**Name**: Kazushi Ueda

**Area of research**: algebraic geometry, symplectic geometry, mathematical physics

**Key words**: mirror symmetry, derived category

**Research interest**: Through its history, mechanics has always been with geometry; Euclidean geometry is an indivisible part of Newtonian mechanics, and same is true with symplectic geometry and analytical mechanics, pseudo-Riemannian geometry and general relativity, and geometry of connections on principal bundles and gauge theory.

In the 20th century, quantum mechanics has taken over classical mechanics as the fundamental law of nature, but it is still not clear what "quantum geometry" is. String theory is a religion which claims that everything in this universe is made of a string which is as small as $10^{-35}$m. It is a window through which we can catch a glimpse of "quantum geometry".

After the second superstring revolution, string theory contains not only strings but also branes, which are extended objects in various dimensions. Topological string enables us to extract the most fundamental information from the dynamics of strings and branes. Although a mathematical formulation of the full string theory is out of reach at the moment, some part of topological string theory can be treated as rigorously. String theorists have used intuitive arguments to predict many non-trivial phenomena in mathematics, which had huge impact on mathematicians.

Ricci-flat Kähler manifolds are called Calabi-Yau manifolds after Yau's solution to the Calabi conjecture. Mirror symetry is a series of conjectures on the geometry of Calabi-Yau manifolds originating from string theory, and homological mirror symmetry is one of the strongest among them. It is a conjecture by Kontsevich which states that the derived category of coherent sheaves on one Calabi-Yau manifold is equivalent to the derived Fukaya category of another. This suggests that branes see the world in a completely different way from particles, and forces us to change our view toward geometry.

My research is centered around homological mirror symmetry. I have also studied dimer models, integrable systems, non-commutative algebraic geometry, moduli of K3 surfaces, and so on. Some of my research papers and reviews can be found in

http://www.ms.u-tokyo.ac.jp/˜kazushi/

**Prerequisites**: To study homological mirror symmetry, one must know both algebraic geometry and symplectic geometry. For algebraic geometry, one must be familiar not only with the standard theory of algebraic varieties and schemes, but also with derived categories. For symplectic geometry, one has to work with pseudo-holomorphic curves and Fukaya categories.