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Shape optimization in spectral geometry via variational methods for harmonic maps

I'll describe joint work with Mikhail Karpukhin, relating the problem of maximizing Laplacian eigenvalues over unit-area metrics on a given Riemann surface to natural min-max constructions of harmonic maps to high-dimensional spheres. I'll explain how our methods give a new approach to producing extremal metrics for the first and second Laplacian eigenvalues, while yielding new estimates and rigidity results for related shape optimization problems in spectral geometry.