Singular Schrödinger operators and Robin billiards: geometry, spectra and asymptotic expansions

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The subject of this talk are spectral properties of several operator clases. They include Schrödinger operators with an attractive singular 'potential', supported by a manifold of a lower dimensionality. The simplest of them of them can be formally written as $-\Delta - \alpha\delta(x-\Gamma)$ with $\alpha > 0$, where Γ is a curve in $\mathbb{R}^d$, $d = 2, 3$, or a surface in $\mathbb{R}^3$; the expression can be modified to include a different singular interaction term or a regular potential bias. Another class are Hamiltonians describing quantum motion in a region with attractive Robin boundary. We discuss the ways in which spectral properties of such systems are influenced by the interaction support geometry, in particular, it the situation when the coupling constant is large, with an attention to similarities and differences between the operators considered.

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