

Electroweak Baryogenesis and Future Colliders

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Sakharov Conditions

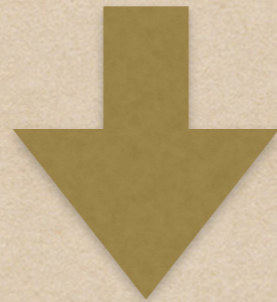
- ◆ CP violation — KM phase in the SM
- ◆ Baryon number violation — sphalerons in the SM
- ◆ Departure from thermal equilibrium — can happen if the PT is strong 1st order

SM:

- Not enough CPV to produce the observed asymmetry
- PT is not first order

1st Order EWPT and New Particles

In order to trigger strong 1st order EW phase transitions, we need new particles which couple strongly to the Higgs.



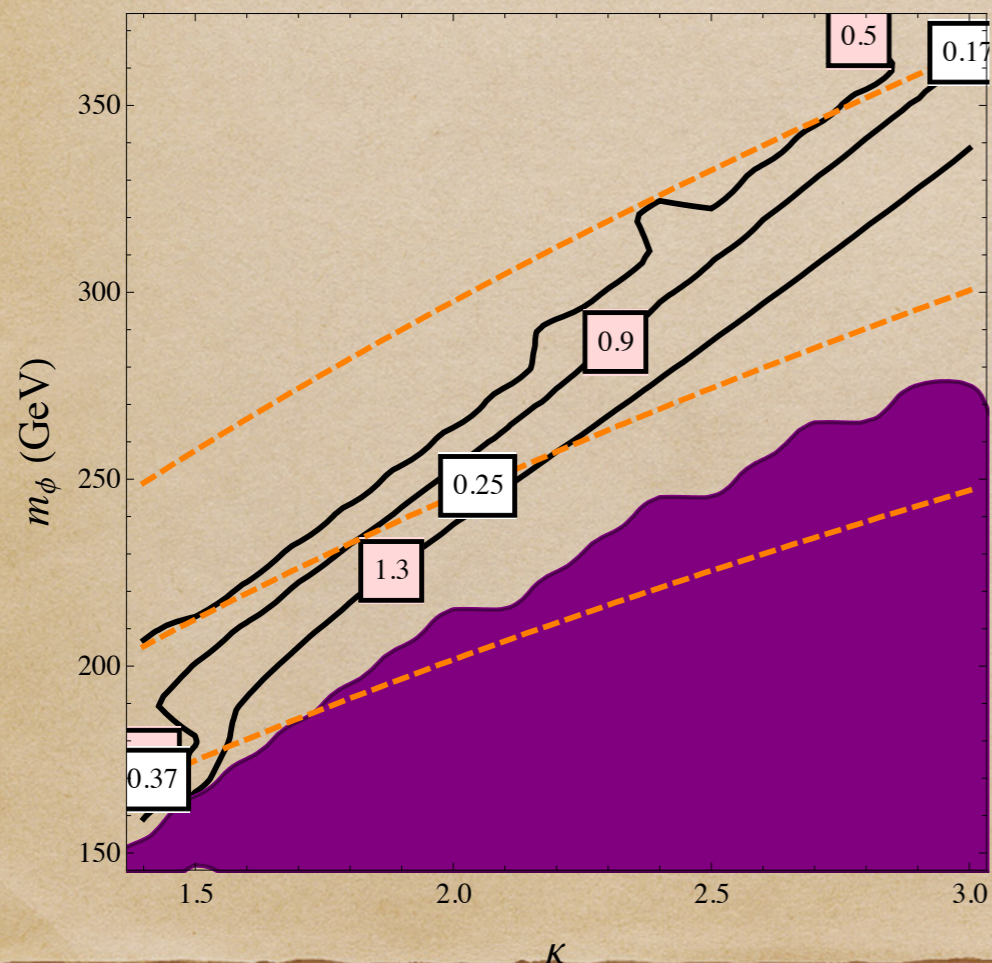
Higgs couplings should deviate from the SM values

$$V \propto \kappa |\Phi|^2 |H|^2$$

Deviation of Higgs Couplings

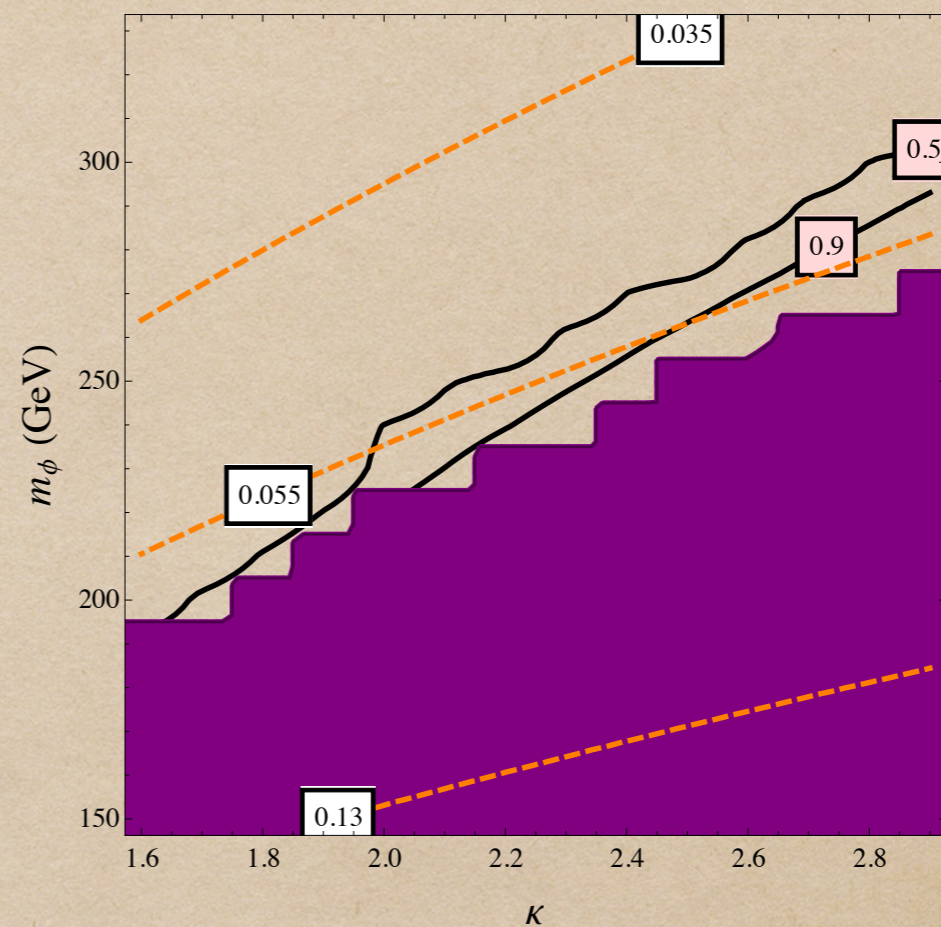
If the new scalar is colored — LHC is enough

$\eta=1, \phi \sim (3, 1)_{2/3}, hgg$



AK & M. Perelstein, 2014

$\eta=1, \phi \sim (1, 1)_1, h\gamma\gamma$

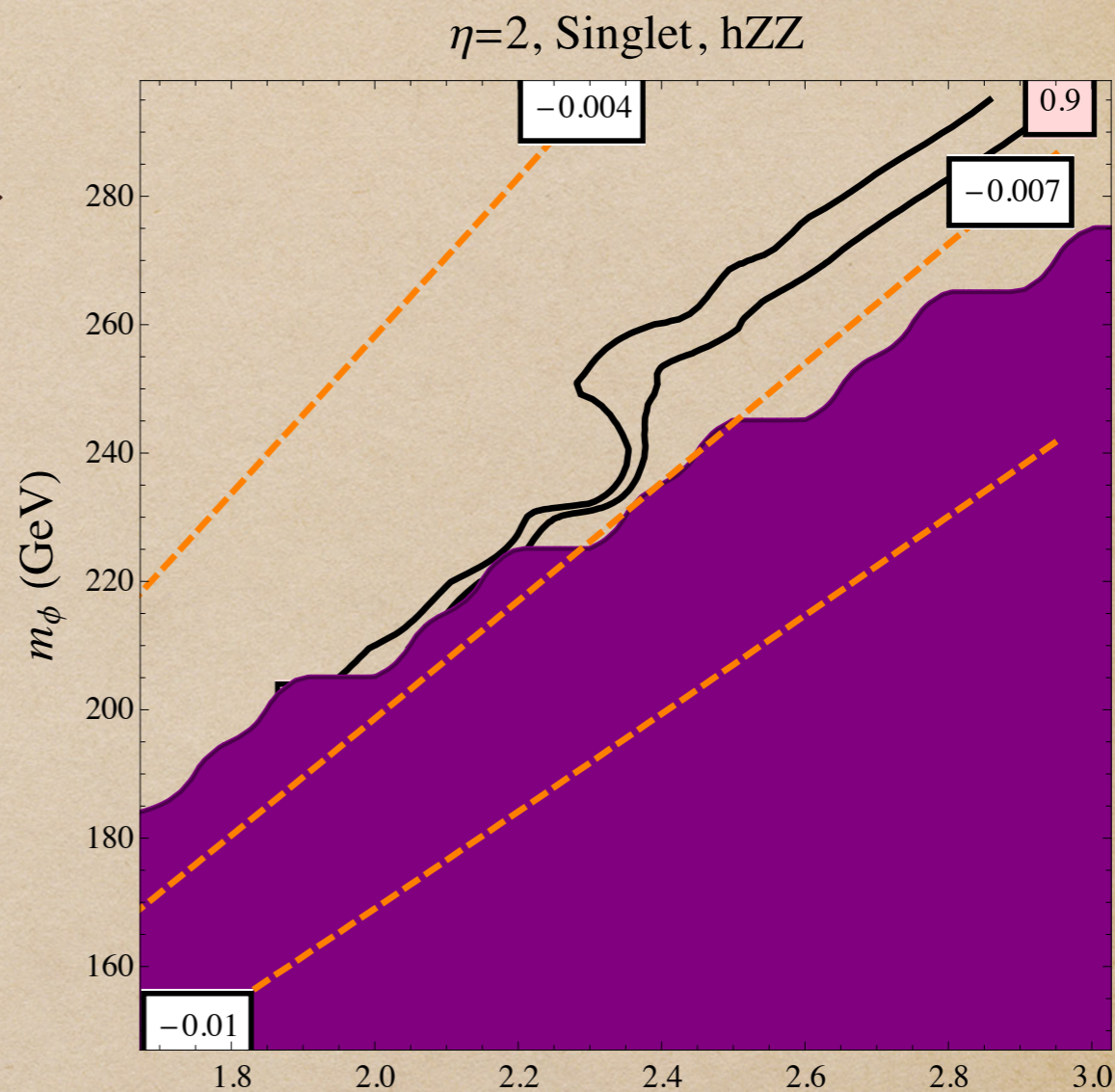


EM charged scalar — hard

Sterile Complex Scalar

Even a completely sterile scalar can trigger 1st order EWPT if the coupling is strong enough.

Wavefunction renormalization — modification of hZZ coupling.



Need precision better than 1%

Little about SUSY Baryogenesis

AK, M. Perelstein, M. Ramsey-Musolf, P. Winslow; in progress

SUSY — natural candidate, needs very light stops.

A-priori not excluded, but needs

- ◆ New source for Higgs quartic
- ◆ shut down new contributions to gluons and photons couplings

From preliminary simulations: not 1st order PT possible if

$$m_{\tilde{t}_2} \gtrsim 900 \text{ GeV}$$

Probably these spectra can be cornered at the LHC

Higgs couplings and EWPM fit, decoupling limit, $\tan \beta = 10$, $m_{\tilde{t}_1} = 120 \text{ GeV}$

