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Fourier transform, null variety, and Laplacian's eigenvalues

Michael LEVITIN
School of Mathematics
Cardiff University
Senghennydd Road
Cardiff, CF24 4AG
UNITED KINGDOM

levitin@cardiff.ac.uk

Abstract

We consider a quantity $\kappa(\Omega)$ – the distance to the origin from the null variety of the Fourier transform of the characteristic function of a domain $\Omega \subset \mathbb{R}^d$. We conjecture, firstly, that $\kappa(\Omega)$ is maximized, among all convex balanced domains Ω of a fixed volume, by a ball, and also that $\kappa(\Omega)$ is bounded above by the square root of the second Dirichlet eigenvalue of Ω . We prove some weaker versions of these conjectures in dimension two, as well as their validity for domains asymptotically close to a disk, and also discuss further links between $\kappa(\Omega)$ and the eigenvalues of the Laplacians.

Joint work with Rafael Benguria and Leonid Parnowski.