

# Kavli IPMU-FMSP Tutorial Workshop “Geometry and Mathematical Physics”

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This workshop was held at the Lecture Hall of the Kavli IPMU from January 22 to 25, 2013 in collaboration with “Leading Graduate Course for Frontiers of Mathematical Sciences and Physics (FMSP)”, which started as a MEXT Program for Leading Graduate School in October, 2012. The lecturers of the workshop were Todor Milanov, Yukinobu Toda, Kentaro Hori, and Alexey Bondal. They are all members of the Kavli IPMU and FMSP instructors as well. Each of them gave 2 or 3 slots of 90 minute lectures. The number of participants was about 50 and many graduate students from the University of Tokyo’s Graduate School of Mathematical Sciences and School of Sciences together with young researchers at the Kavli IPMU attended the workshop. T.

Milanov gave expository lectures on quantum cohomology, Gromov-Witten invariants, Frobenius structures, focusing on a construction of correlation functions on Riemann surfaces satisfying the Eynard-Orantin recursion. Y. Toda started from the explanation of the notion of derived category and its usefulness in non-commutative geometry and mirror symmetry, and gave a description of Donaldson-Thomas (DT) invariants on Calabi-Yau 3-folds. He then explained how stability conditions on derived categories of coherent sheaves are useful for the study of DT invariants and suggested some open problems. K. Hori gave an introductory lecture on supersymmetric quantum mechanics and explained examples such as Landau-Ginzburg model

and non-linear sigma model. He also mentioned a relation to index theorem in geometry and a mathematical description of the notion of D-branes. A. Bondal started from Borel-Weil theory which describes a geometric construction of irreducible representations of complex semi-simple Lie groups and then explained the notion of minuscule varieties, a particularly nice class of homogeneous varieties over semi-simple complex Lie groups. In this workshop, we were able to hear systematic introductory lectures for subjects of current interests, which are related to both mathematics and theoretical physics. It was a stimulating and precious occasion for students and researchers working in mathematics and physics.

