Institute of Mathematical Research
HKU

Department of Mathematics
HKUST

Department of Mathematics and IMS
CUHK

Hong Kong Geometry Colloquium
February 22, 2025 (Saturday)
Room 210, Run Run Shaw Bldg., HKU

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Professor Yi HU

University of Arizona, USA

Derived and modular resolution of moduli of higher genus stable maps and applications to the reduced GW invariants

10:00 – 11:00am

This talk is divided into three parts, addressing the following topics:

1. Derived Resolutions and Reduced GW invariants:
   For an integral stack M with a perfect derived object E, there exists a minimal birational modification M', generally singular, called the derived resolution. Upon pulling E back to M', E becomes locally diagonalizable, making its 0th sheaf cohomology locally free. Consequently, the Euler class $e(E)$ is well-defined. Applying this construction to the main component of the stable map moduli gives a canonical definition of the reduced Gromov-Witten invariants conjectured by Li-Zinger. This is joint work with Jun Li.
2. Smooth Derived Resolutions in Genus One and Two:
   Smooth derived resolutions of stable map moduli exist for genus one and genus two. The genus one case, completed with Jun Li, follows Vakil-Zinger's construction. The genus two case, a collaboration with Jun Li and Jingchen Niu, relies on explicit local defining equations of the stable map moduli derived by Jun Li and the speaker. Both resolutions can be obtained by blowing up the smooth Artin stack Dg of nodal curve and simple divisor pairs.
3. Stacks with twisted fields and Smooth Derived Resolutions:
   Based on the approach in (2), we introduce a framework that birationally modifies a smooth stack M (such as Dg) with tree-like structures (which is modeled on the stable map moduli's local equations). These modifications ensure that the pullbacks of certain tautological monomial sets possess divisibly minimal elements, enabling smooth derived resolutions. The framework, termed the theory of stacks with twisted fields, provides various smooth derived resolutions for genus two and two canonical resolutions for genus one: one by Vakil-Zinger, followed by Hu-Li, and another obtained by reversing the order of Vakil-Zinger's virtual blowups, which is novel. This work is in collaboration with Jingchen Niu.

11:00 – 11:30am *Tea Break*

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Dr. Guokuan SHAO

Sun Yat-sen University, Zhuhai

Bergman kernels and geometric quantization on complex manifolds with boundary

11:30am – 12:30pm

In this talk I will first review the principle that "quantization commutes with reduction" ($[Q,R]=0$) for symplectic manifolds. Then I will discuss the $[Q,R]=0$ principle for complex manifolds with boundary.

An important difference between the complex manifolds with boundary setting and the symplectic setting is that the quantum spaces in the case of compact symplectic manifolds are finite dimensional, whereas the quantum spaces consisting of holomorphic functions smooth up to the boundary for the compact complex manifolds with boundary are infinite dimensional.

We will present that under natural pseudoconvexity assumptions that the Guillemin-Sternberg map is Fredholm. The main ingredient is asymptotics of G-invariant Bergman kernels.

The $[Q,R]=0$ principle for CR manifolds is similar.

This meeting is hosted by the Institute of Mathematical Research, HKU.

All are Welcome