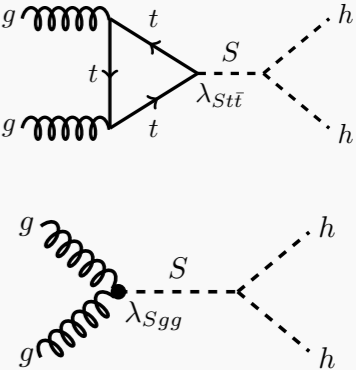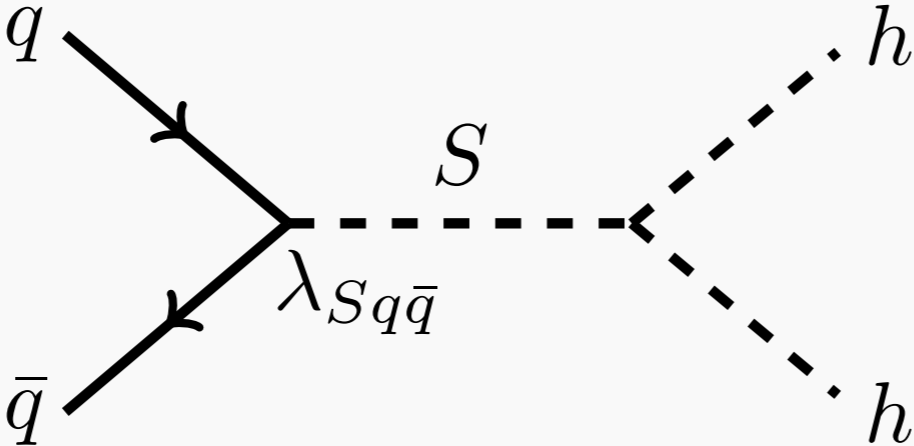# Di-Higgs production via quark-fusion: exploring Higgs flavor

D. Egaña-Ugrinovic, S. Homiller, P. Meade, [1908.11376, 2009.XXXXX]

Leading di-Higgs production diagram at hadron colliders
Concrete 2HDM example in 1908.11376

Loop-suppressed diagrams.
How to discriminate between different models?

**Low mass point
(flavor emphasis):**

$$m_H = m_A = m_{H^\pm} = 500\,\text{GeV}$$

$$\cos(\beta - \alpha) = 0.1$$

$$\lambda_{Hd\bar{d}} = 0.0015 \left(\lambda_{hd\bar{d}}/\lambda_{hd\bar{d}}^{\text{SM}} = 10 \right)$$

$$\sigma_{qq \to hh}^{13\,\text{TeV}} = 0.55\,\text{fb}$$

- Beyond the reach of HL-LHC. Within reach of FCC-hh?
- Target for advances in light quark Yukawa tagging at lepton colliders?

**High mass point
(enhanced cross-section emphasis):**

$$m_H = m_A = m_{H^\pm} = 1.5\,\text{TeV}$$

$$\cos(\beta - \alpha) = 0.025$$

$$\lambda_{Hd\bar{d}} = 0.033 \left(\lambda_{hd\bar{d}}/\lambda_{hd\bar{d}}^{\text{SM}} = 50 \right)$$

$$\sigma_{qq \to hh}^{13\,\text{TeV}} = 3.2\,\text{fb}$$

- Large dihiggs rates with a high mass resonance (not achievable in e.g., singlet extension)
- Potentially visible at HL-LHC w/ novel features
- Complementarity with dijet resonant searches

- hh → bbbb vs. bbjj / jjjj?
- Hunting for heavy Higgses decaying to dijets?

Other interesting pheno to study, but 2 qualitatively different physics points