MAFIA - the seminar you can't refuse

Neumann sieve problem revisited

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Abstract: Let $\Omega \subset \mathbb{R}^n$ be a domain, which is intersected by a hyperplane Γ. We make a lot of small holes $D_{k,\varepsilon}$, $k = 1, 2, 3 \dots$ in $\Gamma \cap \Omega$, where $\varepsilon > 0$ is a small parameter; when $\varepsilon \to 0$, the number of holes tends to infinity, while their diameters tend to zero. Let $\mathcal{A}_\varepsilon$ be the Neumann Laplacian in the perforated domain $\Omega_\varepsilon = \Omega \setminus \Gamma_\varepsilon$, where $\Gamma_\varepsilon = \Gamma \setminus (\cup_k D_{k,\varepsilon})$ ("sieve"). It is well-known that under some critical scaling of the holes radii, the operator $\mathcal{A}_\varepsilon$ converges in the strong resolvent sense to the Laplacian on $\Omega \setminus \Gamma$ subject to the so-called δ'-conditions on $\Gamma \cap \Omega$. In this talk we discuss some resent improvements of this result obtained in [A.K., Ann. Mat. Pura Appl. (2023), 202:1955–1990], where under rather general assumptions on the shapes and locations of the holes we derived estimates on the rate of convergence in terms of $L^2 \to L^2$ and $L^2 \to H^1$ operator norms. If time permits, we also discuss some new (not yet published) results concerning the so-called "thick" sieves.