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Heterotic Superstring Gauge Residue Trivialization Via Homogeneous CP^4 Topology Change

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Abstract. A new mechanism for the cancellation of gauge residue symmetries in the framework of heterotic superstring compactification theories is revealed. The model preserves all the string features and fits naturally in the consistent topological structure of the homogeneous CP^4 Calabi–Yau manifold.

I. Introduction

The anomaly cancellation for the 10-dimensional heterotic superstring theory with $SO(32)$ or $E_8 \times E_8$ gauge group gives hope of allowing a consistent unified theory including gravity, especially if $N = 1$ supersymmetry is required to be unbroken at low energies.[1]

To make a realistic contact with the low energies phenomenology, it is assumed that the $D = 10$ theories compactify into $M^4 \times K^6$, where K is a compact complex 6-dimensional Calabi–Yau manifold for orbifold with $SU(N)$ holonomy. It is further assumed that all the known particles at low energies are singlets under the E_8 group and belong to the representation of E_6. Such realistic connection with low energies is then intrinsically related to lowering the rank of the E_6 gauge group [1].

A powerful method of implementing such symmetry breaking in superstring theory is to consider the string propagation on an orbifold. The most popular and effective method of breaking the gauge symmetry – and consequently reduce the number of generations – is known as the Wilson-lines mechanism [2] in the framework of orbifold compactification.

The Wilson-loop is a homomorphism of the translation defining the torus into

[1] One can consider the Atkin–Lehmer symmetry in a non-supersymmetric background as a good challenge, since its discrete symmetry of modular space makes the integral over τ vanish despite the precise absence of spacetime supersymmetry