

**Thin waveguides with Robin conditions: the influence of twist and curvature.**

G. Bouchitté

We consider a thin three dimensional waveguide with a Dirichlet or Robin type condition on its boundary. In a model case, the behavior of such a waveguide is controlled by the lower eigenvalues of the Laplace operator. Therefore it is worth knowing the asymptotic of these eigenvalues when the diameter of the tube's cross section becomes infinitesimal.

In the Dirichlet case, the spectral gap turns out to remain finite and we show that the behavior of lower energy modes is ruled by a one dimensional Sturm-Liouville problem involving an effective potential depending on local curvature and rotation angle. In contrast, in the case of a Robin type boundary condition, we evidence different behaviors depending on a symmetry criterium for the fundamental mode in the cross section. If that symmetry condition fails, then spectral gap blows up and we prove the localization of lower energy levels in the vicinity of the minimum point of a suitable function on the tube's axis depending on the curvature and the rotation angle.