

Monday, May 26

10:00 – 10:55 Arshak Petrosyan

Title: Higher regularity of the free boundary in the thin obstacle problem.

Abstract: One of the classical approaches in the study of the higher regularity of free boundaries is the hodograph-Legendre transform. A generalization of this approach to the so-called regular part of the (codimension-two) free boundary in the thin obstacle problem leads to a singular hodograph transform which can be shown to be invertible by using a precise asymptotic behavior of the solutions. The corresponding Legendre transform solves a fully nonlinear degenerate elliptic equation, which surprisingly has a subelliptic structure. Treating it as an appropriate perturbation of the Grushin's operator, we are able to prove the smoothness and even the real analyticity of the Legendre transform, which in turn implies the real analyticity of the free boundary. This is a joint work with Herbert Koch and Wenhui Shi.

10:55 – 11:15 Coffee Break

11:15 – 12:10 Noemi Wolanski

Title: Asymptotic behavior for a non-local diffusion Dirichlet problem in domains with holes.

12:10 – 13:30 Lunch

13:30 – 14:25 Irene Gamba

Title: Weighted norms and decay properties for solutions of the Boltzmann equation.

Abstract: We will discuss recent results regarding generation and propagation of summability of moments to solution of the Boltzmann equation for variable hard potentials. These estimates are in direct connection to the understanding of high energy tails and decay rates to equilibrium.

14:25 – 14:45 Coffee Break

14:45 – 15:40 Catherine Bandle

Title: Semi-linear elliptic equations with a Hardy potential

Abstract: We consider problems of the type $\Delta u + V(x)u = u^p$ in a bounded domain in $\mathbf{R}^n$ where V is a Hardy potential $\frac{\mu}{\delta^2(x)}$ and $\delta(x)$ is the distance from a point x to the boundary of the domain. We are interested in the existence of positive solutions, and the interplay between the nonlinearity and the boundary singularity. If $0 < p < 1$ the nonlinearity gives rise to dead cores and if $p > 1$ to boundary blowup. We give a fairly complete picture of the radial solutions and use those solutions as upper and lower solutions for general domains. The talk reports on results obtained in collaboration with V. Moroz (Swansea), W. Reichel (KIT Karlsruhe) and M. A. Pozio (La Sapienza Rome).

Tuesday, May 27

10:00 – 10:55 Henri Berestycki

Title: Propagation and blocking for reaction-diffusion equations in non homogeneous media.

Abstract: I will discuss bi-stable reaction-diffusion equations in cylinders with varying cross-sections motivated by biology and medicine. The aim is to understand the effect of the non-homogenous medium on propagation or blocking of advancing waves. The role played by the geometry of the domain of propagation is of particular interest for these models. I will report on joint work with Juliette Bouhours and Guillemette Chapuisat.

10:55- 11:15 Coffee Break

11:15 – 12:10 Eugen Varvaruca

Title: Global Bifurcation of Steady Gravity Water Waves with Critical Layers

Abstract: I will present some recent results on the problem of two-dimensional travelling water waves propagating under the influence of gravity in a flow of constant vorticity over a flat bed. By means of a conformal mapping and an application of Riemann-Hilbert theory, the free-boundary problem is equivalently reformulated as a one-dimensional pseudodifferential equation which involves a modified Hilbert transform and, moreover, has a variational structure. Using the new formulation, existence is established, by means of real-analytic global bifurcation theory, of a family of solutions which includes waves of large amplitude, even in the presence of critical layers in the flow. This is joint work with Adrian Constantin and Walter Strauss.

12:10 – 13:30 Lunch

13:30 – 14:25 Aram Karakhanyan

Title: Regularity of weak and viscosity solutions to the continuous casting problem.

Abstract: I will talk about some recent result on a steady state phase transition model with constant convection. First, we will establish the optimal local regularity, which is Lipschitz continuity and then dwell of the regularity of free boundary. In fact, in one phase problem we show that the free boundary is locally a Lipschitz continuous graph.

14:30 – 15:25 Eduardo Teixeira

Title: Free boundary problems in random environments.

Abstract: I will discuss about a class of free boundary problems involving elliptic operators with random, discontinuous coefficients. I will also comment on how the ideas and tools designed for the study of such problems reveal improvement of smoothness of solutions to classical equations presenting "non-physical" free boundaries.

15:25 – 16:00 Coffee Break

16:00 – 16:55 Luis Caffarelli

Title: What Makes a Surface "Optimal" - Rothschild Distinguished Visiting Fellow Lecture

Abstract: Area minimizing surfaces, a solid liquid interphase, the surface across which a strategy must switch in a game have some sort of "optimality" that often reflects in its stability, regularity, propagation properties. In the last few decades, starting with the pioneering work of de Giorgi on minimal surfaces, we have attained considerable understanding of the underlying mechanisms that produce these effects. I will try to provide an overall view of these developments.