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Solution of double-eigenvalue problem for a fermionic particle or gauged Q-ball in superfluid vacuum

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A model describing a fermionic particle or Q-ball in a superfluid vacuum is studied numerically. We show that it is a nonlinear double-eigenvalue problem, which thus requires a special treatment. The essential equations to solve are four nonlinear differential equations involving the spinor, electrostatic, and the logarithmically nonlinear scalar field which effectively describes background superfluid in a low-energy regime. The solution is derived in a recursive way, a detailed example demonstrating this process is presented. Among other values, self-energy and total charge of the object are numerically derived. The main conclusion is that our model is free of field singularities, its self-energy is finite and its electric field obeys the Coulomb asymptotics.

Apply to be considered for a student award (Yes / No)?

Yes

Level for award (Hons, MSc, PhD, N/A)?

PhD

Main supervisor (name and email) and his / her institution

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Would you like to submit a short paper for the Conference Proceedings (Yes / No)?

Yes

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