Séminaire : Problèmes spectraux en physique mathématique

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

Programme du lundi 11 mars 2019, en **salle 314** (3e étage)

— 11h15 - 12h15 : **Jean-Marie Barbaroux** (Toulon)
Graphene antidot lattices : a mathematical approach

From the physics point of view, it is important to turn semimetallic graphene into a semiconductor. This can be achieved for example by considering graphene antidot lattices (GALs) that consists of a periodic array of perforations in a graphene sheet. This causes a band gap to open up at the Fermi level. In this talk, I will present some recent mathematical results on two-dimensional Dirac operators modeling Hamiltonians for GALs. I will mostly focus on operators with periodic mass potentials, as well as their random Anderson-like perturbations describing defects in the array of perforations.
This is joint work with H.Cornean, E.Stockmeyer and S.Zalczer.

— 14h - 15h : **Serena Cenatiempo** (Gran Sasso Science Institute, L'Aquila)
Bogoliubov theory in the Gross-Pitaevskii regime

In 1947 Bogoliubov suggested a heuristic theory to compute the excitation spectrum of a weakly interacting Bose gas. Remarkably, such a theory predicts a linear excitation spectrum (in sharp contrast with the quadratic dispersion of free bosons) and provides expressions for the thermodynamic functions which are believed to be correct in the dilute limit. However, so far there are only a few cases where the predictions of Bogoliubov theory can be obtained through a rigorous mathematical analysis. In particular, a major challenge is to recover the physical intuition that the correct parameter to appear in the expressions of the physical quantities is the scattering length of the interaction.
In this talk I will discuss how the validity of the predictions of Bogolibov theory can be established for a system of N interacting bosons trapped in a box in the Gross-Pitaevskii limit, where the scattering length of the potential is of the order $1/N$ and N tends to infinity. Joint work with C. Boccato, C. Brennecke and B. Schlein.

— 15h15 - 16h15 : **Gabriel Stoltz** (Ecole des Ponts + Inria Paris)
Longtime convergence of evolution semigroups in molecular dynamics

I will present exponential decay estimates for the evolution operators associated with paradigmatic stochastic evolutions in molecular dynamics. The first case I will consider is a nonequilibrium Langevin dynamics. The associated generator is hypoelliptic and not coercive. It can however be shown to be hypocoercive for equilibrium dynamics, through the use of a modified L^2 scalar product ; this property persists for nonequilibrium dynamics provided the external forcing is not too large. The second case corresponds to a nonlinear Feynman-Kac dynamics, whose convergence can be studied by Lyapunov techniques, once the existence and uniqueness of the eigenvector associated with the dominant eigenvalue of the evolution operator has been proved through a Krein-Rutman theorem.

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