Matrix Factorization and Related Topics, 2016

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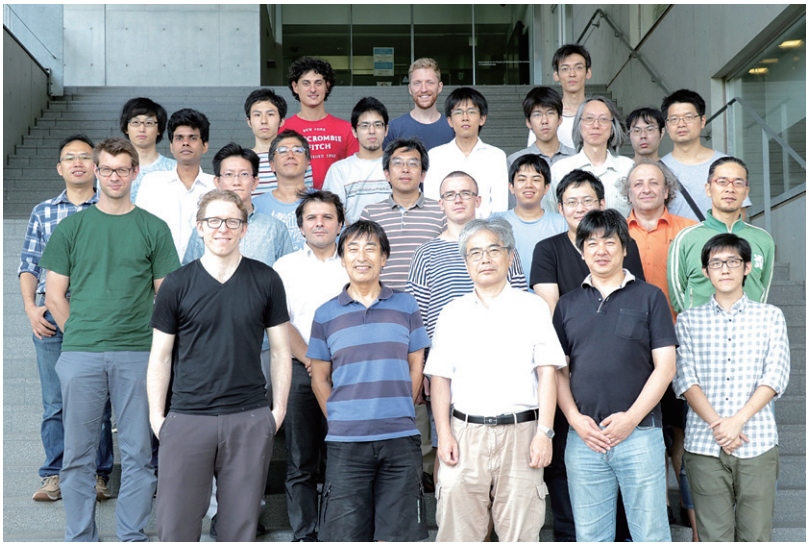
The workshop "Matrix factorization and related topics, 2016", organised by Hiroshi Ohta (Nagoya), Kyoji Saito (Kavli IPMU) and Atsushi Takahashi (Osaka), was successfully held at the Kavli IPMU for four days from September 5, 2016. The programme consisted of two series of lectures by Tobias Dyckerhoff (Bonn) and Daniel Murfet (Melbourne) together with related research talks by Atsushi Takahashi (Osaka), Andrei Losev (Moscow), and Michael Brown (Bonn). This workshop has brought together 35 participants from algebra, geometry, and mathematical physics.

Matrix factorizations were introduced by David Eisenbud, as a tool for studying the homological behaviour of modules over a hypersurface ring. More recently, matrix factorizations have begun appearing in a wide variety of contexts. For instance they arise in string theory as categories of D-branes for Landau-Ginzburg B-models. The expectation in homological mirror symmetry is that for any given symplectic manifold, there is a mirror Landau-Ginzburg model such that, the Fukaya category of the symplectic manifold should be equivalent to the matrix factorization category of the Landau-Ginzburg model. In addition, Kajiura-Saito-Takahashi's explicit description of the equivalence of triangulated categories involving matrix factorizations of simple singularities nicely fits into this categorical expectation.

Tobias Dyckerhoff, following his joint works with Mikhail Kapranov, Chris Brav, Vadim Schechtman, and Yan Soibelman, discussed various topics on topological Fukaya categories. Firstly he constructed topological Fukaya categories for the two dimensional case. Then he introduced the concept of a relative Calabi-Yau structure and constructed them on topological Fukaya categories. Finally, he discussed more details using the categorical machinery of perverse sheaves.

Daniel Murfet gave his lectures under the title of generalized orbifolding of simple singularities. He started his lecture series by explaining an important result due to Carqueville-Ros Camacho-Runkel, which directly leads to new descriptions and relations between the associated categories of matrix factorizations and Dynkin quiver representations of simple singularities. Then he discussed these concepts in the abstract bicategorical framework for generalised orbifolding. He concluded his lectures with some concrete examples of Ladau-Ginzburg models and its graded version. In the final lecture, he explained how to obtain finite dimensional models of matrix factorization categories.



Atsushi Takahashi gave a gentle introduction to Kyoji Saito's theory of primitive forms. He highlighted the historical development of the subject and directions for further advancements mainly in the categorical setup. Under the section of research talks, Michael Brown explained about the topological K-theory of matrix factorization categories in order to extract topological information from the matrix factorization category associated to an isolated singularity. In his research talks, Andrei Losev first discussed about the theory of primitive forms and generalised Hodge theory; and then he went to talk on tropical mirror symmetry where he considered tropical limit of Gromov-Witten theory.

Numerous discussions among the participants, most importantly from different mathematical communities, have contributed to the workshop in an essential way. Furthermore, participants also appreciated ample time for interaction with other researchers. So the workshop provided an ideal atmosphere for fruitful interaction and exchange of ideas.