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A Combination of Perturbative and Non-perturbative Kahler Moduli Stabilization Can Connect String Theory to Inflation

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In recent years, cosmological experiments like PLANCK-2018 [1,2] and BICEP/KECK [3] have shown the efficacy of single field slow-roll inflaton potential in explaining various experimental parameters regarding LSS, CMBR anisotropy and polarization data with significant precession. Therefore, obtaining a low energy effective inflationary theory consistent with such a class of potentials from superstring theory has been a subject of major efforts, although it is seriously at tension with swampland conjecture [4] and trans-Planckian censorship conjecture (TCC) [5]. In this paper, we have proposed that, such a connection is in principle possible in a pleasant way, if we stabilize all Kahler moduli by incorporating several perturbative and non-perturbative quantum corrections in the Kahler potential and super-potential respectively, a suitable uplifting mechanism and a novel canonical normalization technique. Our framework is based on $10d$ type-IIB superstring theory compactified on a T^6/Z_N Calabi-Yau (CY) orientifold, equipped with three magnetized non-interacting and intersecting $D7$ branes, $O7$ planes and the non-trivial quantised RR and NS closed 3-form world volume fluxes threading the 4-cycles of CY-volume. The perturbative corrections arising from α'^3 expansion in LVS [6], multi-graviton scattering upto one-loop with log-correction [7] and non-perturbative corrections related to $E3$-instanton [8] and gaugino condensation [9] break the supersymmetric no-scale structure giving an F-term AdS_4 potential which is dynamically uplifted by D-term potential originating from $U(1)$ charges of $D7$ branes in gravitational sector thereby providing the inflaton potential after normalization. All the parameters of the derived dS_4 potential are carefully tuned to maintain the inflationary plateau region. Cosmological parameters are obtained by k-space analysis of cosmological perturbations by dynamical horizon exit method [10] and found [11] to be consistent with PLANCK and BICEP/KECK constraints viz., $n_s = 0.9652 - 0.9662$, $r = 5.8\times10^{-4} - 6.2\times10^{-4}$, $N = 55.0 - 56.7$,$n_t = (-7.28\times10^{-5}) - (-7.76\times10^{-5})$ at $k = 0.001 - 0.009$ Mpc^{-1}.

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