Mordell-Weil Torsion, Anomalies, and Phase Transitions.

Monica Jinwoo Kang[1*]

[1]Department of Physics, Harvard University, Cambridge, MA, USA

Abstract

We explore how introducing a non-trivial Mordell-Weil group changes the structure of the Coulomb phases of a five-dimensional gauge theory from an M-theory compactified on an elliptically fibered Calabi-Yau threefold with an I_2+I_4 collision of singularities. The resulting gauge theory has a semi-simple Lie algebra $\mathfrak{su}(2) \oplus \mathfrak{sp}(4)$ or $\mathfrak{su}(2) \oplus \mathfrak{su}(4)$. We compute topological invariants relevant for the physics, such as the Euler characteristic, Hodge numbers, and triple intersection numbers. We determine the matter representation geometrically by computing weights via intersection of curves and fibral divisors. We fix the number of charged hypermultiplets transforming in each representation by comparing the triple intersection numbers and the one-loop prepotential. This condition is enough to fix the number of representation when the Mordell-Weil group is $\mathbb{Z}_2$ but not when it is trivial. The vanishing of the fourth power of the curvature forms in the anomaly polynomial is enough to fix the number of representations. We discuss anomaly cancellations of the six-dimensional uplift. In particular, the gravitational anomaly is also considered as the Hodge numbers are computed explicitly without counting the degrees of freedom of the Weierstrass equation.

Keywords: Elliptic fibrations, Crepant resolutions, Mordell-Weil group, Anomaly cancellations, Weierstrass models

March 20, 2018

*e-mail: jkang@physics.harvard.edu