Computing Standard Models from D7-branes

Federico Compagnin[1], Jakob Moritz[2], Elijah Sheridan*[1], and James Halverson[3,4]

[1]Cornell University [New York] – Ithaca, New York 14853, United States
[2]University of Wisconsin-Madison – Madison, WI 53706, United States
[3]Department of Physics, Northeastern University – Boston, Massachusetts 02115, United States
[4]NSF AI Institute for Artificial Intelligence and Fundamental Interactions – United States

Abstract

Intersecting D-brane models have realized many aspects of the Standard Model (SM), yet realistic visible sectors remain hard to engineer efficiently and at scale in weakly coupled, topologically complex Calabi–Yau (CY) compactifications. Many physical phenomena depend intimately on the SM's realization, making the visible sector a key bottleneck in string phenomenology. I will present computational methods for realizing the SM gauge and matter content in a large ensemble of CY orientifold compactifications with D7-branes, including at h11 = 100. In particular, I will show how flux constraints reduce to simple linear and quadratic integer problems, how D-brane locality leads to generic preservation of SMs under flops, and how vector-like matter can be studied in many examples.

Keywords: string theory, string phenomenology, compactification, Standard Model, particle physics, D, branes, Calabi, Yau

*Speaker