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Determining Two Coefficients in Elliptic Operators via Boundary Spectral Data: a Uniqueness Result

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For a bounded and sufficiently smooth domain Ω in $\mathbb{R}^N$, $N \geq 2$, let $(\lambda_k)_{k=1}^{\infty}$ and $(\varphi_k)_{k=1}^{\infty}$ be respectively the eigenvalues and the corresponding eigenfunctions of the problem (with Neumann boundary conditions)

$$-\mathrm{div}(a(x)\nabla\varphi_k) + q(x)\varphi_k = \lambda_k \rho(x)\varphi_k \quad \text{in } \Omega, \quad a\frac{\partial}{\partial \mathbf{n}}\varphi_k = 0 \quad \text{on } \partial\Omega.$$

We prove that knowledge of the Dirichlet boundary spectral data $(\lambda_k)_{k=1}^{\infty}$, $(\varphi_{k|\partial\Omega})_{k=1}^{\infty}$ determines uniquely the Neumann-to-Dirichlet (or the Steklov-Poincaré) map γ for a related elliptic problem. Under suitable hypothesis on the coefficients a, q, ρ their identifiability is then proved. We prove also analogous results for Dirichlet boundary conditions.