

Contents

1	Introduction	1
1.1	Basic ideas of Standard Model	1
1.2	Minimal SU(5) GUT	4
1.3	Inclusion of left-right symmetry	8
1.4	Extension to include supersymmetry	10
1.5	Low energy unification	14
2	LEP Constraints on Unified Theories	18
2.1	Prelude	18
2.2	Effects of Higher Dimensional Operators	19
2.3	Constraints on Left-Right Symmetric GUTs	23
2.4	Constraints on Non-Perturbative Unification	30
3	Low energy unification	36
3.1	Higgs Effect in SU(15) GUT	36
3.2	Implications of SUSY SU(15) GUT	41
3.3	Low energy unification with SU(16)	44
3.3.1	Proton Decay	50
3.3.2	$N - \bar{N}$ Oscillations	51
3.4	Appendix	52
3.4.1	SU(16) Tensor Products	52
3.4.2	SU(16) Branching Rules	52
3.4.3	SU(12) Tensor Products	52
3.4.4	SU(12) Branching Rules	53
3.4.5	SU(6) Branching Rules	53
4	Evolution of the Yukawa Couplings of MSSM	57
5	Conclusions	62
5.1	LEP Constraints on Unified Models	62
5.2	Studies on Low Energy Unification	63
5.3	Evolution of Yukawa Couplings	64