PERTURBATION OF NEAR THRESHOLD EIGENVALUES: CROSSOVER FROM EXPONENTIAL TO NON-EXPONENTIAL DECAY LAWS

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For a two-channel model of the form

$$H_\varepsilon = \begin{bmatrix} H_{\rm op} & 0 \\ 0 & E_0 \end{bmatrix} + \varepsilon \begin{bmatrix} 0 & W_{12} \\ W_{21} & 0 \end{bmatrix} \quad \text{on} \quad \mathcal{H} = \mathcal{H}_{\rm op} \oplus \mathbf{C},$$

appearing in the study of Feshbach resonances, we continue the rigorous study, begun in our paper [1], of the decay laws for resonances produced by perturbation of unstable bound states close to a threshold. The operator $H_{\rm op}$ is assumed to have the properties of a Schrödinger operator in odd dimensions, with a threshold at zero. We consider for ε small the survival probability $|\langle \Psi_0, e^{-itH_\varepsilon}\Psi_0\rangle|^2$, where Ψ_0 is the eigenfunction corresponding to E_0 for $\varepsilon = 0$. For E_0 in a small neighborhood of the origin *independent of* ε, the survival probability amplitude is expressed in terms of some special functions related to the error function, up to error terms vanishing as $\varepsilon \to 0$. This allows for a detailed study of the crossover from exponential to non-exponential decay laws, and then to the bound state regime, as the position of the resonance is tuned across the threshold.

Keywords: Schrödinger operator, non-exponential decay law, threshold properties

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