Title:	Group Theoretical Aspects of Asymptotically Strong Supersymmetric GUTs
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Abstract:	We recapitulate the basic group theory needed for GUTs. It include the weights, roots, Dynkin diagrams, generalized Gell-Mann matrices for SU (N) and spinorial representations of SO(10). In the second chapter, we present a quick overview of SU (5) and SO(10) GUTs. For both the GUTs, spontaneous symmetry breaking is discussed at length. In the case of SU (5), exact B,L violating vertices and hence four-Fermi lagrangian is calculated. Then we calculate the decompositions of SO(10) representations under two maximal subgroups SU (5) × U (1) and G P S . In third chapter, we present a quick overview of superspace formulation and supersym- metry. It includes the details about how to construct a supersymmetric lagrangian and an instructive example, MSSM (Minimal Supersymmetric Standard Model). We present a few properties of adjoint type representations r × r; especially with totally symmetric representations as the base (r) in Chapter 4. We note that the irreducible representations appearing in this particular case have some neat properties. S 2 for all such representations is calculated in closed form. Using these bigger adjoint type multiplets, symmetry breaking of toy models SU (2), SU (3) are presented. Since SU (5) → G SM also preserves the rank, we can use any adjoint type multiplets for this. We present two non- trivial ways to break this symmetry. According to a recent work [Aulakh 20], gaugino condensates drive the creation of vevs of chiral supermulitplet in AS gauge theories. This replaces the usual potential driven symmetry breaking by dynamical symmetry breaking. We use this to calculate symmetry breaking vevs for two cases: SU (2) → U (1) and SU (5) → G SM . Numerical calculations were done to calculate vevs for these two cases. Later on we extend the given framework to include the traceless fields also. The loop equations for such a field are derived from the GKA equations. Numerical calculations were done to calculate vevs for three symmetry breaking patterns: SU (2) → U (1), SU (3) → SU (2) × U (1) and SU (5) → G SM using traceless 3 × 3, 6 × 6 and 10 × 10 respectively.
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