

NONLINEAR PROBLEMS IN GEOMETRY

April 3rd – April 4th, 2019
Science Center, Room 4102
Graduate Center, CUNY

Speakers:

Pengfei Guan (McGill University, Montreal, Canada)
Matthew J. Gursky (University of Notre Dame)
Fengbo Hang (Courant Institute, New York)
Lan-Hsuan Huang (University of Connecticut)
Emmanuel Humbert (Université François Rabelais, Tours, France)
Ernst Kuwert (Albert-Ludwigs-Universität, Germany)
YanYan Li (Rutgers University, USA)
Gabriella Tarantello (Rome Tor Vergata, Italy)

Wednesday April 3rd

- 9 am - 9:30 am: Breakfast
- 9:30 am - 10:30 am: YANYAN LI
- 10:30 am - 10:45 am: Coffee
- 10:45 am - 11:45 am: GABRIELLA TARANTELLLO
- 1:30 pm - 2:30 pm: EMMANUEL HUMBERT
- 2:30 pm - 3:00 pm: More Coffee
- 3:00 pm - 4:00 pm: ERNST KUWERT

Thursday April 4th

- 9 am - 9:30 am: Breakfast
- 9:30 am - 10:30 am: PENGFEI GUAN
- 10:30 am - 10:45 am: Coffee
- 10:45 am - 11:45 am: LAN-HSUAN HUANG
- 1:30 pm - 2:30 pm: MATTHEW J. GURSKY
- 2:30 pm - 3:00 pm: More Coffee
- 3:00 pm - 4:00 pm: FENGBO HANG

Abstracts

PENGFEI GUAN (McGill University, Montreal, Canada)

Flows of hypersurfaces by curvatures and applications to sharp geometric inequalities

We discuss new type of flows of hypersurface by its curvatures in space form. These are generalized flows of mean curvature or inverse mean curvature type. These flows are associated to various isoperimetric geometric inequalities related to curvature integrals. An interesting aspect of this type of flows is monotonicity property for corresponding global geometric quantities. The main question is the long time existence and convergence. We will discuss recent results on some longstanding problems related to sharp geometric inequalities and open problems arising from these new flows.

MATTHEW J. GURSKY (University of Notre Dame)

An index estimate for Yang-Mills in connections and an application to Einstein metrics

I will describe recent work with C. Kelleher and J. Streets in which we prove a conformally invariant estimate for Schrödinger operators acting on vector bundles over four-manifolds, based on the classical Cwikel-Lieb-Rozenblum estimate. As applications we give an estimate of the index of a Yang-Mills connection, and an estimate for the index for Einstein metrics in terms of the topology and the Einstein-Hilbert energy.

FENGBO HANG (Courant Institute, New York)

The sphere covering inequality and its dual

The sphere covering inequality discovered recently by Gui-Moradifam is remarkable in view of its many applications to the symmetry and uniqueness of solutions of elliptic equations involving exponential nonlinearity in dimension two. In a joint work with Gui-Moradifam, we try to understand the inequality from the point view of comparison geometry. This consideration produces a dual inequality and a sphere covering type inequality unifying several known inequalities.

LAN-HSUAN HUANG (University of Connecticut)

Rigidity of positive mass theorem

It is fundamental to understand obstructions to deform scalar curvature and the corresponding rigidity phenomena. The celebrated Riemannian positive mass theorem implies that one cannot promote the scalar curvature on Euclidean space without increasing the ADM mass. Those concepts extend to a broader setting in general relativity and relate to the (spacetime) positive mass conjecture. We will discuss recent progress toward the positive mass conjecture, with an emphasis on the rigidity statement. The talk is based on a joint work with Dan Lee.

EMMANUEL HUMBERT (Université François Rabelais, Tours, France)

Mass functions on a manifold

I will present some recent results we obtained with Andreas Hermann. Let M be a compact manifold of dimension n larger than 3. We introduce the mass functions as follows : for $a > 0$, it is computed as the supremum/infimum of the masses at some point p of m (i.e. the constant term at p of the Green function for the Yamabe operator) over the set of points p and metrics g which are flat on the ball $B^g(p, 1)$ and whose Yamabe constant is greater than a . We show several interesting properties of these functions.

ERNST KUWERT (Albert-Ludwigs-Universität, Germany)

L^2 curvature for surfaces in Riemannian manifolds

For surfaces immersed into a compact Riemannian manifold, we consider the curvature functional given by the L^2 integral of the second fundamental form. We discuss an area bound in terms of that functional, with application to the existence of minimizers (joint work with V. Bangert).

YANYAN LI (Rutgers University, USA)

Existence and uniqueness of Green's function to a nonlinear Yamabe problem

For a given finite subset S of a compact Riemannian manifold $(M; g)$ whose Schouten curvature tensor belongs to a given cone, we establish a necessary and sufficient condition for the existence and uniqueness of a conformal metric on $M \setminus S$ such that each point of S corresponds to an asymptotically flat end and that the Schouten tensor of the new conformal metric belongs to the boundary of the given cone. This is a joint work with Luc Nguyen.

GABRIELLA TARANTELLA (Rome Tor Vergata, Italy)

Minimal immersions of closed surfaces in hyperbolic 3- manifold

Motivated by the work of K. Uhlenbeck, we discuss minimal immersions of closed surfaces of genus larger than 1 on hyperbolic 3-manifold. In this respect we establish multiple existence for the Gauss-Codazzi equation and describe the asymptotic behaviour of the solutions in terms of the marked conformal structure on the surface and the (prescribed) second fundamental form of the minimal immersion. This is a joint work with Z. Huang and M. Lucia.

Organizers:

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