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Living without supersymmetry

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The assumption of a supersymmetry between bosons and fermions has been found capable of addressing many key issues in particle physics and gravity such as the cancellation of ultraviolet divergences in particle and gravitational scattering amplitudes as well as in the vacuum energy density, providing a solution to the hierarchy problem, evasion of the Coleman-Mandula theorem, construction of a consistent candidate quantum theory of gravity, string theory, and providing a prime candidate for dark matter. However, despite this quite extensive theoretical inventory, actual experimental detection of any of the required superparticles has so far proven elusive. And the situation is disquieting enough that one should at least contemplate whether it might be possible to dispense with supersymmetry altogether. If however one is to consider doing so, then one must seek an alternative to supersymmetry that has the potential to also achieve its key successes. We propose that it is conformal symmetry that is to be the required symmetry, and show that the above key results of supersymmetry can be achieved via conformal symmetry instead. In particular we show that rather than be an elementary scalar field, the Higgs boson is a dynamical fermion-antifermion bound state with a mass of order the dynamically induced fermion mass, so that there is then no quadratically divergent hierarchy self-energy problem for it.

Reference: P. D. Mannheim, Living without supersymmetry – the conformal alternative and a dynamical Higgs boson, J. Phys. G 44, 115003 (2017). (arXiv:1506.01399 [hep-ph]).

Content of the contribution

Theory

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