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Heterotic de Sitter Beyond Modular Symmetry

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We study the vacua of 4d heterotic toroidal orbifolds using effective theories consisting of an overall Kahler modulus, the dilaton, and non-perturbative corrections to both the superpotential and Kahler potential that respect modular invariance. We prove three de Sitter no-go theorems for several classes of vacua and thereby substantiate and extend previous conjectures. Additionally, we provide evidence that extrema of the scalar potential can occur inside the $SL(2, \mathbb{Z})$ fundamental domain of the Kahler modulus, in contradiction of a separate conjecture. We also illustrate a loophole in the no-go theorems and determine criteria that allow for metastable de Sitter vacua. Next, we identify inherently stringy non-perturbative effects in the dilaton sector that could exploit this loophole and potentially realize de Sitter vacua. Finally, we move beyond the symmetric regime of a single overall Kahler modulus and treat the bulk moduli of a T^2 -orbifold explicitly, driving us into the world of $Sp(4, \mathbb{Z})$ Siegel modular forms.

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