

SCATTERING ON THE LINE DECORATED BY COMPACT QUANTUM GRAPHS

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Abstract

Scattering of quantum particles on graphs has been actively studied since the late 1980s [1], and the scattering theory on the line has by now been successfully extended to quantum graphs. In this talk, we address the scattering problem on a line decorated with a locally periodic array of compact quantum graphs (see Fig. 1). These decorations act as resonant scatterers, effectively inducing energy-dependent point interactions (pseudo-potentials) on the line. Remarkably, even in the absence of any edge potential, such systems can display highly non-trivial transmission characteristics such as tunneling effects and the emergence of effective band-pass filters (see Fig. 2), similarly to the scattering on δ' -combs [2].

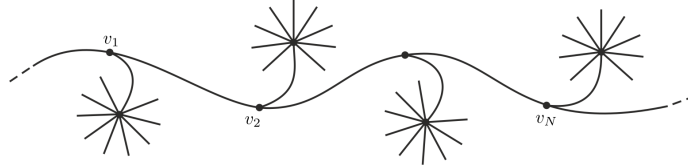


Figure 1: Locally periodic graph Γ decorated with dandelions.

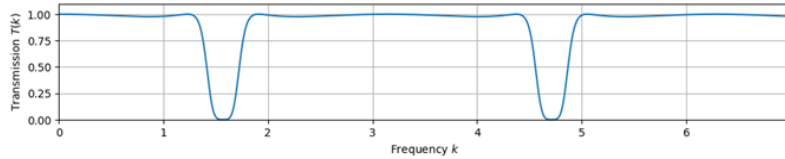


Figure 2: Transmission probabilities $T(k)$ for three single-edge decorations

The model is exactly solvable and allows great flexibility in terms of the choice of

compact graph, the number of decorations, and the interface conditions at the junction points. This flexibility can enable analytic construction of scattering models with desired transport properties, thus providing a rigorous framework for exploring wave propagation in structured quantum systems.

The talk is based on the joint work with Khrystyna Buhrii and Yuriy Golovaty [3].

References

- [1] Gerasimenko, N.I. and Pavlov, B.S. Scattering problems on noncompact graphs. *Theoret. and Math. Phys.*, **74** (1988), no. 3, 230–240.
- [2] Golovaty, Y., Hryniv, R., and Lavrynenko, S. Transmission resonances in scattering by δ' -like combs. *J. Phys. A: Math. Theor.* **58** (2025), id. 275304 (21 p.).
- [3] Buhrii, Kh., Golovaty, Y., and Hryniv, R., Scattering on locally periodic quantum graphs. *Submitted*.