Geometry and Analysis Seminar — Mini Workshop 2023

date : 25 January 2023 (Wed), 13 : 30 — 18 : 00 (GMT +9:00)

venue : Graduate School of Information Sciences, Tohoku Univ.
the large lecture room, 2nd floor (and online)

format : in-person and online (zoom)

Program

13:30 — 14:30 : Keisuke Takasao (Kyoto Univ.)
Existence of weak solution to volume preserving mean curvature flow in higher dimensions

14:40 — 15:40 : Michiaki Onodera (Tokyo Inst. Tech.)
A quantitative stability estimate for a fourth order overdetermined problem

15:50 — 16:50 : Junya Takahashi (Tohoku Univ.)
Small eigenvalues of the rough and Hodge Laplacians under fixed volume

17:00 — 18:00 : Ilaria Lucardesi (Università degli Studi di Firenze)
An isoperimetric problem with two distinct solutions

Registrarion for zoom

If you would like to join this workshop online, please register the following form. We will send you the zoom address by email.

Registrarion form : https://forms.gle/xVDPnKJktix9qq398

The deadline is 22 January 2023, 23:59 (GMT +9:00).

Support

This workshop is supported by JSPS Grant-in-Aid for Scientific Research (B) (♯ 18H01126) entitled “Geometry of partial differential equations and inverse problems”.

Homepage

https://www.math.is.tohoku.ac.jp/~gaseminar/mini-workshop-2023.html

Organizers

Shigeru Sakaguchi, Kei Funano, Lorenzo Cavallina, Junya Takahashi (Tohoku Univ.)

Abstracts

(1) Keisuke Takasao,

In this talk, we show a global existence of the weak solution (family of integral varifolds) to the volume preserving mean curvature flow in the d-dimensional torus, where $d \geq 2$. This flow is also a distributional BV-solution for a short time, when the perimeter of the initial data is sufficiently close to that of ball with the same volume.?

To construct the flow, we use the Allen-Cahn equation with non-local term motivated by studies of Mugnai, Seis, and Spadaro (2016), and Kim and Kwon (2020).

(2) Michiaki Onodera,

I will talk about a joint work with Yuya Okamoto concerning a fourth order overdetermined boundary value problem in which the boundary value of the Laplacian of the solution is prescribed, in addition to the homogeneous Dirichlet boundary condition.

It is known that, in the case where the prescribed boundary value is a constant, this overdetermined problem has a solution if and only if the domain under consideration is a ball.

In this talk, we study the shape of a domain admitting a solution to the overdetermined problem when the prescribed boundary value is slightly perturbed from a constant.

We derive an integral identity for the fourth order Dirichlet problem and a nonlinear weighted trace inequality, and the combination of them results in a quantitative stability estimate which measures the deviation of a domain from a ball in terms of the perturbation of the boundary value.

(3) Junya Takahashi,

We consider the positive eigenvalues of the rough and Hodge Laplacian acting on p-forms on closed Riemannian manifolds.

For each degree p and each natural number $k \geq 1$, we construct on any closed manifold a family of Riemannian metrics, with fixed volume such that the k-th positive eigenvalue of the rough or the Hodge Laplacian acting on p-forms converge to zero. In particular, on the sphere, we can choose these Riemannian metrics as those of non-negative sectional curvature.

This talk is base on a joint work with Colette Anné at Université de Nantes.

(4) Ilaria Lucardesi,

In 2009 R.S. Laugesen, I. Polterovich, and B.A. Siudeja proposed a very nice conjecture about the shape optimization of the second Neumann eigenvalue of the Laplacian: among planar convex sets with prescribed perimeter, the eigenvalue is maximized by 2 shapes, the square and the equilateral triangle. So far this is still a conjecture, but there are elements, from numerics and analysis, which confirm it. In this talk I will prove the validity of the conjecture in a particualr case: planar convex sets with two axis of symmetry.

This is a joint work with A. Henrot and A. Lemenant, both from IECL, Nancy, France.