2018 Young Mathematician Forum

Program

Wednesday, July 18

9:30-10:30   Chunyi Li

Stability Condition and Wall-crossing

The notion of stability condition on a triangulated category is introduced by Bridgeland inspired by mathematical physics. Algebraic geometers then notice that the theory can be applied to solve or give new interpretations for some classical problems. I will talk about some basic concepts, ideas and philosophies in this field as well as some established results and open problems.

11:00-12:00   Ruixiang Zhang

An Almost Sharp L^2 Schrödinger Maximal Estimate in $\mathbb{R}^n$

Carleson proposed the following problem: For which s, the solution of the free Schrödinger equation converges to the initial data almost everywhere when t goes to 0 and when the initial data is in H^s? The answer of this problem is now fully known in dimension 1 (Carleson, Dahlberg-Kenig) and known up to the endpoint in higher dimensions (Bourgain, Du-Guth-Li, Du-Z.). We will talk about an almost sharp (i.e. with an $ \mathbb{R} ^{\varepsilon}$-loss) L^2 Schrödinger maximal estimate in $\mathbb{R} ^n$ and the ideas behind the proof. This estimate together with Bourgain's counterexample solves Carleson's problem up to endpoint in general dimensions, which is new for dimension $n>2$ (joint work with Xiumin Du).

13:30-14:30   Shuai Guo

Higher Genus Mirror Symmetry for Quintic 3-fold

In this talk. I will try to explain the physics and mathematics that related to a quintic Calabi-Yau hypersurface in the 4-dimensional complex projective space. On the physics side, I will talk about Yamaguchi-Yau's finite generation conjecture, holomorphic anomaly equation and their application in higher genus computation by Huang-Klemm-Quackenbush. On the mathematics side, I will talk about our recent progress on the structures of higher genus Gromov-Witten invariants. This talk is based on the joint works with F. Janda, Y. Ruan and with H-L Chang and J. Li.

15:00-16:00   Siqi He

A Kobayashi-Hitchin Correspondence for the Extended Bogomonly Equations

We will discuss Witten's gauge theory approaches to define the Jones polynomial for a knot over general 3-manifold by counting solutions to some gauge theory equations. We will discuss a Kobayashi-Hitchin type correspondence for the dimensional reduction of these gauge equations. This talk will base on joint works with R.Mazzeo.

16:15-17:15   Yu Pan

Legendrian knots and exact Lagrangian cobordi

Legendrian knot is key object in the study of contact topology. As in geometric topology, we study the surfaces connecting two Legendrian knots, called exact Lagrangian cobordisms. We will give certain constructions and obstructions of the exact Lagrangian cobordisms using Floer

theory, symplectic field theory and augmentation category.

Thursday, July 19

9:30-10:30   Lue Pan

Fontaine–Mazur Conjecture in the Residually Reducible Case

We prove the modularity of some two-dimensional residually reducible p-adic Galois representations over Q under certain conditions on the residual representation at p. To do this, we generalize Emerton's local-global compatibility result and devise a patching argument for completed homology in this setting.

11:00-12:00   Aditya Karnataki

Level-raising for GL_n

We describe our work on finding level-raising congruences for regular algebraic conjugate self-dual automorphic representations of GL_n over a CM number field.

13:30-14:30   Yuan Yuan

Holomorphic isometries from the Poincare disk into bounded symmetric domains

I will first overview the classical holomorphic isometry problem between complex manifolds, in particular between bounded symmetric domains. When the source is the unit ball, in general the characterization of holomorphic isometries is not quite clear. With Shan Tai Chan, we characterized the holomorphic isometries from the Poincare disk to the product of the unit disk with the unit ball and it provided new examples to irreducible bounded symmetric domains of rank at least 2.

15:00-16:00   Nan Li

Quantitative Estimates on the Singular Sets of Alexandrov Spaces

We study the quantitative singular sets $\mathcal S^k_\epsilon$ for collapsed Alexandrov spaces. We prove a new covering theorem and the packing estimates for $\mathcal S^k_\epsilon$. We also show that $\mathcal S^k_\epsilon$ are k-rectifiable, and for every $1\le k\le n-2$, we construct examples for which $\mathcal S^k_\epsilon$ is a Cantor set with positive $\mathcal H^k$-measure. This is a joint work with Aaron Naber.

16:15-17:15   Hui Gao

Locally analytic vectors and overconvergent (\varphi, \tau)-module

The (\varphi, \tau)-modules is an analogue of the more classical (\varphi, \Gamma)-modules, and they also classify p-adic Galois representations.

In this talk, we study locally analytic vectors in some period rings and in the (\varphi, \tau)-modules; this enables us to establish the overconvergence property of the (\varphi, \tau)-modules. This is joint work with Léo Poyeton.

Friday, July 20

9:30-10:30 Yalong Cao

Zero Dimensional Donaldson-Thomas Invariants of Calabi-Yau 4-folds

We study Hilbert schemes of points on a smooth projective Calabi-Yau 4-fold X and define DT4 invariants by integrating the Euler class of a tautological vector bundle against the virtual class. We conjecture a formula for their generating series, which we prove in certain cases when L corresponds to a smooth divisor on X. A parallel equivariant conjecture for toric Calabi-Yau 4-folds is proposed. This conjecture is proved for smooth toric divisors and verified for more general toric divisors in many examples. Combining the equivariant conjecture with a vertex calculation, we find explicit positive rational weights, which can be assigned to solid partitions. The weighted generating function of solid partitions is given by exp(M(q)-1), where M(q) denotes the MacMahon function. This is joint work with Martijn Kool.

11:00-12:00 Weiwei Wu

Triangulated Structures in Floer Theory

The Fukaya category is a categorical invariant associated to a symplectic manifold. It is the basic object of study in homological mirror symmetry and has various applications to the topology of Lagrangian submanifolds. The key algebraic structure that allows concrete computations of a Fukaya category is its triangulated structure. We will explain how this is related to surgeries (connected sum) on Lagrangian submanifolds, according to a surgery formula discovered by Fukaya, Oh, Ohta and Ono. We'll give an easy proof of this formula, and extend it to the case of surgeries along a clean intersection (fibered sum).

13:30-14:30 Dongyi Wei

Transition threshold for the 3D Couette flow in Sobolev space

In this paper, we study the transition threshold of the 3D Couette flow in Sobolev space at high Reynolds number {Re}. It was proved that if the initial velocity v_0 satisfies $\|v_0-(y,0,0)\|_{H^2}\le c_0{Re}^{-1}$, then the solution of the 3D Navier-Stokes equations is global in time and does not transition away from the Couette flow. This result confirms the transition threshold conjecture in physical literatures.

15:00-16:00 Disheng Xu

Lyapunov Exponents and Rigidity

In this talk we will give a short introduction to the Lyapunov exponents and its applications in the study of dynamical systems and Schrodinger operators. Moreover we will show 1. an abstract theorem on the problem of frequency of hyperbolic behaviour. 2. a superrigidity result for the geodesic flow of hyperbolic manifold. The second result is a joint work with C. Butler. The basic philosophy hidden behind our results could be summarised as follows: for a dynamical system A or a family of dynamical systems A_t, if the associated Lyapunov exponents are all equal, then A (or A_t) should satisfy certain uncommon dynamical properties (so-called rigidity phenomena).