Contribution ID: **63** Type: **not specified**

Light U(1)s in Heterotic String Models

Friday, 5 December 2014 17:00 (25 minutes)

Although additional low scale U(1)s have been discussed extensively in SUSY GUTs and superstring models, having a viable light, extra U(1) in worldsheet heterotic string constructions has proven to be a challenge. Here, we present the construction of heterotic string models using the free fermionic formulation and focus on how viable U(1)s may arise. We motivate an example as an appealing proposition to explain the suppression of proton decay mediating operators, induced in supersymmetric models. The additional symmetry forbids the undesired operators, and therefore must be light to accommodate proton lifetime constraints. We discuss and contrast two classes of superstring models with a desirable additional U(1): those with charges embedded in E6 and those without embedding. We show that the gauge coupling data at the electroweak scale necessitate that the Z' charges are embeddable in E6 but that anomaly free U(1) combinations require no such embedding. We present a recipe of how enhancement may circumvent this conundrum and construct a standardlike model with desirable properties.

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Session Classification: Parallel 7: Supersymmetry, Supergravity, Strings, Branes