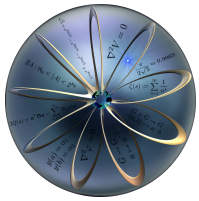

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supersymmetry

Canonical name	Supersymmetry
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Entry type	Definition
Classification	msc 55U40
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Synonym	extended quantum symmetry structures
Synonym	generalized double algebras
Synonym	supersymmetries
Related topic	QuantumAlgebraicTopology
Related topic	AlgebraicFoundationsOfQuantumAlgebraicTopology
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Related topic	LieSuperalgebra3
Defines	extended quantum symmetry structures
Defines	both local and global

Definition 0.1. *Supersymmetry* or Poincaré, (extended) quantum symmetry is usually defined as an extension of ordinary spacetime symmetries obtained by adjoining N spinorial generators Q whose anticommutator yields a translation generator: $\{Q, Q\} = \{P\}$.

As further explained in ref. [**?**]:

> "This *(super)* symmetry...(of the *superspace*)... can be realized on ordinary fields (that are defined as certain functions of physical spacetime(s)) by transformations that mix bosons and fermions. *Such realizations suffice to study supersymmetry (one can write invariant actions, etc.) but are as cumbersome and inconvenient as doing vector calculus component by component. A compact alternative to this 'component field' approach is given by the* superspace–superfield *approach*", which is defined next.

Definition 0.2. *Quantum superspace, or superspacetimes*, can be defined as an extension(s) of ordinary spacetime(s) to include additional anticommuting coordinates, for example, in the form of N two-component Weyl spinors θ.

Definition 0.3. *(Quantum) superfields* $\Psi(x, \theta)$ are *functions* defined over such superspaces, or superspacetimes. Taylor series expansions of the superfield functions can be then performed with respect to the anticommuting coordinates θ; this Taylor series has only a finite number of terms and the series expansion coefficients obtained in this manner are the ordinary 'component fields' specified above.

Remarks: Supersymmetry is expected to be manifested, or observable, in such superspaces, that is, the *supersymmetry algebras* are represented by translations and rotations involving *both* the spacetime and the anticommuting coordinates. Then, the transformations of the 'component fields' can be computed from the Taylor expansion of the *translated and rotated superfields*. Especially important are those transformations that mix boson and fermion symmetries; further details are found in ref. [**?**].

References

[1] J.S. Gates, Jr, et al. "Superspace"., arxiv-hep-th/0108200 preprint (1983).

[2] "Preprint of 1,001 Lessons in Supersymmetry." `http://arxiv.org/abs/hep-th/0108200`on line PDF.