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Gopakumar-Vafa invariants and Simple Flops of all Lengths

The problem of explicitly computing Gopakumar-Vafa (GV) invariants of Calabi-Yau threefolds is, in most cases, challenging.

We propose a novel way to fully characterize the GV invariants of singular Calabi-Yau threefolds arising from deformations of ADE singularities, employing a completely linear-algebraic method that computes zero-modes of an adjoint Higgs scalar, associated to the singularity.

Building on this result, we are able to analyze the GV invariants of simple flops of all lengths, namely singular deformed ADE singularities admitting only one exceptional complex curve, furnishing concrete examples and cross-checking with the existing mathematical literature. This also permits to inspect the Higgs branches of the rank-0 5d $\mathcal{N} = 1$ SCFTs engineered by M-theory on simple flops threefolds.

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