

Torsion in Superstring Theory

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Edward Witten: “String theory is a 21st century piece of physics that somehow fell into the 20th century.

Stephen Hawking: “Torsion is necessary to make superstring theory consistent.”

This torsion is a superfield living on superspace. The simplest version of superspace is the 8-d coset space P/L , where P is the 14-d graded Poincare group and L is the Lorentz group $SO(1,3)$.

Superspace: Bosonic + Fermionic dim.

Bosonic coordinates: $[x,y] = xy - yx = 0$

Fermionic coordinates: $\{a,b\} = ab + ba = 0$

A supersymmetry transformation t changes fermions into bosons (and vice versa). The combination tt generates a space-time translation (but no translation in the fermionic space).

By gauging supersymmetry, a gauge field is generated called supergravity, which contains Einstein's gravity (general relativity).

[Three ingredients: supersymmetry, gauge theory, and general relativity – could have been discovered in any order.]

