

# Synergies between GW experiments and colliders for BSM discoveries

*FCC Workshop, July `23*

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- > *Sounds a nice statement for an advertisement but is it true?*
- > *In which way are they synergetic? Which observables are really synergetic?*
- > *What do we learn from these observables? Are conclusions model dependent or independent?*
- > *What searches are most suitable for these observables? What is their forecast accuracies (when combined)?*
- > *Any need to understand all that now? Can the results from the collider program influence the GW experimental program (or vice versa) ?*

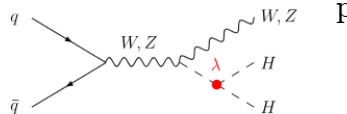
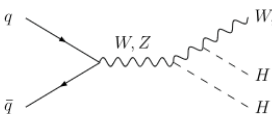
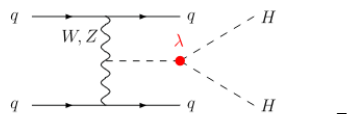
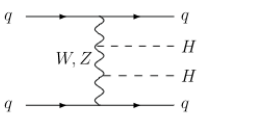
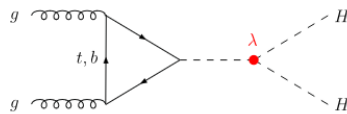
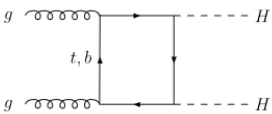
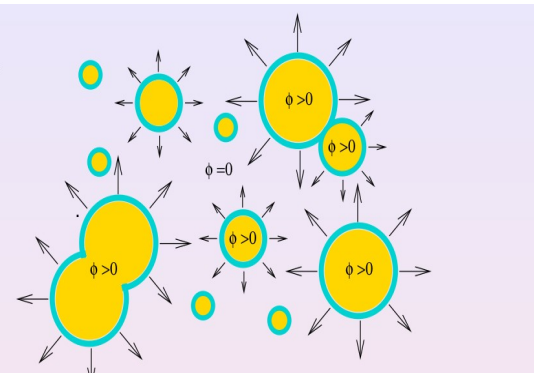
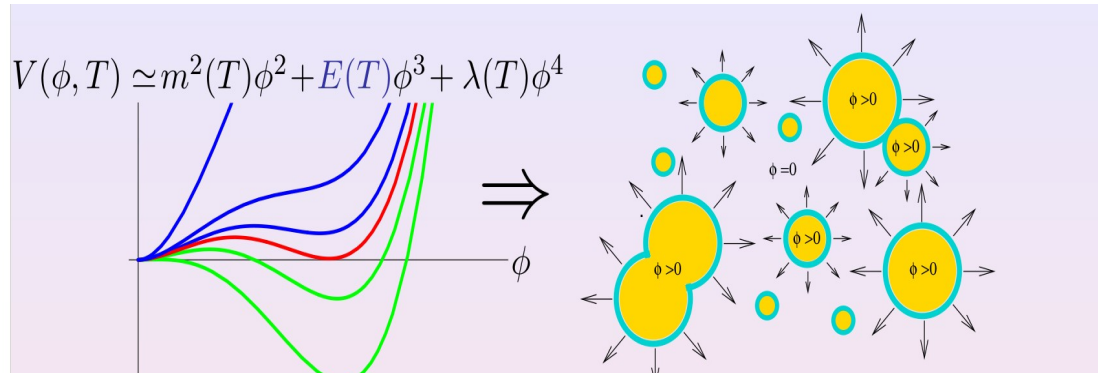
# Synergies between GW experiments and colliders for BSM discoveries

> Sounds a nice statement for an advertisement but is it true? **YES**

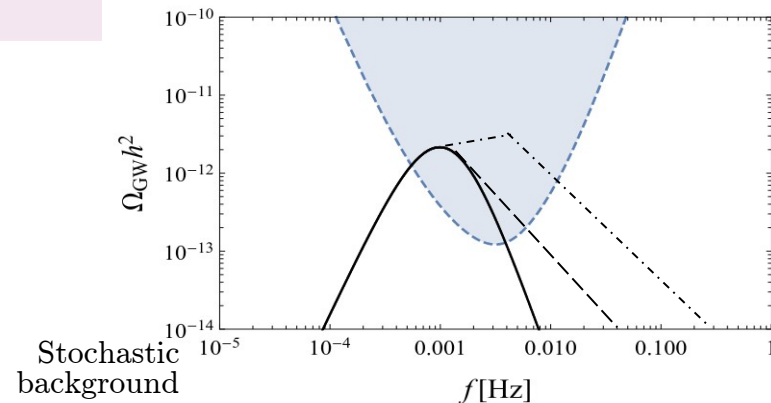
> In which way are they synergetic? Which observables are really synergetic?

**NO EXHAUSTIVE, GENERIC ANSWER.** But we have some educative, specific examples. One of them:

Higgs potential  $V(\phi, T) \simeq m^2(T)\phi^2 + E(T)\phi^3 + \lambda(T)\phi^4$



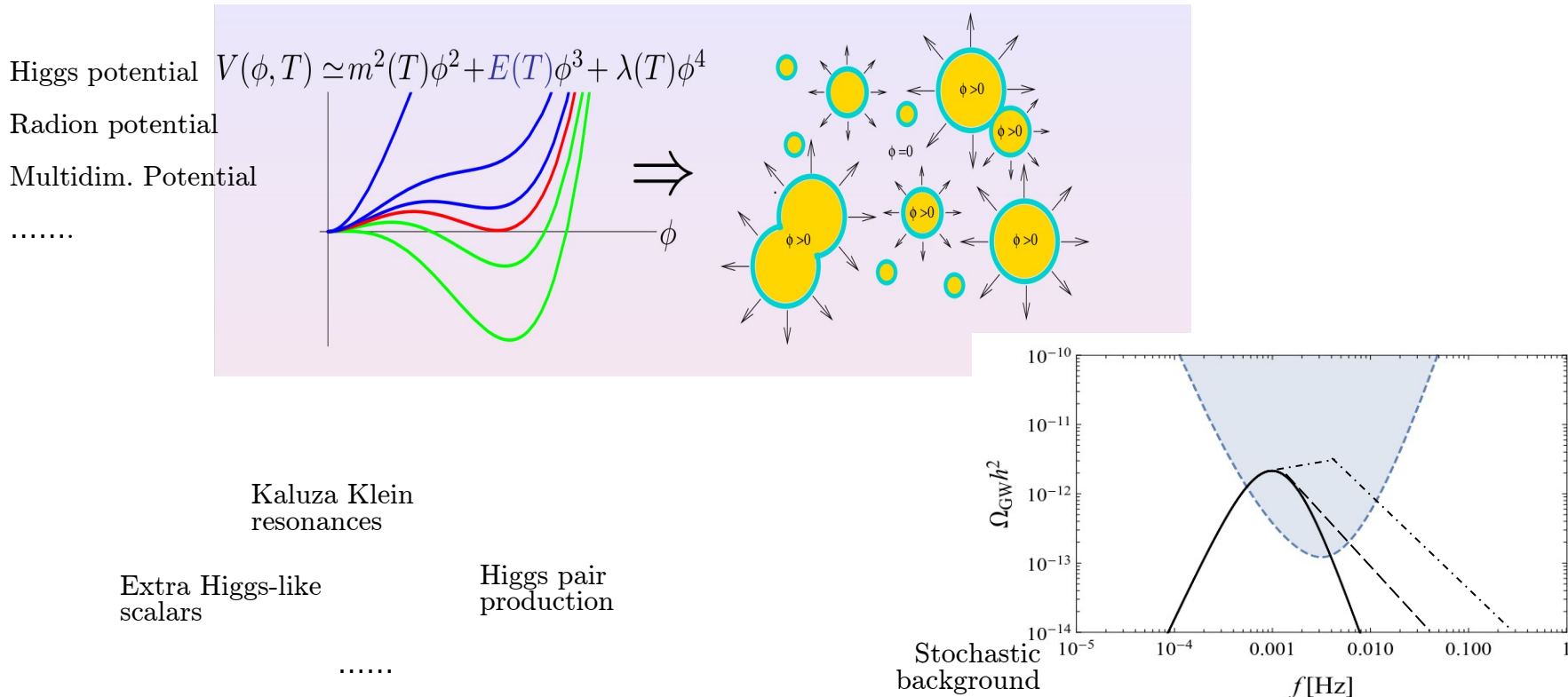
Higgs pair production



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- > *What do we learn from these observables?* **NOT UNIQUE ANSWER** (Higgs potential, extradimensions, ...)

*Are conclusions model dependent or independent?* **MODEL DEPENDENT**

- > *What searches are most suitable for these observables? What is their forecast accuracies (when combined)?*

**SOME STUDIES IN THE LITERATURE but NOT EXHAUSTIVE ANSWER.**

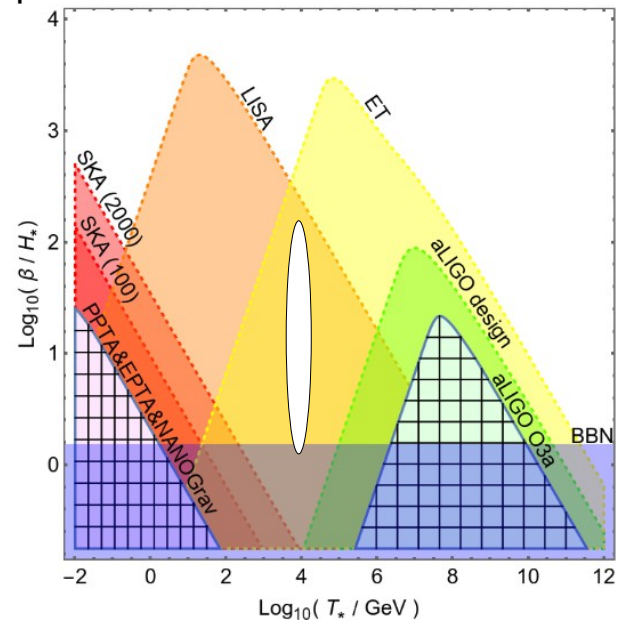
**IN GENERAL, DIFFICULT TO GET PRECISE ANSWERS.  
THIS REQUIRES ADVANCED EXPERTISE AND TOOLS ON BOTH GW  
AND COLLIDER EXPERIMENTS**

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➤ Any need to understand all that now? Can the results from the collider program influence the GW experimental program (or vice versa)?

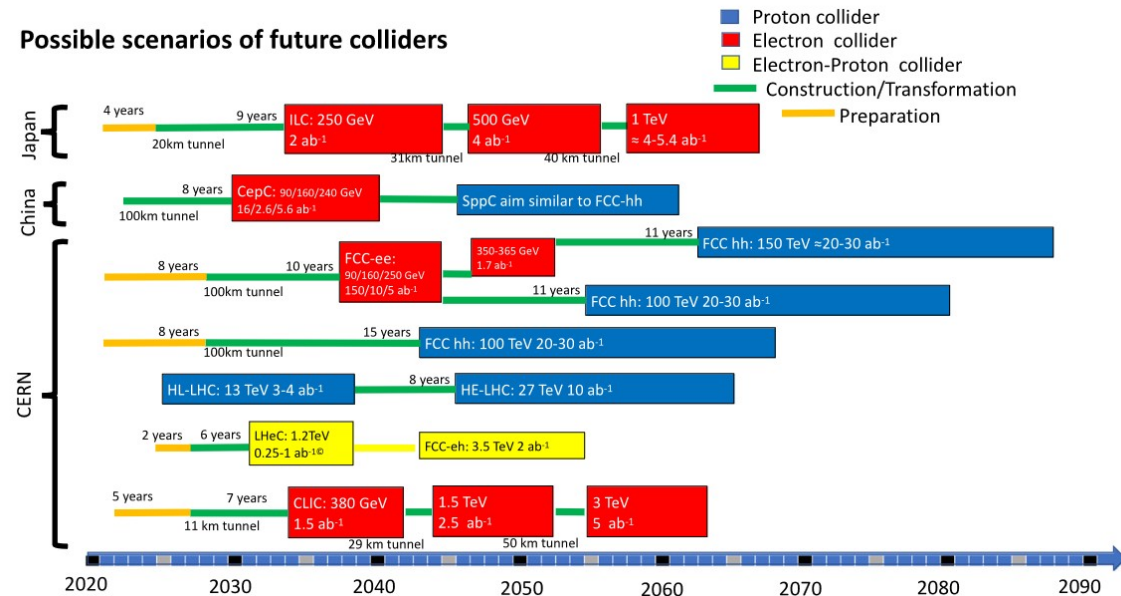
H.M. Gray '21

GW exp. reach to 1<sup>st</sup>-order phase transitions



LISA CosWG '22

Possible scenarios of future colliders



➔ LISA  
➔ ET  
➔ PTA

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Let's see what Michael, Chiara and Pedro will say