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Curves on Hyperkähler varieties and modular forms

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The enumerative geometry of curves on algebraic surfaces is a fascinating subject with roots in the 19-th century. For example, Cayley and Salmon in 1849 proved the remarkable fact that every cubic surface in P3 contains precisely 27 lines. A more modern highlight is the Yau-Zaslow formula, proven by Beauville and Bryan-Leung in the 1990s, which says that the counts of rational curves on K3 surfaces are the Fourier coefficients of the reciprocal of the discriminant modular form. The result links together the geometry of K3 surfaces, modular forms and insights from string theory in a beautiful way. In this talk, I will review these results and then discuss an analogue of K3 surfaces in higher dimension, the mysterious class of hyperkähler varieties. For the most prominent deformation family of these varieties, the K3[n]-type hyperkähler varieties, I will discuss how counting of curves is linked to Jacobi forms. In particular, we obtain new constructions of vector-valued Jacobi forms and gain new tools to attack difficult enumerative problems about hyperkähler varieties and CHL Calabi-Yau threefolds.

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