FINAL REPORT, SHORT VERSION, P 14195-MAT
LIE THEORY AND APPLICATIONS. II

In this project 39 papers were prepared, 18 of these are already published, 3 are in press, 9 are submitted, 8 are still unfinished, and 1 is unpublished. The reseach in this project was centered in the following fields:

Invariant Theory I: Lifting of curves. The basic question is whether a real smooth curve of hyperbolic (with all roots real) polynomials admits arrangements of its roots which are differentiable. We have already answers which are best possible in several directions. Also applications to differentiable choices of eigenvalues for smooth curves of unbounded selfadjoint operators on Hilbert spaces are given. A PhD thesis was prepared in this field (promotion sub auspiciis praesidentis rei publicae).

Invariant Theory II: other results. Conditions for lifting of tensor fields from orbit spaces are determined.

Completing infinitesimal actions of vector fields and Lie algebras. Here the problem of describing the completion of a manifold with a vector field or a manifold with the action of a finite dimensional Lie algebra is treated.

Gerbes and foliated bundles. The notion of a gerbe with connection is reformulated in terms of the simplicial de Rham complex.

Reflections groups on Riemannian manifolds. Discrete groups of isometries of a complete connected Riemannian manifold which are generated by reflections are investigated.

Lie theory and representation theory. Extension theory of super Lie algebras. The generalized Cayley map from an algebraic group to its Lie algebra is studied.

Symplectic manifolds. Conformal symplectic diffeomorphisms. Harmonic cohomology. The c–splitting conjecture. Floer theory based on non-contractible one periodic orbits of a symplectic vector field.

Riemannian orbit spaces and completely integrable systems. Spin Calogero-Moser systems associated to polar representations, singular stratified cotangent bundle reduction, and degenerate integrability of such a system. A PhD thesis is nearly finished.

Infinite dimensional manifolds and Lie groups, shape theory and pattern recognition. The simplest Riemannian metric on the space of 2-dimensional 'shapes'. Vanishing of geodesic distance for the L^2-Riemannian metric on the space of immersions modulo the diffeomorphism group of the source space, for curves and in higher dimensions. Exact volume preserving diffeomorphisms as subgroup of the group of all volume preserving diffeomorphisms. Perfectness of the group of diffeomorphisms. Geometric quantization on the non-linear Grassmannian of n dimensional (unparameterized) closed oriented submanifolds of a given manifold M. Central extension by $\mathbb{R}$ of groups of symplectic diffeomorphisms. Homology of Lie algebroid structures.

Spectral geometry. ρ-invariant and improved Morse–Novikov theory. Analytic torsion and counting functions of closed trajectories of a vector field X. Euler structures and Ray–Singer torsion. A generalization of the Bismut–Zhang theorem to Morse–Bott–Smale vector fields.

Non-commutative geometry. The non-commutative torus and its universal covering, the Heisenberg plane, are studied. The notion of smooth $*$-algebras is introduced.