

Perturbative expansions in Chern-Simons theory from the point of view of Holomorphic Floer Theory

About 10 years ago together with Maxim Kontsevich we started a project which we called “Holomorphic Floer Theory” (HFT for short). In HFT one deals with complex symplectic manifolds instead of real ones. Then, generically, the Floer differential vanishes. As a result, one has to develop a new theory and ask new questions. I am going to explain some of them in the simplest example of the Morse theory of a holomorphic Morse function.

HFT has many applications e.g. the unifying point of view on the Riemann-Hilbert correspondence. I am going to explain an application to exponential integrals in finite and infinite dimensions. In the case of Chern-Simons theory this leads to several interesting conjectures, including the one about the existence of a mixed Hodge structure of infinite rank associated to a complexified Chern-Simons functional.