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Unification of the Four Forces in the Spin (11,1) Geometric Algebra[1] ANDREW HAMILTON, University of Colorado, Boulder — The spinors of the group Spin(N) of rotations in N spacetime dimensions are indexed by a bit-code with $[N/2]$ bits. A well-known promising grand unified group that contains the standard-model group is Spin(10). Fermions in the standard model are described by five bits $durgb$, consisting of two weak bits d and u, and three color bits r, g, b. If a sixth bit T is added, necessary to accommodate a time dimension, then the enlarged Spin(11,1) algebra contains the standard-model and Dirac algebras as commuting subalgebras, unifying all four forces. The largest subgroup of Spin(11,1) that commutes with the Poincaré group is $\mathrm{Spin}(5) \times \mathrm{Spin}(6)$, suggesting that the latter is a partial unification on the way to complete unification in Spin(11,1). The $\mathrm{Spin}(5) \times \mathrm{Spin}(6)$ algebra contains a subalgebra with precisely the properties of the electroweak Higgs field. The $\mathrm{Spin}(5) \times \mathrm{Spin}(6)$ symmetry contains, and is spontaneously broken by, a U(1) symmetry related to the $\mathrm{U}_{B-L}(1)$ symmetry. Grand unification is associated with a change in the dimensionality of spacetime.

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