SMEFT Theory Errors

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In SMEFT framework

$$|A|^2 = |A_{SM}|^2 + \frac{2Re(A_{SM}^* A_6)}{\Lambda^2} + \frac{1}{\Lambda^4}\Big(|A_6|^2 + 2Re(A_{SM}^* A_8) \Big) + \cdots$$

interference piece,
usually largest effect.

State of the art
SMEFT

'Higher order'
$(1/\Lambda)$ corections

SMEFT analysis strategy: precision, precision, precision!

Need to include theory errors, including from higher order terms

Full $\mathcal{O}(1/\Lambda^4)$ term: $$+\frac{1}{\Lambda^4}\Big(|A_6|^2 + 2Re(A_{SM}^* A_8) \Big) + \cdots$$

$\mathcal{O}(1000)$ 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:

$$\chi^2 = \frac{(N_{obs} - \mathscr{L}\,(\sigma_{\mathrm{SM}} + \sigma_{\mathrm{SMEFT}\,\mathcal{O}(\mathrm{A}_6)}))^2}{\mathscr{L}\,(\sigma_{\mathrm{SM}} + \sigma_{\mathrm{SMEFT}\,\mathcal{O}(\mathrm{A}_6)}) + (\mathscr{L}\,\sigma_{\mathrm{SMEFT}\,\mathcal{O}(\mathrm{A}_6^2)})^2}$$

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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!