Abstracts of the Workshop
Geometry of singularities (Münster 09)

M. Banagl: Singular spaces, Poincaré Complexes and String Theory.

Abstract: We introduce a method that associates to certain singular spaces, for example to conifolds, a cell complex whose ordinary rational homology satisfies Poincaré Duality. The construction is of a homotopy theoretic nature and uses Moore approximations of the links of singularities. Surprisingly, the thus obtained new homology theory is not isomorphic to Goresky-MacPherson's intersection homology, but a mirror-symmetry partner of it. In addition to purely mathematical applications, we shall also sketch applications in theoretical physics: While intersection homology counts massless D-branes arising in type IIA string theory correctly, the new homology theory, contrary to intersection homology, sees the correct count of such D-branes in type IIB string theory.

J.P. Brasselet: A relative de Rham theorem.

Abstract: The origin of the work is a question asked to Bernard Teissier by François Trèves: Given an analytic map $g : S^n \to \mathbb{R}$ and a $\mathcal{C}^1$ differential form ω of degree $r \leq n$ on S^n such that the restriction to each non singular fibre of g is exact, does it exist a Hölder $(r-1)$-differential form H on S^n such that one has $dg \wedge (\omega - dH) = 0$? Here the differential dH is to be considered in the sense of distributions. We prove the result in a more general situation, the one of proper triangulable subanalytic maps between non-singular varieties. The proof uses the notion of Whitney forms introduced by Hassler Whitney in his nice proof of the de Rham Theorem.

W. Ebeling: Multi-variable Poincaré series associated with Newton diagrams.

Abstract: We define a multi-index filtration on the ring of germs of functions on a hypersurface singularity associated with its Newton diagram and compute the multivariable Poincar series of this filtration in some cases. This is joint work with S.M. Gusein-Zade.

M. Lönne: The braid monodromy invariant associated to a germ of a projection of a plane curve.
Abstract: We first define the invariant mentioned in the title. It is then computed in some easy examples. We describe some striking homomorphisms between braid groups and knot groups of discriminants and bifurcation sets. Properly exploited they should lead to an understanding of symplectic monodromy of plane curves.

U. Ludwig: The Witten complex for algebraic curves with cone-like singularities.
Abstract: The Witten deformation is an analytical method proposed by Witten which, given a function $f : M \to \mathbb{R}$ on a smooth compact Riemannian manifold M, leads to a proof of the Morse inequalites. In this talk we generalise the Witten deformation to singular complex algebraic curves X with cone-like singularities, and functions on X which we call admissible Morse functions. They are particular examples of stratified Morse functions in the sense of the theory developed by Goresky/MacPherson.

T. Ohmoto: Some formulae of Chern classes of symmetric products and Hilbert schemes.
Abstract: I would like to talk about an general form of generating function for (singular) Chern classes of Hilbert schemes of points, and discuss about a sort of McKay correspondence.

M. Oka: Mixed Projective curves.
Abstract: Let $f(\mathbf{z}, \bar{\mathbf{z}})$ be a polar homogeneous polynomial. It defines a projective variety $V = \{f = 0\}$. We study the topology of this hypersurface.

T. Suwa: Intermediate Thom classes.
Abstract: The usual Thom class of a complex vector bundle may be thought of as a combined notion of the top Chern class of the bundle and its “local information”. I will introduce similar classes for the other Chern classes and explain how they are related to some local invariants appearing in the singularity theory.

K. Takeuchi: Monodromy at infinity, A-hypergeometric D-modules and local zeta functions.
Abstract: In this talk we explain how the basic tools in D-module theory can be applied to some problems in related fields. More precisely, we apply them to

(a) the degree (dimension) formula for the A-discriminant varieties introduced by Gelfand-Kapranov-Zelevinsky (arXiv:0807.3163).

(b) the monodromy at infinity of general polynomial maps $\mathbb{C}^n \longrightarrow \mathbb{C}^k$, $k \leq n$ (arXiv:0809.3149).

(c) the analytic continuation (monodromy representation) of A-hypergeometric functions i.e. the solutions to A-hypergeometric D-modules (arXiv:0812.0652).

Finally, we will give an application of real toric modifications and hyperfunction theory to the explicit description of the poles of local zeta functions (arXiv:0903.4265). This result would shed some light on the (twisted) monodromy conjecture.

M. Tibar: On the monodromy of maps on surfaces.
Abstract: We study the monodomy group of a map from an affine surface onto a curve in relation to the completion of that map, in paticular we discuss the situation when the monodromy is trivial. This report on work in progress jointly with A.J. Parameswaran.

W. Veys: Zeta functions and monodromy for ideals.
Abstract: The monodromy conjecture states that every pole of the topological (or related) zeta function induces an eigenvalue of monodromy. This conjecture has already been studied a lot; however in full generality it is proven only for zeta functions associated to a polynomial in two variables. In this talk we work with zeta functions associated to an ideal. First we work in arbitrary dimension and obtain a formula (like the one of A'Campo) to compute the "Verdier monodromy" eigenvalues associated to an ideal. Afterwards we prove a generalized monodromy conjecture for arbitrary ideals in two variables.

S. Yokura: Motivic canonical classes.
Abstract: I will discuss Fulton's canonical classes from a "motivic" viewpoint.