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No Need To Be Vexed: CY Hypersurfaces from Reflexive Polytopes Beyond FRSTs

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The Krezuer-Skarke (KS) database of toric hypersurface Calabi-Yau (CY) threefolds arising from fine, regular, star triangulations (FRSTs) of 4D reflexive polytopes—following Batyrev's original construction—has long provided an important setting for explicit model building in string phenomenology. It is known, however, that the Kahler moduli spaces of KS Calabi-Yau geometries are not fully described by FRSTs: rather, they can contain geometries that do not admit an obvious Batyrevian hypersurface description; these are more difficult to study, and are thus not well understood. Such geometries have been discussed in the literature using monikers such as "non-toric phases" or "vex triangulations." In this talk, we explain how the secondary fan can be used to organize all toric fans associated to a reflexive polytope. In the process, we will clarify the differences between FRSTs and vex triangulations, and we will illustrate —through concrete examples and exhaustive enumeration at small Hodge numbers —how the latter category can be employed in practice to describe a much larger subset of KS CY Kahler moduli spaces using toric geometry. Hopefully, the presented methods and examples will help enable the systematic employment of non-FRST toric fans in string phenomenology.

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