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Cohomological crepant resolution conjecture for the Hilbert scheme of points on surfaces

ABSTRACT: The Hilbert scheme of n points on a surface is the crepant resolution of the n -fold symmetric product of the surface. Yongbin Ruan conjectured that the cohomology ring structure of the Hilbert scheme can be related to the Chen-Ruan cohomology ring of the symmetric product via a correction from extremal Gromov-Witten invariants. In this talk, we will discuss the proof of the conjecture in the joint work with Zhenbo Qin with lots of help from Jun Li. We first prove a universality result by the detailed analysis of the virtual cycle of the moduli space of three-points extremal stable maps to the Hilbert scheme using a method of Jun Li on Hilbert scheme of points on three-folds and the cosection localization of Kiem-Li, and by the vertex algebraic treatment of the cohomology of Hilbert scheme and the symmetric product due to Nakajima, Lehn, Li-Qin-Wang, and Qin-Wang. Then the result of Cheong who proves Ruan's conjecture for toric surfaces is used to prove the conjecture for general projective surfaces.