Discrete spectrum of Dirichlet Laplacian in spiral-shaped regions

Pavel Exner

Doppler Institute for Mathematical Physics
and Applied Mathematics, Prague

We discuss spectral properties of Laplace operator in spiral-shaped regions with Dirichlet boundary, in particular, their discrete spectrum. As a case study we analyze in detail the region generated by the Archimedean spiral, where in contrast to 'less curved' tubular regions the discrete part is empty due to a subtle difference between the radial and perpendicular widths, and the spectrum is absolutely continuous away from the thresholds. For more general spiral regions the spectral nature depends substantially on whether their coil width is 'expanding' or 'shrinking' with respect to the angle; the most interesting situation occurs in the case we call asymptotically Archimedean, where the existence of isolated eigenvalues depends on the sign of the leading term in the asymptotics.

Mailing addresses:
Department of Theoretical Physics, NPI
Czech Academy of Sciences
Hlavní 130, CZ-25068 Řež near Prague;
Department of Physics, FNSPE
Czech Technical University
Břehová 7, CZ-11519 Prague

E-mail: exner@ujf.cas.cz