Higgs physics beyond MSSM

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The Higgs is special and its mass tells us about the scale of SUSY

- The Higgs boson is the only elementary scalar particle we know
- The mass of elementary scalars is not protected by any symmetry and hence the quantum corrections to the mass are proportional to the scale of new physics $\Rightarrow$ New physics either not too far from the electroweak mass scale or weakly coupled to the SM
- Softly broken supersymmetry provides a consistent way of introducing a cutoff to loop corrections
- The Higgs mass suggests that superpartners that couple strongly to the Higgs are not much above 1 TeV

Nonminimal supersymmetric models have a richer phenomenology

- Supersymmetry requires a second Higgs doublet, but extending the Higgs sector beyond with additional singlets or triplets can help in generating neutrino masses, CP-violation...
- The extensions can also lift the Higgs mass so that superpartners need not to be so heavy as in the MSSM
- The mixing of different states with the SM-like Higgs leads to altered production cross sections and branching ratios — the constraints from Higgs data are becoming competitive to e.g. low energy precision data
- The larger particle content can lead to signatures that are not present in minimal models