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Vacuum stability and SUSY at high scales with 2 H doublets

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In this talk I consider two-H doublet models (THDMs) with a supersymmetric UV completion. Contrary to the Standard Model, THDMs can be embedded in high-scale supersymmetry with a SUSY breaking scale as high as the scale of grand unification. The stability of the electroweak vacuum and experimental constraints point towards low values of $\tan(\beta) < 2$ and a pseudoscalar mass of at least about a TeV. If the higgsino superpartners of the H fields are also kept light, the conclusions are similar and essentially independent of the higgsino mass. However, if all gauginos are also given electroweak-scale masses (split supersymmetry with two H doublets), the predicted Standard Model-like H boson mass is always too large. Light neutral and charged higgsinos emerge as a promising signature of minimal theories with supersymmetric UV completions at high scales, and can be searched for at colliders.

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