

# Particle Theory — Where we Stand

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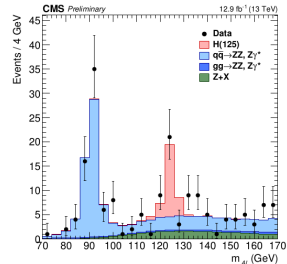
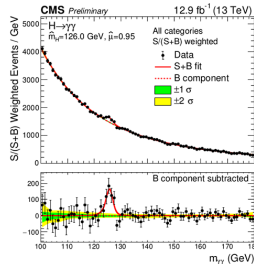
## Open Questions

## What is the dark matter agent? [Ch. 7]

- particle dark matter stronger than ever
- mass between  $10^{-20}$  eV and 30 solar masses
- electroweak scale still miraculous

## Is the Higgs mass a problem? [Ch. 2.6, Paper I]

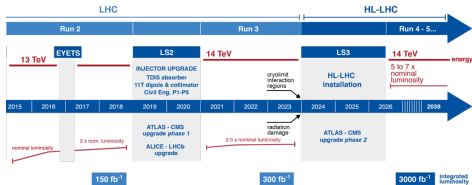
- Standard Model structurally complete
- is the Higgs sector minimal?
- fundamental scalars a QFT problem
- should we worry?



# Opportunities at and beyond LHC

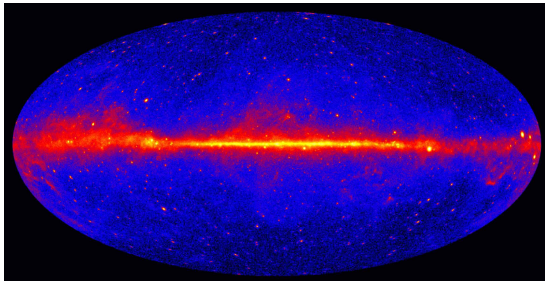
## LHC Run III and HL-LHC to come

- $139 \text{ fb}^{-1}$  at 13 TeV on tape
- $300 \text{ fb}^{-1}$  at 14 TeV soon
- $3000 \text{ fb}^{-1}$  scheduled



## LHC is not alone [Ch. 6, Paper III]

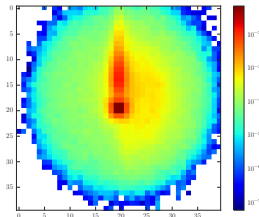
- dark matter searches a global effort
  - direct searches
  - indirect searches
  - collider searches
- who will find it (first)?



## Techniques for data-driven science

## LHC is big data [Ch. 5]

- $10^{10}$  di-jet events
- $10^8$  top pair events
- can Google and Facebook help?
- fundamental insights in return



## Progress to be made

- jet classification done
- event classification — beyond CNN? [Paper II]
- anomaly searches — autoencoders?
- error bars — Bayesian networks?
- simulation — GANs?

⋮

