Some problems of minimization involving the first eigenvalue of the Laplacian-Dirichlet

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Let $\lambda_1(\Omega)$ be the first eigenvalue of the Laplace operator with Dirichlet boundary conditions on a bounded domain $\Omega \in \mathbb{R}^N$. In this talk, I will report on some optimization problems, old and new, involving $\lambda_1(\Omega)$. I will begin by the problem of minimizing $\lambda_1(\Omega)$ among polygons with a fixed number of sides which has been considered by G. Pòlya. Then, I will consider the problem of minimizing $\lambda_1(\Omega)$ among subsets Ω of a fixed box D with a given volume. In the second part of the talk, which is a joint work with Davide Zucco in progress, I will look for the optimal obstacle K to put in a fixed domain Ω in order to maximize $\lambda_1(\Omega \setminus K)$. After a general existence result and some qualitative properties, the case where Ω is a disk or an annulus will be considered.

References

[H]   A. Henrot, Extremum problems for eigenvalues of elliptic operators, Frontiers in Mathematics. Birkhäuser Verlag, Basel, 2006.

[HZ] A. Henrot, D. Zucco, Looking for the best obstacle in order to maximize the first eigenvalue of the Dirichlet-Laplacian, in preparation.