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Dynamics of Revolving D-Branes at Short Distances

Thursday, 5 December 2019 15:00 (3 hours)

We study the behavior of the effective potential between revolving Dp-branes at all ranges of the distance r, interpolating regions on which r is larger and smaller than the string length. Since the one-loop open string amplitude cannot be calculated exactly, we instead employ an efficient method of partial modular transformation. The method is to perform the modular transformation partially in the moduli parameter and rewrite the amplitude into a sum of contributions from both of the open and closed string massless modes. It is nevertheless free from the double counting and can approximate the open string amplitudes with less than 3% accuracy. From the D-brane effective field theory point of view, this amounts to calculating the one-loop threshold corrections of infinitely many open string massive modes. We show that threshold corrections to the $\omega^2 r^2$ term of the moduli field r cancel among them, where ω is the angular frequency of the revolution and sets the scale of supersymmetry breaking. This cancellation suggests a possibility to solve the hierarchy problem of the Higgs mass in high scale supersymmetry breaking models.

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