The Plasmonic Eigenvalue Problem and the Dirichlet-to-Neumann Operator on Manifolds with Fibered Cusps

Elmar Schrohe; Leibniz University Hannover

Abstract. A plasmon of a bounded domain $\Omega \subseteq \mathbb{R}^n$ is a nontrivial harmonic function on $\mathbb{R}^n \setminus \partial\Omega$ that is continuous at $\partial\Omega$ and whose interior and exterior normal derivative at $\partial\Omega$ have a constant ratio. This ratio is called a plasmonic eigenvalue of Ω. It is indeed an eigenvalue of $N_+^{-1}N_-$, where $N_\pm$ denote the exterior and interior Dirichlet-to-Neumann operators.

Motivated by the case of two touching convex domains in $\mathbb{R}^n$, we consider this problem on a manifold with fibered cusp singularities. In a first step we show that the Calderòn projector for elliptic operators in this setting is a matrix of ϕ-pseudodifferential operators in the sense of Mazzeo and Melrose. From this we derive that also the Dirichlet-to-Neumann operator is a first order ϕ-pseudodifferential operator. This gives us a precise understanding of the behavior of its Schwartz kernel near the boundary.

Finally we study the spectrum of the Dirichlet-to-Neumann operator on manifolds with fibered cusp singularities.

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