

# SMEFT Theory Errors

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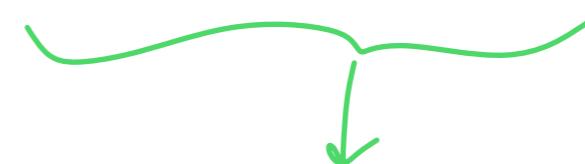
Snowmass EF04 metting, Oct 23rd 2020

# In SMEFT framework

$$|A|^2 = |A_{SM}|^2 + \frac{2\text{Re}(A_{SM}^* A_6)}{\Lambda^2} + \frac{1}{\Lambda^4} \left( |A_6|^2 + 2\text{Re}(A_{SM}^* A_8) \right) + \dots$$



interference piece,  
usually largest effect.  
State of the art  
SMEFT



‘Higher order’  
( $1/\Lambda$ ) corrections

SMEFT analysis strategy: precision, precision, precision!  
Need to include theory errors, including from higher order terms

**Full  $\mathcal{O}(1/\Lambda^4)$  term:**

$$+\frac{1}{\Lambda^4} \left( \underbrace{|A_6|^2 + 2Re(A_{SM}^* A_8)}_{\mathcal{O}(1000) \text{ operators}} \right) + \dots$$

$\mathcal{O}(1000)$  operators  
(mostly from dim-8)

**Not feasible for most processes!**

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**Instead:**

- Keep  $\mathcal{O}(1/\Lambda^2)$  (only!) as the SMEFT signal
- Calculate  $|A_6|^2$  piece, use it as a theory uncertainty when extracting limits

[Shepherd et al. 1711.07484 .1812.0757]

**Ex:**

$$\chi^2 = \frac{(N_{obs} - \mathcal{L}(\sigma_{\text{SM}} + \sigma_{\text{SMEFT } \mathcal{O}(A_6)}))^2}{\mathcal{L}(\sigma_{\text{SM}} + \sigma_{\text{SMEFT } \mathcal{O}(A_6)}) + (\mathcal{L} \sigma_{\text{SMEFT } \mathcal{O}(A_6^2)})^2}$$

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**Pros:**

- Consistent treatment of SMEFT signal
- Calculable with existing MC SMEFT setups (i.e. SMEFTSim)

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**LOI plan:**

- Apply to diboson processes as an example
- Explore how to incorporate into SMEFT global fits

**THANKS!**