Discrete spectrum of two-dimensional soft waveguides

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We discuss soft quantum waveguides described by two-dimensional Schrödinger operators with an attractive potential in the form of a channel of a fixed profile built along a smooth curve in $\mathbb{R}^2$. If the latter is infinite and not straight, but asymptotically straight in a suitable sense, we derive using Birman-Schwinger principle a quantitative criterion for the discrete spectrum of such an operator to be nonempty; this happens, in particular, when the potential well defining the channel profile is deep and narrow enough. We also address the question about ground state optimization in the situation when the generating curve has the shape of a loop without self-intersections. Some related results and problems are also mentioned.

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