GEOMETRY, TOPOLOGY, AND PHYSICS SEMINAR

Gauged linear sigma models and non-complete-intersection Calabi–Yau varieties

Dave Morrison
UCSB

Friday, January 28, 2011, 4:00 p.m.
Room 6635 South Hall

Abstract: A large class of examples of Calabi–Yau varieties is provided by "complete intersections" in toric Fano varieties: that is, Calabi–Yau varieties whose homogeneous ideal has the same number of generators as the codimension of the variety. This class has been well-studied both in mathematics and in physics, in part because of Witten's "gauged linear sigma model" (GLSM) construction which provides a two-dimensional superconformal field theory corresponding to the Calabi–Yau variety. The GLSM corresponding to a complete intersection always has an abelian gauge group.

From the viewpoint of projective geometry, it is well-understood that "most" varieties are not complete intersections. A classical result of Serre shows that a codimension two variety can be expected to be a complete intersection, but in codimension three, Buchsbaum and Eisenbud showed around 1970 that a different construction is needed: the variety can be expected to be a "Pfaffian variety," determined by a rank condition on a skew-symmetric matrix of homogeneous polynomials.

In 1998, Rødland studied Calabi–Yau threefolds built from a 7×7 skew-symmetric matrix, and in 2006, Hori and Tong showed how to describe these Calabi–Yau threefolds with a GLSM using a non-abelian gauge group.

There have been other constructions of Pfaffian Calabi–Yau threefolds in recent years, notably by Tonoli and Kanazawa. This report on work in progress will describe how to extend the Hori–Tong construction to give GLSM descriptions of these Calabi–Yau threefolds. In principle, the construction should work for any Calabi–Yau variety of codimension three in a toric Fano ambient space.