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"Quantification of unique continuation for the Laplace operator in 2d and application to the control of a semi-linear parabolic equation"

Joint Work with Kévin Le Balc'h (Laboratoire Jacques-Louis Lions and INRIA).

The goal of this talk is to present some recent results on the unique continuation of the Laplace operator, and its quantification in terms of the norm of the potential.

This result is strongly inspired by the impressive work by A. Logunov, E. Malinnikova, N. Nadirashvili and F. Nazarov proving the Landis conjecture in the plane (https ://arxiv.org/abs/2007.07034), that we shall carefully adapt to our case.

We will present the main steps of the proof, and in particular : a perforation process based on the nodal set of the functions at hand that transforms the domain to a perforated domain with small Poincaré constant ; a quasiconformal transformation to reduce the elliptic equation into an harmonic equation ; and Carleman estimates conjugated with Harnack inequalities.

As an application, we will derive new results for controlling semi-linear elliptic equations in the spirit of E. Fernandez-Cara and E. Zuazua's open problem concerning the small-time global null-controllability of slightly super-linear heat equations.