

## RESEARCH SEMINAR, SUMMER SEMESTER 2012

A del Pezzo surface is defined as a smooth projective surface whose anti-canonical sheaf is ample. The goal of the seminar is to understand the paper [1] which proves homological mirror symmetry for del Pezzo surfaces and their noncommutative deformations. This will hopefully give us the opportunity to understand some of the techniques in this area in a concrete and accessible example.

**Talk 1.** Briefly state the main results of the paper. Briefly give the facts about del Pezzos presented in the paper. Talk about exceptional collections, enhancements and so forth, see Section 2.1. Give some details about the proof of Theorem 2.5. Briefly describe how to recover the surface from the category associated with the quiver of the exceptional collection.

**Talk 2.** This talk is concerned with Sections 2.2 and 2.3, that is, simple degenerations and noncommutative deformations of del Pezzo surfaces. We need to know what the derived category of such a surface is. Explain what a noncommutative deformation of a del Pezzo surface is.

**Talk 3.** The mirror Landau-Ginzburg models (Section 3): explain how to compactify the mirror of  $\mathbb{P}_{\mathbb{C}}^2$ , talk about vanishing cycles and so forth.

**Talk 4.** The construction in talk 3 is somewhat adhoc, so present the construction of the mirror Landau-Ginzburg models following [2].

**Talk 5.** For the following two talks we will need some background from symplectic geometry, e.g. concerning the Maslov index. We do not need all the details concerning the objects appearing in Sections 4.1 & 4.2, but we want to get some intuition.

**Talks 6+7.** Define the category of vanishing cycles (Sections 4.1 & 4.2). Since this is based on [3], it is probably best to consider the original reference.

**Talk 8.** Give an outline concerning compositions in the category of vanishing cycles (Section 4.3). We probably do not want to see all the details, but only get a feeling what ingredients are needed.

**Talk 9.** Section 4.4 & 4.5, that is, simple degenerations and modular invariance.

**Talk 10.** We bring everything together to prove the main results.

## REFERENCES

- [1] A. Auroux, L. Katzarkov and D. Orlov, *Mirror symmetry for Del Pezzo surfaces: Vanishing cycles and coherent sheaves*, Invent. Math. 166 (2006), 537-582.
- [2] M. Carl, M. Pumperla and B. Siebert, *A tropical view of Landau-Ginzburg models*, <http://www.math.uni-hamburg.de/home/siebert/preprints/LGtrop.pdf>.
- [3] P. Seidel, *Vanishing cycles and mutation*, <http://arxiv.org/pdf/math/0007115.pdf>