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Title: Reflexive modules on normal Gorenstein Stein surfaces, their deformations and moduli

Abstract: The McKay correspondence is a bijection between the irreducible representations of a finite subgroup of $SL(2, \mathbb{C})$ and the irreducible components of the exceptional divisor of the minimal resolution of the associated quotient surface singularity. This correspondence was explained in terms of vector bundles on the minimal resolution by Gonzalez-Springberg and Verdier by case by case computation. Later, Artin and Verdier proved this correspondence with reflexive modules and this theory was developed by Esnault and Wunram for quotient surface singularities.

In this talk we will generalize the Artin-Verdier, Esnault and Wunram construction of McKay correspondence to arbitrary Gorenstein surface singularities. The key idea is the definition and a systematic use of a degeneracy module, which is an enhancement of the first Chern class construction via a degeneracy locus. We study also deformation and moduli questions. Among our main result we quote: a full classification of special reflexive modules on normal Gorenstein surface singularities in terms of divisorial valuations centered at the singularity of discrepancy zero, a first Chern class determination at an adequate resolution of singularities, construction of moduli spaces of special reflexive modules, a complete classification of Gorenstein normal surface singularities in representation types, and a study on the deformation theory of reflexive modules and its interaction with their pullbacks at resolutions. As a consequence of the theory we confirm a conjecture of Drodz, Greuel and Kashuba in the Gorenstein case. Joint work with Javier Fernández de Bobadilla.