Some remarks on the MSSM sec:mssm 1.3

The Minimal Supersymmetric extension of the Standard Model consists of taking the Standard Model of electroweak and strong interactions as it is known today, including the as yet undiscovered Higgs boson particle, and adding the corresponding supersymmetric partners HC, HAMSSM.

The supersymmetric partners of the quarks and leptons are the spin-zero squarks and sleptons. For a given fermion $f$, there are two supersymmetric partners $\tilde{f}_L$ and $\tilde{f}_R$ which are the scalar partners of the corresponding left and right-handed fermions. Correspondingly, in the case of sneutrinos there is no $\tilde{\nu}_R$. For simplicity we shall ignore intergenerational mixing.

The supersymmetric partners of the gauge bosons are the spin-one-half fermions called gauginos. The partners of the gluon $g_\mu$, and the four weak bosons $W_\mu^a$ (a=1,2,3), $H_\mu$ are, correspondingly, the gluino $\tilde{g}$, the winos $\tilde{W}_\mu^a$ and the bino $\tilde{B}$.

In addition, the MSSM must possess two complex scalar Higgs doublets $H_1, H_2$ in order to give masses to down and up type fermions in a manner consistent with supersymmetry. The corresponding fermionic superpartners are the Higgsinos $\tilde{H}_1, \tilde{H}_2$ which are also needed in pairs, in order to avoid gauge anomalies. Supersymmetry, on the other hand, imposes strong constraints on the form of the Higgs potential. In particular, the quartic self couplings of the Higgs fields are fixed in terms of the $SU(2) \times U(1)$ gauge couplings and, therefore, the Higgs sector of the MSSM is always weakly interacting.

The MSSM Lagrangian consists of two parts, a supersymmetry-conserving Lagrangian and a supersymmetry-breaking Lagrangian: equation lmssm $L_{MSSM} = L_{SUSY} + L_{SUSY}^{\text{break}}$
Fig. 1a
Fig. 1b