

RECENT ADVANCES IN NONLINEAR PROBLEMS

October 31st, 2019
Science Center, Room 4102
Graduate Center, CUNY

ITS @ The Graduate Center
Initiative for the Theoretical Sciences

Nonlinear PDE is an important mathematical area that impacts many different fields in mathematics and physics. This one-day event, which is now part of a symposium series at the Graduate Center of CUNY, aims to explore recent trends, applications, and future directions in this very active area.

Speakers:

Monica Clapp, Universidad Nacional Autónoma de México
Luca Martinazzi, University of Padua (Italy)
Tristan Rivière, ETH Zürich (Switzerland)
Yi Wang, Johns Hopkins University

- 9 am - 9:30 am: Breakfast
- 9:30 am - 10:30 am: TRISTAN RIVIÈRE
- 10:30 am - 10:45 am: Coffee
- 10:45 am - 11:45 am: YI WANG

- 1:30 pm - 2:30 pm: LUCA MARTINAZZI
- 2:30 pm - 3:00 pm: More Coffee
- 3:00 pm - 4:00 pm: MONICA CLAPP

Abstracts

MONICA CLAPP (Universidad Nacional Autónoma de México)

Symmetries and concentration in variational problems

Many interesting problems in differential geometry are expressed in terms of a partial differential equation that is invariant under conformal transformations. A typical example is the Yamabe problem, which is an extension to higher dimensions of the classical uniformization problem for surfaces.

The conformal invariance gives rise to a blow-up phenomenon, which turns the question of existence of solutions for this type of equations into a delicate issue. But we can also use it to our advantage. In this talk we will show how, through the analysis of the concentration and blow-up phenomena in an appropriate symmetric context, one can obtain solutions for this type of problems.

LUCA MARTINAZZI (Padua University)

Topological and variational methods for the supercritical Moser-Trudinger equation

We discuss the existence of critical points of the Moser-Trudinger functional in dimension 2 with arbitrarily prescribed Dirichlet energy using degree theory. If time permits, we will also sketch an approach on Riemann surfaces using a min-max method introduced by Djadli-Malchiodi. This talk is based on joint works (and a work in progress) with Francesca De Marchis, Olivier Druet, Andrea Malchiodi, Gabriele Mancini and Pierre-Damien Thizy.

TRISTAN RIVIÈRE (ETH Zurich)

Immersed 2-spheres in \mathbb{R}^3 from a Morse theoretic perspective

In their attempt to generalize Euler elastic theory of beams to flexible membranes, Sophie Germain and Siméon Poisson introduced, two centuries ago, a Lagrangian which has now become a mathematical object whose study goes a way beyond the mechanics of bent surfaces. The so called Willmore Lagrangian is a functional that shows up in many areas of sciences such as conformal geometry, general relativity, cell biology, optics ...etc.

We will try to shed some lights on the universality of this Lagrangian. One remarkable fact is a quantization phenomenon of the Willmore critical spherical membranes which happen to have all integer valued energy. We shall then present the project of using the Willmore energy as a Morse function for studying the fascinating space of immersed 2-spheres in the euclidian 3 space and relate topological obstructions in this space to integer values and minimal surfaces.

YI WANG (Johns Hopkins University)

Boundary operator associated to σ_k curvature

On a Riemannian manifold (M, g) , the σ_k curvature is the k -th elementary symmetric function of the eigenvalues of the Schouten tensor A_g . It is known that the prescribing σ_k curvature equation on a closed manifold without boundary is variational if $k=1, 2$ or g is locally conformally flat; indeed, this problem can be studied by means of the energy $\int \sigma_k(A_g) dv_g$. We construct a natural boundary functional which, when added to this energy, yields as its critical points solutions of prescribing σ_k curvature equations with general non-vanishing boundary data. Moreover, we prove that the new energy satisfies the Dirichlet principle. If time permits, I will also discuss applications of our methods. This is joint work with Jeffrey Case.

Organizers:

- Zeno Huang, CUNY-CSI/GC
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