

2d (0,2) Brane Brick gauge theories

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Brane Brick models are 2d (0,2) gauge theories on the world-volume of D1-branes probing toric Calabi-Yau (CY) 4-fold singularities. Given a toric diagram, we can construct the gauge theory by orbifolding, partial resolution, or other means. For abelian theories, we can verify that the classical moduli space coincides with the CY geometry, most efficiently by using a combinatorial tool called brick matching. The map between gauge theory and geometry is in general many to one. In some concrete examples, we show that the gauge theories corresponding to the same geometry are related to each other via Gaiotto-Gukov-Putrov triality. One way to understand the triality is to study the mirror dual of the toric CY singularity. Mirror symmetry leads to a geometric unification of dualities in different dimensions, where the order of duality is $(n-1)$ for a CY n -fold. At the quantum level, we expect that the abelian theory will flow to a sigma model on the CY singularity with the left-moving fermions transforming in the 6 representation of the $SU(4)$ holonomy group of the tangent bundle. We confirm this expectation by computing the elliptic genus of the gauge theory.

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