Non-scattering energies for acoustic-type equations on manifolds with a single flat end

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We consider the scattering theory for acoustic-type equations on non-compact manifolds with a single flat end. Our main purpose is to show an existence result of non-scattering energies. Precisely, we show a Weyl-type lower bound for the number of non-scattering energies. Usually a scattered wave appears for every incident wave by the inhomogeneity of the media. However, there may exist suitable wavenumbers and patterns of incident waves such that the corresponding scattered wave vanishes. We call (the square of) this wavenumber a non-scattering energy in this paper. This phenomena is an analogue of the resonant-tunneling effect for 1D Schrödinger equation in the quantum mechanics. The problem of non-scattering energies can be reduced to a well-known interior transmission eigenvalues problem.