WG3: BSM @ HL-LHC & HE-LHC

Status report

WG3 conveners

EX: Monica D’Onofrio (ATLAS), Keith Ulmer (CMS), Xabier Cid Vidal (LHCb)

TH: Patrick Fox, Riccardo Torre
• Hierarchy problem
• Origin of Dark Matter
• Strong CP problem
• Neutrino masses
• Matter/anti-matter asymmetry
• Explanation of Yukawas, fermion masses
• Quantum gravity
• Inflation
• ....

Many potential explanations of these involve physics that can be probed at LHC or HE-LHC

all involve BSM physics
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Good synergy between WG’s 2, 3, and 4
HL/HE-LHC

Reference Parameters:

- **HL-LHC**: $\sqrt{s} = 14$ TeV; $L = 3$ ab$^{-1}$; for LHCb: 50 → 300 fb$^{-1}$;
- **HE-LHC**: $\sqrt{s} = 27$ TeV; $L = 15$ ab$^{-1}$;

Both present great opportunity to learn about SM/discover BSM

Opportunities, challenges, complementarity, uniqueness of each?

Yellow report as input to European Strategy for Particle Physics
What is the reach of HL/HE-LHC?

We can update existing analyses for 3/ab, compare techniques

But we should also think of new types of analyses that take advantage of the increase in luminosity or energy

e.g.
   Go out on tails
   Require boosting
   Associated production for trigger or just to suppress background

Other interesting corners of phase space that may become available?

Don’t lose sight of light, weakly coupled new physics
   Take advantage of high pT to dig under SM and search for light stuff
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Send email to conveners: hllhc-wg3-admin@cern.ch
Send email to WG3: hllhc-wg3@cern.ch
Join WG mailing list: https://indico.cern.ch/event/647676/overview

Contribute to Yellow Report
**WG3 (BSM) Activities**

Conveners: Patrick J. Fox and Riccardo Torre (TH), Monica D’Onofrio (ATLAS), Keith Ulmer (CMS), Xabier Cid Vidal (LHCb)

- CERN kickoff meeting (Oct 30-Nov 1, 2017)
  - >30 BSM talks
- Fermilab meeting (now!)
  - >30 BSM talks
- On-line (vidyo) meeting (Apr 23, 2018)
- On-line (vidyo) meeting (~May 21, 2018)
- First draft of contributions (May 30, 2018)
- CERN plenary meeting (June 18-20, 2018)
- More on-line meetings
- Yellow Report (Dec 18, 2018)

Many proposed analyses for HL and HE, from theorists and ATLAS, CMS and LHCb members
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- SUSY, with and without R-parity
- Resonances
- Long lived particles
- Future new detectors: MATHUSLA, CODEX-b, FASER, milliQan
- New collider: e-p LHeC
- Dark Matter
- Extended scalar sectors
- Axions
- Neutral naturalness
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To see ongoing work, to propose a new analysis etc see spreadsheet
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Studies need to be as “realistic as necessary”
   Scale existing results
     vs
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     vs
     Delphes detector simulator?
     vs
     Full sim.

Also should make uniform assumptions

SM backgrounds may be different for HL/HE
Collect list of generated background samples in a central place? On the twiki?
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Increased lumi/energy may allow new techniques and channels to be used that haven’t been used before
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Some general workshop details

**WIFI:** “guest” or “eduroam” should work

**Coffee:** in the lobby (but you already know that)

**Lunches:** Lobby, then 2nd floor or other seminar room (across lobby)

**Thursday social:** right after the last session on Thursday (~5:30pm) we will adjourn to the “Frontier Pub” in Aspen East.

**Dinners in general:** see “resources” link on workshop webpage, or ask a local

Please upload talks to Indico before your session starts