Massive Abelian Gauge Symmetries and Fluxes in F-theory

F-theory compactified on a Calabi-Yau fourfold naturally describes non-Abelian gauge symmetries through the singularity structure of the elliptic fibration. In contrast Abelian symmetries are more difficult to study because of their inherently global nature. We argue that in general F-theory compactifications there are massive Abelian symmetries, such as the uplift of the Abelian part of the U(N) gauge group on D7-branes, that arise from non-Kahler resolutions of the dual M-theory setup. The four-dimensional F-theory vacuum with vanishing expectation values for the gauge fields corresponds to the Calabi-Yau limit. We propose that fluxes that are turned on along these U(1)s are uplifted to non-harmonic four-form fluxes. We derive the effective four-dimensional gauged supergravity resulting from F-theory compactifications in the presence of the Abelian gauge factors including the effects of possible fluxes on the gauging, tadpoles and matter spectrum.

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