Geometry and Algebra of Topological String Theory
Math 996 – FALL 2008

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Prerequisites: Knowledge of basic algebra, including the notion of complex as well as elementary geometry of manifolds.

Textbook: Not Listed

Topological String Theory is the area of String Theory which deals with quantities independent of the metric. Absence of dynamics is compensated by rich topological structures. Sypersymmetry gives rise to various structures of homological algebra. In particular, observables of the theory can be often described as elements of chain complexes, such that for equivalent theories corresponding complexes have isomorphic cohomology.

Many fundamental discoveries in recent mathematics were influenced by Topological String Theory. They include: various knot invariants (from Jones polynomial to Khovanov's categorical knot invariants), as well as famous Gromov_Witten or Donaldson-Thomas invariants. I plan to discuss several mathematical structures motivated by, or playing an important role in, the Topological String Theory. They include:

1. A-infinity categories and Calabi-Yau categories.
2. Gromov-Witten and Donaldson-Thomas invariants.
3. Mathematical interpretations of various string dualities and their geometrical consequences, e.g. Mirror Symmetry or Large N duality.
4. Corollaries and applications include knot invariants, invariants of symplectic manifolds, representation theory of quivers and cluster transformations.

For more information about the course, please contact Yan Soibelman.