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G-bundles on Abelian surfaces, hyperk\"aler manifolds, and stringy Hodge numbers

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Abstract: We study the moduli space M_G (A) of flat G-bundles on an Abelian surface A, where G is a compact, simple, simply connected, connected Lie group. Equivalently, M_G (A) is the (coarse) moduli space of s-equivalence classes of holomorphic semi-stable $G^{\cnums}$ -bundles with trivial Chern classes. M_G (A) has the structure of a hyperk\"ahler orbifold. We show that when G is Sp(n) or SU (n), M_G (A) has a natural hyperk\"ahler desingularization which we exhibit as a moduli space of $G^{\cnums}$ -bundles with an altered stability condition. In this way, we obtain the two known families of hyperk\"ahler manifolds, the Hilbert scheme of points on a K3 surface and the generalized Kummer varieties. We show that for G not Sp (n) or SU (n), the moduli space M_G (A) does \emph{not} admit a hyperk\"ahler resolution. \sloppy {Inspired by the physicists Vafa and Zaslow, Batyrev and Dais define ``stringy Hodge numbers'' for certain orbifolds. These numbers have been proven to agree with the Hodge numbers of a crepant resolution (when it exists). We directly compute the stringy Hodge numbers of $M_{SU\ (n)}$ (A) and $M_{Sp\ (n)}$ (A), thus deriving formulas (originally due to G\"ottsche and G\"ottsche-Soergel) for the Hodge numbers of the Hilbert schemes of points on K3 surfaces and generalized Kummer varieties.}

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