Mini-Workshop on Matrix Factorizations

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Organizers:

Henning Krause (Bielefeld), David Ploog (Hannover), Christoph Schweigert (Hamburg)

1 Report

With support of the DFG priority program 1388 “Representation theory”, the following group of mathematicians and mathematical physicists gathered in Hannover on June 28 and 29, 2010, for a mini workshop to explore recent developments about matrix factorizations in mathematics and mathematical physics:

- Ragnar-Olaf Buchweitz, Toronto
- Nils Carqueville, München
- Xiao-Wu Chen, Paderborn
- Henning Krause, Bielefeld
- Helmut Lenzing, Paderborn
- Daniel Murfet, Bonn
- David Ploog, Hannover
- Ingo Runkel, Hamburg
- Christoph Schweigert, Hamburg

Program:

Monday:
Nils Carqueville: Why physicists are interested in matrix factorizations
Xia-Wu Chen: Compact generators in categories of matrix factorizations, after Dyckerhoff
David Ploog: Graded matrix factorizations and Fuchsian singularities

Tuesday:
Ragnar Buchweitz: What is the real/proper/correct/intrinsic Hochschild Cohomology of Matrix Factorizations?
Lenzing: Matrix factorizations related to weighted projective lines and illustrations of the Orlov context
Daniel Murfet: The determinant formula for residues and fusion of defects in Landau-Ginzburg models

Nils Carqueville started with an exposition of Landau Ginzburg models, treating both the case of worldsheets with and without boundaries. His contribution ended with an explanation on how matrix factorizations arise as a solution to the so-called Warner problem of finding supersymmetric boundary conditions for the Landau-Ginzburg Lagrangian.

Xia-Wu Chen reported on Dyckerhoff's work on compact generators in categories of matrix factorizations `arXiv:0904.4713v4 [math.AG]`.

David Ploog reported on the approach of Lenzing and de la Peña to Fuchssian singularities and its relations to graded matrix factorizations.

In his talk, Ragnar Buchweitz raised the question of what the appropriate intrinsic definition of Hochschild cohomology of matrix factorizations should be. In particular, he explained that Dyckerhoff obtains the Hochschild cohomology of the map $w : \mathbb{C}^n \to \mathbb{C}$, not the stabilized Hochschild cohomology of the hypersurface singularity $w^{-1}(0) \subset \mathbb{C}^n$, as one might have expected.

Helmut Lenzing discussed matrix factorizations related to weighted projective lines and illustrations of the Orlov context. To a weighted projective line X, one can associated graded Gorenstein algebras R. The category $vect(X)$ of vector bundles on X is isomorphic to the category of graded Cohen-Macaulay modules over R and becomes a Frobenius category. The passage to the associated stable category yields a triangulated category which equals Buchweitz's "stable derived category" of R or Orlov's triangulated category of the singularities of R. The comparison of $coh(X)$ and the stable category of $vect(X)$ thus becomes an instance of Orlov's theorem.

Daniel Murfet explained his recent work on making Fourier-Mukai functors between categories of matrix factorisations explicit. This work is motivated and has applications in the computation of Khovanov-Rozansky link homology and the description of fusion of topological defects in Landau-Ginzburg models.