Mathematics and CS Seminar

Quantum topology from symplectic geometry

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The discovery of the Jones polynomial in the early 80's was the beginning of quantum topology'': the introduction of various invariants which, in one sense or another, arise from quantum mechanics and quantum field theory. There are many mathematical constructions of these invariants, but they all share the defect of being first defined in terms of a knot diagram, and only subsequently shown by calculation to be independent of the presentation. As a consequence, the geometric meaning has been somewhat opaque. By contrast, in the physics literature, there is a geometric story: Witten showed that the invariants can be extracted from a 3d quantum field theory, and he later showed that this quantum field theory can be found as a boundary condition in string theory. However, it has been difficult to translate these ideas into mathematics, because they a priori depend on infinite dimensional integrals which have no mathematically rigorous definition. In the talk I will explain how just enough of the open topological string theory can be made mathematically precise so as to give a manifestly geometric interpretation of the skein relation: it is a boundary term which must be set to zero in order to invariantly count holomorphic curves with boundary. As a consequence one finds that the HOMFLY polynomial (a generalization of the Jones polynomial) is a count of holomorphic curves in a certain 6-dimensional setting which is invariantly and geometrically constructed from the three-dimensional topology. This talk draws from the paper Skeins on Branes'' written with Tobias Ekholm.

Monday, March 11, 2019 10:00am - 11:00am

Mondi Seminar Room 2, Central Building

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