

# Modern Interactions between Algebra, Geometry and Physics

## Workshop

### **Date**

June 27 (Mon) , 2016 - June 29 (Wed) , 2016

### **Venue**

TOKYO ELECTRON House of Creativity 3F, Lecture Theater, Katahira  
Campus, Tohoku University

### **Invited Speakers**

Xiuxiong Chen (Stony Brook)

Toshiki Mabuchi (Osaka)

Shinichiroh Matsuo (Nagoya)

Hiroshi Iritani (Kyoto)

Yuji Odaka (Kyoto)

Kazushi Ueda (Tokyo)

Giovanni Landi (University of Trieste)

Kenta Tottori (Tohoku)

## Time schedule

Date	Time	Speaker
27(Mon)	11:00 - 12:30	Kazushi Ueda(Tokyo)
	12:30 - 15:00	Lunch and Discussion
	15:00 - 16:30	Xiuxiong Chen (Stony Brook)
	18:00 -	Reception (Restaurant Hagi)
28(Tue)	11:00 - 12:30	Hiroshi Iritani (Kyoto)
	12:30 - 13:45	Lunch and Discussion
	13:45 - 14:45	Giovanni Landi (University of Trieste)
	15:00 - 16:30	Shinichiroh Matsuo (Nagoya)
29(Wed)	11:00 - 12:30	Toshiki Mabuchi (Osaka)
	12:30 - 14:15	Lunch and Discussion
	14:15 - 14:45	Kenta Tottori (Tohoku)
	15:00 - 16:30	Yuji Odaka (Kyoto)

## Title and Abstract

- Kazushi Ueda(Tokyo)

Title: Residue mirror symmetry for Grassmannians

Abstract: Motivated by recent works on localizations in  $A$ -twisted gauged linear sigma models, we discuss a generalization of toric residue mirror symmetry by Batyrev-Matsevich to complete intersections in Grassmannians. This is a joint work with Bumsig Kim, Jeongseok Oh, and Yutaka Yoshida.

- Xiuxiong Chen (Stony Brook)

Title: A recent update on Kähler geometry

Abstract: There is a long standing conjecture which relates the existence of Kähler Einstein metrics with positive scalar curvature to the stability of underlying polarization, which goes back to Yau in 1980s. In this lecture, we will give an expository account of its resolution by Chen-Donaldson-Sun in 2012 and in addition, we will

also go over several new proofs (namely, proofs based on continuity path, the Kähler ricci flow and variation method respectively) to this important result emerging in recent years.

- Hiroshi Iritani (Kyoto)

Title: Mirror symmetry for toric stacks

Abstract: I will describe Landau-Ginzburg mirror symmetry for big and equivariant quantum cohomology of toric stacks. I will also discuss the convergence of the mirror isomorphism and how quantum D-modules change under toric flips. Part of this talk is based on joint work with Tom Coates, Alessio Corti and Hsian-Hua Tseng.

- Giovanni Landi (University of Trieste)

Title Line bundles over noncommutative spaces

Abstract: We give a Pimsner algebra construction of noncommutative circle bundles. In particular, noncommutative lens spaces are given as ‘direct sums of line bundles’ and exhibited as ‘total spaces’ of certain principal bundles over noncommutative weighted projective spaces. We naturally get an analogue of the classical Gysin sequence which relates K-theory classes of the total space algebra to that of the base space algebra. In turn this is used to select T-dual noncommutative bundles.

- Shinichiroh Matsuo (Nagoya)

Title: The perturbation of the Seiberg-Witten equations

Abstract: We will introduce a new class of perturbations of the SW equations. It is naturally crystallised through Weitzenbock formulae and offers flexibility in the way the SW invariants are constructed. The part of this talk is based on a joint work with Mikio Furuta.

- Toshiki Mabuchi (Osaka)

Title: An extremal Kähler version of the Yau-Tian-Donaldson conjecture

Abstract: The Yau-Tian-Donaldson conjecture for Kähler-Einstein cases was affirmatively solved by Chen-Donaldson-Sun and Tian. However, its generalized version including extremal Kähler cases is still open. In this talk, I'd like to discuss the general case focussing on what is the right choice of the definition of K-stability in this general case.

- Kenta Tottori (Tohoku)

Title: Calabi's conjecture of the Kähler-Ricci soliton type

Abstract: As a generalization of Calabi's conjecture, Zhu introduced the Kähler-Ricci soliton version of this conjecture. In this talk, we discuss this conjecture on a compact Fano manifold (more generally, a compact Kähler manifold with a holomorphic vector field which has a zero point) and prove it by using a geometric flow. If time allows, we will also talk about the case of a nowhere vanishing holomorphic vector field.

- Yuji Odaka (Kyoto)

Title: Gromov-Hausdorff compactification of moduli variety of Kähler-Einstein varieties

Abstract: Kähler-Einstein (KE) metric on a variety is a certain class of canonical metric and Gromov-Hausdorff distance gives a way to get a canonical limit of (sequence/family) of varieties when combined with the KE metrics, appropriately rescaled to make the diameters bounded. We use such differential geometric tools to an algebraic geometry question - compactify algebraic moduli spaces of varieties, which are often classical moduli varieties, and closely look at the structure we get at the boundary. There is a crucial difference with positive curvature case ( " Fano manifold " ) and non-negative curvature case.