

# Abstract

In this thesis we focus on Grand Unified Theories based on the  $SO(10)$  gauge group and, in particular, on the viability of the minimal nonsupersymmetric  $SO(10)$  models. Technically, this amounts to a detailed assessment of their vacuum stability and related (non-)tachyonicity of their scalar spectrum. It turns out that the one-loop scalar mass corrections are important for elimination of the tachyonic behaviour of certain pseudo-Goldstone bosons. In this work these issues are briefly reviewed and two distinct methods for the calculation of the critical radiative corrections are discussed. More specifically, besides the revision of the effective potential approach to the  $45 \oplus 16$  Higgs model also the standard perturbative theory method is employed for this purpose. The latter approach is particularly suitable for the more realistic  $45 \oplus 126$  Higgs model since it appears to be practically impossible to construct the corresponding effective potential in that case. Consequently, diagrammatic methods are used to calculate the  $SO(10)$ -invariant leading scalar quantum correction to the problematic pseudo-Goldstone masses in the  $45 \oplus 126$  model.