

The Deepest Symmetries of Nature

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The structure of matter is related to symmetries on every level of study. CPT symmetry is one of the most important laws of field theory: it states the invariance of physical properties when simultaneously changing the signs of the charge and of the spatial and time coordinates of particles. Although in general opinion CPT symmetry cannot be violated in Nature, there are theoretical attempts to develop CPT-violating models. The Antiproton Decelerator at CERN was built to test CPT invariance.

Several observations imply that there might be another deep symmetry, supersymmetry (SUSY), between basic fermions and bosons. SUSY assumes that every fermion and boson observed so far has supersymmetric partners of the opposite nature. In addition to some theoretical problems of the Standard Model of elementary particles supersymmetry may provide solution to the constituents of the mysterious dark matter of the Universe. However, as opposed to CPT, SUSY is necessarily violated at low energies as so far none of the predicted supersymmetric partners of existing particles was observed experimentally. The LHC experiments at CERN aim to search for these particles.