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Bubbles of Nothing and Supersymmetric Compactifications

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We investigate the non-perturbative stability of supersymmetric compactifications with respect to decay via a bubble of nothing. We show examples where this kind of instability is not prohibited by the spin structure, i.e., periodicity of fermions about the extra dimension. However, such "topologically unobstructed" cases do exhibit an extra-dimensional analog of the well-known Coleman-De Luccia suppression mechanism, which prohibits the decay of supersymmetric vacua. We demonstrate this explicitly in a four dimensional Abelian-Higgs toy model coupled to supergravity. The compactification of this model to M_3×S_1 presents the possibility of vacua with different windings for the scalar field. Away from the supersymmetric limit, these states decay by the formation of a bubble of nothing, dressed with an Abelian-Higgs vortex. We show how, as one approaches the supersymmetric limit, the circumference of the topologically unobstructed bubble becomes infinite, thereby preventing the realization of this decay. This demonstrates the dynamical origin of the decay suppression, as opposed to the more familiar argument based on the spin structure. We conjecture that this is a generic mechanism that enforces stability of any topologically unobstructed supersymmetric compactification.

Presentation type

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Primary authors: Prof. BLANCO-PILLADO, Jose Juan (IKERBASQUE & UPV/EHU); Dr SHLAER, Ben (University of Auckland); Dr URRESTILLA, Jon (UPV/EHU); SOUSA, Kepa

Presenter: SOUSA, Kepa

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