Modern Interactions between Algebra, Geometry and Physics

Workshop

Date

July 13 (Wed) , 2016

Venue

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

Invited Speakers

Shing-Tung Yau (Harvard) Atsushi Takahashi (Osaka) Shinichiro Matsuo (Nagoya)

Time schedule

Date	Time	Speaker
13(Wed)	9:00 - 10:30	Shing-Tung Yau (Harvard)
	10:45 - 12:15	Atsushi Takahashi (Osaka)
	12:15 - 13:30	Lunch
	13:30 - 15:00	Shing-Tung Yau (Harvard)
	15:15 - 16:45	Shinichiro Matsuo (Nagoya)

Title and Abstract

- Shing-Tung Yau (Harvard)
- Title: First talk: Geometry and Physics

Second talk: General relativity and important physical quantities

Abstract: First talk:

The interactions of geometry and physics in the past 150 years since the time of Riemann will be discussed. The geometric ideas of Riemann were used, successfully, in general theory of relativity by Einstein who predicted the existence of gravitational waves 100 years ago. This is a triumph of Einstein's theory which has recently been confirmed directly by physics collaboration LIGO. The idea of unifying all the forces in nature was pursued by Einstein and continued by string theorists, who took physics from a 4-dimensional spacetime to a 10-dimensional spacetime. The six extra dimensions, which are posited by string theory, is the inner space of the universe. There is no doubt that great activities in the interactions between geometry and physics will go on today and in the future.

Second talk:

Quasilocal mass in general relativity is a notion defined for a closed spacelike 2-surface in spacetime. It has been an important question to find the right definition. Penrose gave a talk on this question in my seminar in the Princeton Institute for Advances Study in 1979 and listed it as the first major problem in his famous list of "Some Unsolved Problems in Classical General Relativity". We explain the Wang-Yau quasi-local mass originated from a blend of new ideas in differential geometry and nonlinear partial differential equations, and compare it with other notions of quasilocal mass. This is joint work with Po-Ning Chen and Mu-Tao Wang.

• Atsushi Takahashi (Osaka)

Title: On orbifold Jacobian algebras

Abstract: To an isolated hypersurface singularity at the origin, one can associate a finite dimensional algebra called the Jacobian algebra, which is a commutative Frobenius algebra. We propose axioms for "orbifold Jacobian algebras" which generalize the Jacobian algebras to those for isolated hypersurface singularities with a group action. We shall prove the existence and the uniqueness for invertible polynomials in three variables with their symmetry groups and show a compatibility with the geometry of vanishing cycles. This is a joint work with Alexey Basalaev and Elisabeth Werner.

• Shinichiro Matsuo (Nagoya)

Title: Brody curves and mean dimension

Abstract: A Brody curve is a 1-Lipschitz holomorphic map from the entire complex plane to a complex projective space. The space of all Brody curves admits the structure of an infinite dimensional dynamical system. We will report our research on this huge system from the viewpoint of Gromov's mean dimension theory. Joint work with Masaki Tsukamoto.