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Nodal deficiency, spectral flow, and the Dirichlet-to-Neumann map

Courant's nodal domain theorem provides a natural generalization of Sturm–Liouville theory to higher dimensions; however, the result is in general not sharp. It was recently shown that the nodal deficiency of an eigenfunction is encoded in the spectrum of the Dirichlet-to-Neumann operators for the eigenfunction's positive and negative nodal domains. While originally derived using symplectic methods, this result can also be understood through the spectral flow for a family of boundary conditions imposed on the nodal set. In this talk I will describe this flow for a Schrödinger operator with separable potential on a rectangular domain, and describe a mechanism by which low energy eigenfunctions do or do not contribute to the nodal deficiency. Operators on non-rectangular domains and quantum graphs will also be discussed.

This talk represents joint work with Gregory Berkolaiko (Texas A&M) and Jeremy Marzuola (UNC Chapel Hill).