STATISTICAL SUPERFIELD – A field consisting of both commuting and anticommuting variables, whose configurations are summed over in a partition function or path integral. For example, a vector superfield has the form

$$\Psi = \begin{pmatrix} \Psi^b \\ \Psi^f \end{pmatrix}, \; \Psi^b = \begin{pmatrix} z_1^b \\ z_2^b \\ \vdots \\ z_n^b \end{pmatrix}, \; \Psi^f = \begin{pmatrix} z_1^f \\ z_2^f \\ \vdots \\ z_{n'}^f \end{pmatrix}$$

where the z_i^b are ordinary commuting variables and the z_i^f are anticommuting Grassmann variables. Such fields are useful in statistical physics [1] and may possibly have fundamental significance [2]. See also "supersymmetry methods, in statistical physics".

An action or theory is supersymmetric if it is invariant under a transformation which converts fermions to bosons and vice-versa [3]. Sometimes "super" is used as a generic prefix for any objects that involve both commuting and anticommuting variables (see e.g. [1,2] and elsewhere [4]). This usage parallels that for "complex", which signifies that a quantity contains both real and imaginary parts. The most standard forms of supersymmetry are inextricably wedded to Lorentz invariance, whereas the broader usage permits a Lorentz-violating theory to be supersymmetric [2].

BIBLIOGRAPHY

[1] K. Efetov, Supersymmetry in Disorder and Chaos, Cambridge University Press, Cambridge, 1999.

[2] R. E. Allen, Int. J. Mod. Phys. A 12, 2385 (1997), hep-th/9612041; and in Beyond the Desert 2002, edited by H. V. Klapdor-Kleingrothaus et al. Institute of Physics, Bristol, 2003, hep-th/0008032.

[3] J. Wess, J. Bagger, Supersymmetry and Supergravity, 2nd ed., Princeton Univ., 1992.

[4] F. A. Berezin, Introduction to Superanalysis, Dordrecht 1987; D. Leites, Theory of Supermanifolds, Petrozavodsk 1983; D. Leites, Russian-Math. Surveys, 35 (1980) 3; B. S. DeWitt, Supermanifolds, Cambridge University Press, Cambridge, 1992.