

Spectral Estimates for Laplace operators, Geometry of Graphs, and Expanders

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I will offer an invitation to spectral geometry of metric graphs. Several bounds on the spectral gap of the Laplacian on metric graphs with standard or Dirichlet vertex conditions will be derived. I will especially present estimates based on recently introduced metric quantities, such as the length of a shortest cycle (girth), the avoidance diameter, the torsional rigidity and the mean distance. Using known results about Ramanujan graphs, a class of expander graphs, we also prove that some of these metric quantities, or combinations thereof, do not deliver any spectral bounds with the correct scaling. If time allows, I will briefly discuss the case of graphs with infinitely many edges.