Name: Kei Irie

Research field: Geometry and Topology

Key words: Symplectic Geometry, Morse-Floer Theory

Research description:

In classical mechanics, phase spaces play a role as a background to write down Hamilton's equation of motion. Shortly speaking, symplectic geometry is "geometry of phase spaces". In particular, study of global and topological aspects of symplectic geometry has rapidly expanded since 1980's.

Symplectic geometry has many aspects and many related areas. My research mainly concerns quantitative invariants of symplectic manifolds (so called symplectic capacities) with emphasis on relations to Hamiltonian dynamics. An excellent introductory book to this field of research is "Symplectic Invariants and Hamiltonian Dynamics" by Hofer & Zehnder. From technical point of view, I mainly use pseudo-holomorphic curves (also called as J-holomorphic curves) introduced by Gromov, and "semi-infinite" homology theory invented by Floer (now called Floer homology theory), which is technically based on theory of pseudo-holomorphic curves.

I'm also interested in various topics related to the subject described above. For instance, I have also studied geometry of loop spaces (in particular, a relatively recent subject called string topology), billiard dynamics, and so on.

Notices to students:

I expect students who would like to work with me that they have at least mastered undergraduate level manifold theory and (singular) homology theory. I also encourage them to learn basic subjects in geometry and topology, such as characteristic classes, connections and curvature, and theory of harmonic integrals.

For students who wish to do research in symplectic geometry, I recommend them to learn (at least a bit of) classical mechanics. For pseudo-holomorphic curves and Floer homology, there are good books such as "J-holomorphic curves and symplectic topology" by McDuff & Salamon and "Morse Theory and Floer Homology" by Audin & Damian.