

Spectral geometry of quantum graphs via surgery principles

James Kennedy

University of Lisbon

`j.bernard.kennedy@gmail.com`

Gregory Berkolaiko

Texas A&M University

`gregory.berkolaiko@math.tamu.edu`

Pavel Kurasov

Stockholm University

`kurasov@math.su.se`

Delio Mugnolo

University of Hagen

`delio.mugnolo@fernuni-hagen.de`

“Surgery” on a (metric) graph means making a small, generally local, change to its structure: for example, joining two vertices, lengthening an edge, or maybe removing an edge and reinserting it somewhere else.

We will introduce a number of sharp new surgery principles which allow one to control the eigenvalues of the Laplacian on a metric graph with any of the usual vertex conditions (natural, Dirichlet or delta). We will illustrate how these principles can be used to give new proofs and sharper versions of existing “isoperimetric”-type eigenvalue estimates by sketching a result which interpolates between the theorems of Nicaise and Band-Lévy for the first non-trivial eigenvalue of the Laplacian with natural vertex conditions.

This is based on joint work with Gregory Berkolaiko, Pavel Kurasov and Delio Mugnolo.