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Abstract

The existence of potentials for relativistic Schrödinger operators allowing eigenvalues embedded in the essential spectrum is a long-standing open problem. We construct Neumann-Wigner type potentials for the massive relativistic Schrödinger operator in one and three dimensions for which an embedded eigenvalue exists. We show that in the non-relativistic limit these potentials converge to the classical Neumann-Wigner and Moses-Tuan potentials, respectively. For the massless operator in one dimension we construct two families of potentials, different by the parities of the (generalized) eigenfunctions, for which an eigenvalue equal to zero or a zero-resonance exists, dependent on the rate of decay of the corresponding eigenfunctions. We obtain explicit formulae and observe unusual decay behaviours due to the non-locality of the operator.

Key-words: relativistic Schrödinger operator, non-local operator, Neumann-Wigner potentials, embedded eigenvalues, resonances

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