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Resolution independent structure in 4D F-theory flux vacua

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I describe recent progress in exploring the landscape of 4D F-theory flux vacua with chiral massless spectra. The main result of this effort is a streamlined approach for computing vertical fluxes and associated chiral indices that combines tools in intersection theory with the low energy effective description of F-theory geometry. A key role is played by the vertical middle cohomology of smooth elliptic Calabi-Yau fourfolds resolving the singular F-theory limit, which we conjecture is independent of the choice of resolution and thus sheds light on geometric properties of the physics of the 4D vacuum. We analyze vertical flux backgrounds for models with simple gauge groups as well as models with a single abelian gauge factor; a notable example is the universal (SU(3) x SU(2) x U(1)) / Z_6 model constructed in 1912.10991. In all cases we study, we find that vertical flux backgrounds can produce nontrivial chiral indices for all anomaly-free chiral matter spectra, suggesting that F-theory geometry imposes no additional linear constraints beyond those implied by anomaly cancellation.

Presenter: JEFFERSON, Patrick (Massachusetts Institute of Technology)