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The Vafa-Witten equations and T-branes

The Vafa-Witten equations are a higher-dimensional analogue of the Hitchin equations on compact Riemann surfaces for oriented four-manifolds. On a compact complex surface, their solutions are polystable Higgs bundles (with Higgs fields taking values in a vector bundle twisted by the canonical bundle of the surface); T-branes are solutions whose Higgs fields are non-abelian. In this talk, we describe the geometry of T-branes and prove, in particular, that they can only exist on properly elliptic surfaces and surfaces of general type. We also give examples. This is work in progress with Fernando Marchesano and Raffaele Savelli.