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Metric upper bounds for Steklov and Laplace eigenvalues

I will discuss two upper bounds for the Steklov eigenvalues of a compact Riemannian manifold with boundary. The first involves the volume of the manifold and of its boundary, as well as the distortion, packing and volume growth constants of the boundary. The second bound is in terms of the intrinsic and extrinsic diameters of the boundary, as well as its injectivity radius. By applying these bounds to cylinders over closed manifold, we also obtain new bounds for eigenvalues of the Laplace operator on closed manifolds, in the spirit of Grigor'yan-Netrusov-Yau and of Berger-Croke. For instance, on any closed Riemannian manifold M the eigenvalue $\lambda_j(M)$ is bounded above in terms of the diameter, volume and injectivity radius:

$$\lambda_j(M)\mathsf{diam}(M)^2 \leq K(n)\frac{\mathsf{Vol}(M)}{\mathsf{inj}(M)^n}j^{n+1}.$$

I will also discuss related concentration phenomena for manifolds with boundary, akin to Gromov–Milman concentration for closed manifolds.

This is joint work with Bruno Colbois (Université de Neuchâtel).