Séminaire : Problèmes spectraux en physique mathématique

Les séminaires ont lieu à l'**Institut Henri Poincaré**, 11 rue Pierre et Marie Curie, 75005 Paris.

Programme du lundi 15 juin 2015, en **salle 201**

— 11h15 - 12h15 : **Michael Hitrik** (UCLA)
Rational invariant tori and spectral asymptotics for non-selfadjoint operators in dimension two

We study spectra for non-selfadjoint perturbations of selfadjoint semiclassical operators in dimension 2, assuming that the classical flow of the unperturbed part is completely integrable. Complete asymptotic expansions are established for all individual eigenvalues in suitable regions of the complex spectral plane, close to the edges of the spectral band. The eigenvalues have the form of the « legs in a spectral centipede » and are produced by suitable rational flow-invariant Lagrangian tori. This is joint work with Johannes Sjöstrand.

— 14h - 15h : **Svitlana Mayboroda** (U. of Minnesota)
Localization of eigenfunctions

The phenomenon of wave localization permeates acoustics, quantum physics, energy engineering. It was used in the construction of noise abatement walls, LEDs, optical devices. Localization of quantum states of electrons by a disordered potential has become one of the prominent subjects in quantum physics, as well as harmonic analysis and probability. Yet, no known methods predicted specific spatial location or frequencies of the localized waves.
In this talk I will present recent results revealing a universal mechanism of localization for an elliptic operator in a bounded domain. Via a new notion of « landscape » we connect localization to a certain multi-phase free boundary problem and identify location, shapes, and energies of localized eigenmodes. In the context of the Schrödinger operator, the landscape further provides sharp estimates on the exponential decay of eigenfunctions and delivers accurate bounds for the corresponding eigenvalues, in the range where both semi-classical Agmon estimates and Weyl law notoriously fail. This is joint work with D. Arnold, G. David, M. Filoche, and D. Jerison.

— 15h15 - 16h15 : **Yannick Privat** (UPMC)
Optimal shape and location of actuators or sensors in PDE models

We investigate the problem of optimizing the shape and location of actuators or sensors for evolution systems driven by a partial differential equation, like for instance a wave equation, a Schrödinger equation, or a parabolic system, on an arbitrary domain Ω, in arbitrary dimension, with boundary conditions if there is a boundary, which can be of Dirichlet, Neumann, mixed or Robin. This kind of problem is frequently encountered in applications where one aims, for instance, at maximizing the quality of reconstruction of the solution, using only a partial observation. From the mathematical point of view, using probabilistic considerations we model this problem as the problem of maximizing what we call a randomized observability constant, over all possible subdomains of Ω having a prescribed measure. The spectral analysis of this problem reveals intimate connections with the theory of quantum chaos. More precisely, if the domain Ω satisfies some quantum ergodic assumptions then we provide a solution to this problem.
This work is in collaboration with Emmanuel Trélat (Univ. Paris 6) and Enrique Zuazua (BCAM Bilbao, Spain).

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