It is easy to see that the condition 6.13 will be satisfied, for SU(N), as long as $N \geq 3$ (not SU-2!) and b_o is small enough. We can always make b_o small by including fermion representations; whose only effect is to decrease b_o. (We can exclude Yukawa couplings by the discrete symmetry $\phi \to -\phi$). In the case of SU-3 we must incorporate 16 fermion triplets in order to make b_o equal to $-\frac{1}{48\pi^2}$.

We see already in this simplest of all cases that the UV stability of λ is extremely delicate. Even in the most favorable case, $N \gg 1$ and $b_o \simeq 0$, we can at most accommodate two vector multiplets of scalar fields. Moreover if we do not include enough fermions to render b_o sufficiently small we cannot include any scalars. Roughly speaking unless b_o is small the gauge mesons, which are stabilizing the inherently unstable $\lambda\phi^4$ coupling, vanish too rapidly as $t \to \infty$.

Clearly we cannot include enough vector representations to break the gauge symmetry completely. We have also investigated many other models with scalar particles (i.e. other groups and representations). We shall just give a brief summary of the more interesting results.

The adjoint and the symmetric tensor representation of SU(N), as well as the $(N,\bar{N})$ representation of SU(N) x SU(N) are examples of theories with two scalar quartic couplings. They lead to renormalization group equations of the form 6.6, which can again be simplified by dividing by $\bar{g}^2$ as in 6.11. The result has the form: