

Strong first-order phase transitions in the Next-to-Minimal Supersymmetric Standard Model

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We perform a comprehensive survey of the phase structure of the Next-to-Minimal Supersymmetric Standard Model (NMSSM), focusing on the first order phase transitions. Strong first order phase transitions are required for successful electroweak baryogenesis explanations of the observed baryon asymmetry of the universe and can lead to gravitational wave signals. The NMSSM is one of the most plausible models that has a viable electroweak baryogenesis mechanism. We identify the regions of parameters space where strong first order phase transitions can be achieved and reveal very rich patterns of phase transitions that lead to the observed electroweak symmetry breaking vacuum. We classify the different types of patterns we find, showing what first order phase transitions may occur in each case. We present benchmark points for each scenario and discuss the implications for electroweak baryogenesis and observable gravitational wave signals.

Authors: ATHRON, Peter; BALAZS, Csaba (Monash University); ZHANG, yang; Dr FOWLIE, Andrew (Nanjing Normal University); POZZO, Giancarlo; WHITE, Graham (Monash University)

Presenter: ATHRON, Peter

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