(Pseudo) Dirac Gravitino

Karim Benakli[1] and Arno Goudeau*[1]

[1]Laboratoire de Physique Théorique et Hautes Energies (LPTHE) – Sorbonne Universite, Centre National de la Recherche Scientifique – Boîte 126, T13-14 4ème étage 4 place Jussieu 75252 Paris CEDEX 05, France

Abstract

We discuss low-energy effective theories with a Dirac gravitino. Our main benchmark is Scherk–Schwarz supersymmetry breaking with anti-periodic boundary conditions for fermions on S1/Z2. In this case two Majorana spin- 3/2 modes are degenerate, so the low-energy theory is naturally organized around a Dirac gravitino and an associated R-symmetry selection rule. We show, in minimal supergravity, that this Dirac spin- 3/2 mixing has no local Dirac-gaugino-type N = 1 superspace realization: a superspace description requires projection onto the transverse superspin- 3/2 sector.

We then analyze some consequences for matter couplings and radiative masses. The ordinary gravitino supercurrent coupling gives the standard universal Scherk–Schwarz scalar threshold; in the minimal benchmark this contribution is negative, and should therefore be regarded as one calculable contribution to the scalar mass matrix, not as a complete scalar-spectrum prediction. Dirac fermion masses can be generated if an additional companion-channel matter current is present. The existence and normalization of this current are not fixed by the Dirac gravitino alone and depend on the ultraviolet completion.

We finally discuss small R-breaking deformations, the resulting pseudo-Dirac regime, and comment on possible applications to singlet fermions, modulini, and radiative Dirac neutrino masses.

Keywords: Supergravity, Gravitino, Scherk–Schwarz supersymmetry breaking

*Speaker