Effective Hamiltonian in curved quantum waveguides and when it does not work

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The Dirichlet Laplacian in a curved two-dimensional strip built along a plane curve is investigated in the limit when the uniform cross-section of the strip diminishes. We show that the Laplacian converges in a norm resolvent sense to the well known one-dimensional Schrödinger operator whose potential is expressed solely in terms of the curvature of the reference curve. In comparison with previous results we allow the curves which are unbounded and whose curvature is not differentiable. On the other hand, we present the most recent and surprising result that there are curves with bounded curvature for which the Hamiltonian in the waveguide is not well approximated by the conventional effective Hamiltonian. This is a joint work with David Krejčiřík.