Quantum graph Hamiltonians violating the time-reversal invariance.

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Abstract: The talk is concerned with quantum graphs the vertex coupling of which does not preserve the time-reversal invariance. As a case study we analyze the simplest example with the asymmetry being maximal at a fixed energy. In this situation the high-energy scattering depends crucially on the vertex parity; we will demonstrate implications of this fact for spectral and transport properties in several classes of graphs, both finite and infinite periodic ones.
In particular, we prove the Band-Berkolaiko universality for Kagome lattices with this coupling. Furthermore, we discuss other time-asymmetric graphs and identify a class of such couplings which exhibits a nontrivial PT-symmetry despite being self-adjoint; we also illustrate the role of the Dirichlet component in the vertex coupling and discuss spectrum of the Cairo lattice. Finally, we show how a square lattice with such a coupling behaves in the presence of a magnetic field when the two time-asymmetry effects compete. The results come from a common work with Marzieh Baradaran, Jiri Lipovsky, and Milos Tater.