Outline of the main lecture course

The subject of the main lecture course is Lagrangian Floer homology and its applications in symplectic topology. The starting point is the association of a (filtered) A_∞-algebra to each (closed, oriented and relatively spin) Lagrangian submanifold, and an A_∞-bimodule to each pair of such manifolds. We explain how these algebraic structures arise from the compactifications of moduli spaces of holomorphic disks and briefly touch upon some technical issues in the construction (Kuranishi structures, orientations). We discuss deformations of A_∞-structures, (weak) Maurer-Cartan elements, and the extraction of invariants.

In the second part we explicitly compute the Floer homology for the T^n orbits of a toric manifold. We reduce this calculation to the calculation of a so-called potential function, and we apply this calculation to questions of non-displaceability. We also explain, by explicit examples, how several algebraic constructions such as deformation of the chain complex by using cohomology classes from the Lagrangian submanifold and from the ambient symplectic manifold are used in the study of the T^n orbits of a toric manifold.

Another case where calculation of Lagrangian Floer homology is possible arises from cutting and pasting Lagrangian submanifolds. Lagrangian surgery is one example of such an operation. We discuss how the moduli space of pseudo-holomorphic discs changes under Lagrangian surgery and use it to obtain various examples.