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A Recipe for a Strong First Order Electroweak Phase Transition

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Taking on a new perspective of the electroweak phase transition, we investigate a quantity called the one loop zero temperature vacuum energy difference. This quantity allows us to address all manner of features that are known to give rise to a strong first order electroweak phase transition. Our study is conducted using six extensions to the Standard Model of varying complexity, non-supersymmetric to supersymmetric in nature. We find there is a strong trend between the one loop zero temperature vacuum energy difference and the strength of the electroweak phase transition, subject to the vanishing of Higgs masses which ill-define the broken vacuum and avoid a strong first order phase transition. We suggest two recipes that guarantee a strong first order electroweak phase transition without the need for any finite temperature calculations.

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