interactions for one-dimensional Dirac operator. Taking the non-relativistic limit we show how all possible point-like interactions for one-dimensional Schrödinger operator of free spinless particle can be obtained from the Dirac Hamiltonian. In case of spin-1/2 we show that there are boundary conditions with spin-flop mechanism. We suggest the physical interpretation these point-like extensions in terms of the Rashba (spin-orbital) coupling.

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