1) LHC findings: the Higgs... and nothing else yet

Typical experimental problem: large, uncontrolled backgrounds rely on Monte Carlo simulations? Trust sideband fits? Try less noisy channels (low statistics is also low noise)

4.c) Search for vector resonances

Theory: IAM with J=1

Experiment: ATLAS diboson

Additional terms in the Lagrangian coupling the photon

Access to J= 0^+, 2^+ resonances

5) Particularly clean: γγ collisions

\[
\frac{d^2 \sigma_{\gamma\gamma \to WW^*}}{dy_1 dy_2} = \int \frac{dx_1 d^2 p_T^{x_1} f(x_1)}{E_{x_1}} \frac{d^2 p_T^{x_2}}{E_{x_2}^y} \delta (\gamma_1 - 4E_{x_1}^y) \\
= \int \frac{d^2 p_T^{x_1} f(x_1)}{E_{x_1}} \frac{d^2 p_T^{x_2}}{E_{x_2}^y} \delta (\gamma_1 - 4E_{x_1}^y)
\]

Soon to be published.

ABSENCE OF RESONANCES? CONSTRAIN PARAMETERS

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4.b) Searches for axial resonances: 3 TeV wh at ATLAS

Is that anything but a fluctuation?

4.a) Absence of W_L W_L resonance to constrain b (hh-W_L W_L coupling)

Perturbative amplitudes grow polynomially in s (and violate unitarity)

Unitarized pert. Theory

"Inverse Amplitude Method" produces resonances with M and Γ related to the Lagrangian parameters.

Method: compare experimental resonance searches to IAM and use it to constrain parameters of HEFT

Preprint IFT/UAM-CSIC 17-048

Existing constraints on the HEFT parameters

* Oblique S, T parameter constraints from LEP.

* Obtained by spectral representation of S, T in terms of spectral functions

2) Lagrangian with chiral (derivative) counting

3) Use resonance searches

4) Examples from recent LHC data

5) Particularly clean: γγ collisions

SMEFT (Standard Model EFT)

*) Linear realization of spontaneous symmetry breaking

*) The Higgs h is part of a complex doublet

*) Constraints among coefficients

HEFT (Higgs EFT)

*) Non-Linear realization of spontaneous symmetry breaking

*) The Higgs h is an independent scalar field

*) Most general possible EFT for the electroweak sector

Empirical science after all...

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What to do next @LHC?

Otherwise, constrain the Effective Field Theory of the particles that we do see.

2.5 2.6 2.7 2.8 2.9 3.0

Unitarized pert. Theory

"Inverse Amplitude Method"

produces resonances

with M and Γ related to the Lagrangian parameters.

Method: compare experimental resonance searches to IAM and use it to constrain parameters of HEFT

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How to make further progress at the LHC and at future e+e- colliders?

Access to J= 0^+, 2^+ resonances

ABSENCE OF RESONANCES?

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