# A 10 TeV Muon Collider for the Future of Particle Physics

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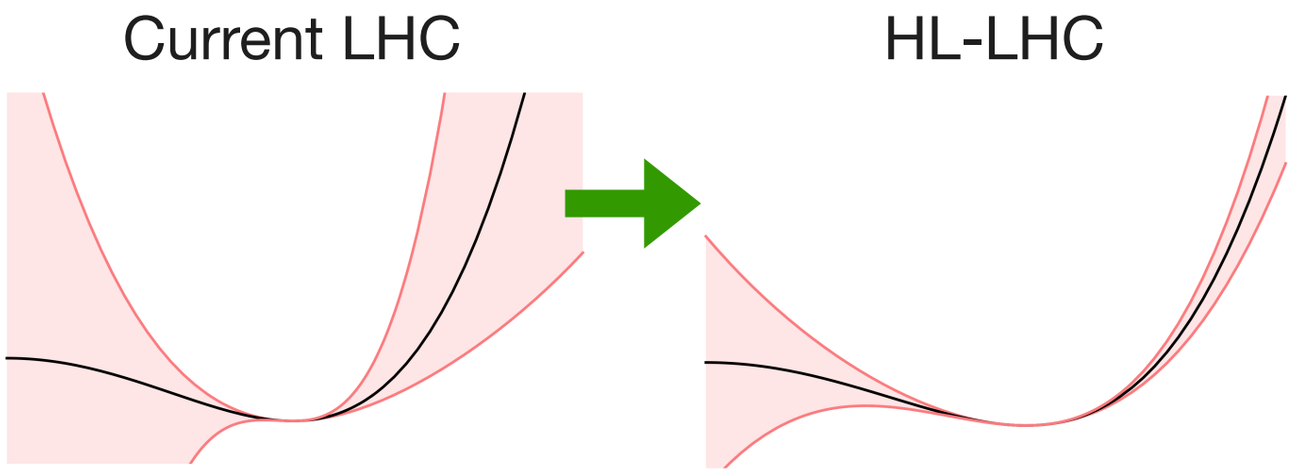
Harvard University

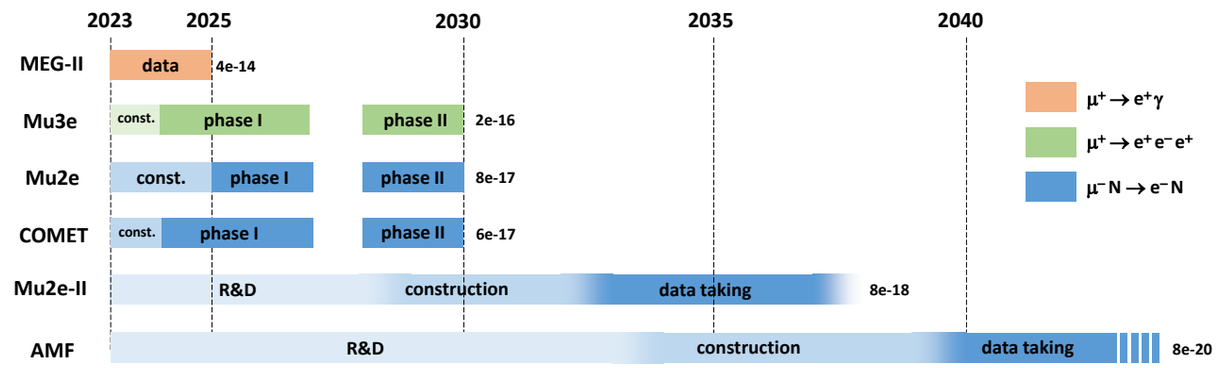
**SLAC P5 Town Hall, May 4, 2023**

# An Exciting Future for Particle Physics

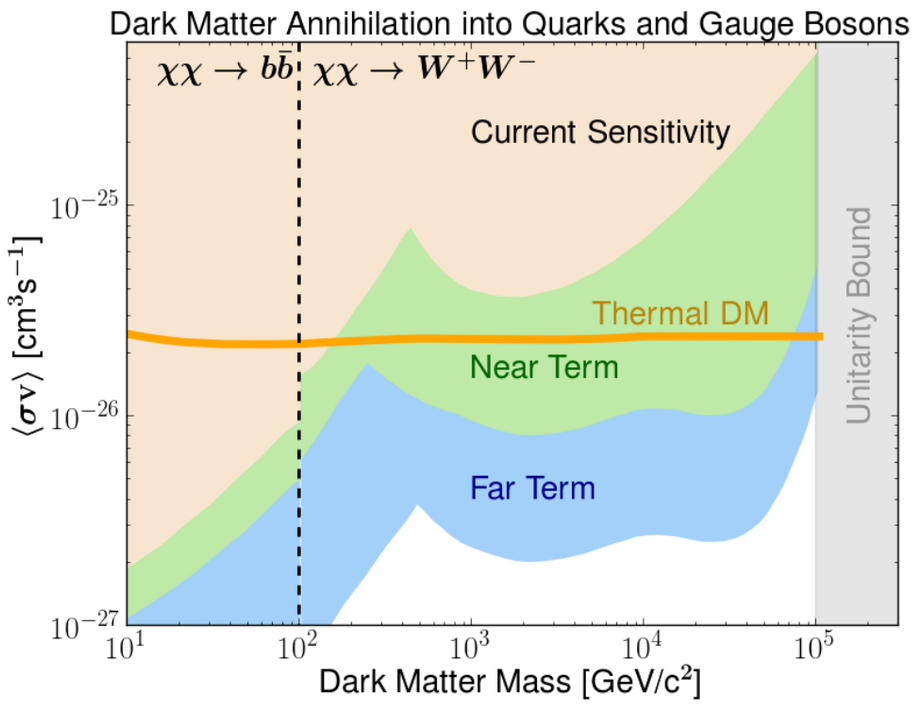
## Direct & Indirect Searches will dramatically increase sensitivity in coming years




(N. Craig, R. Petrossian-Byrne)




RPF Report [2210.04765]

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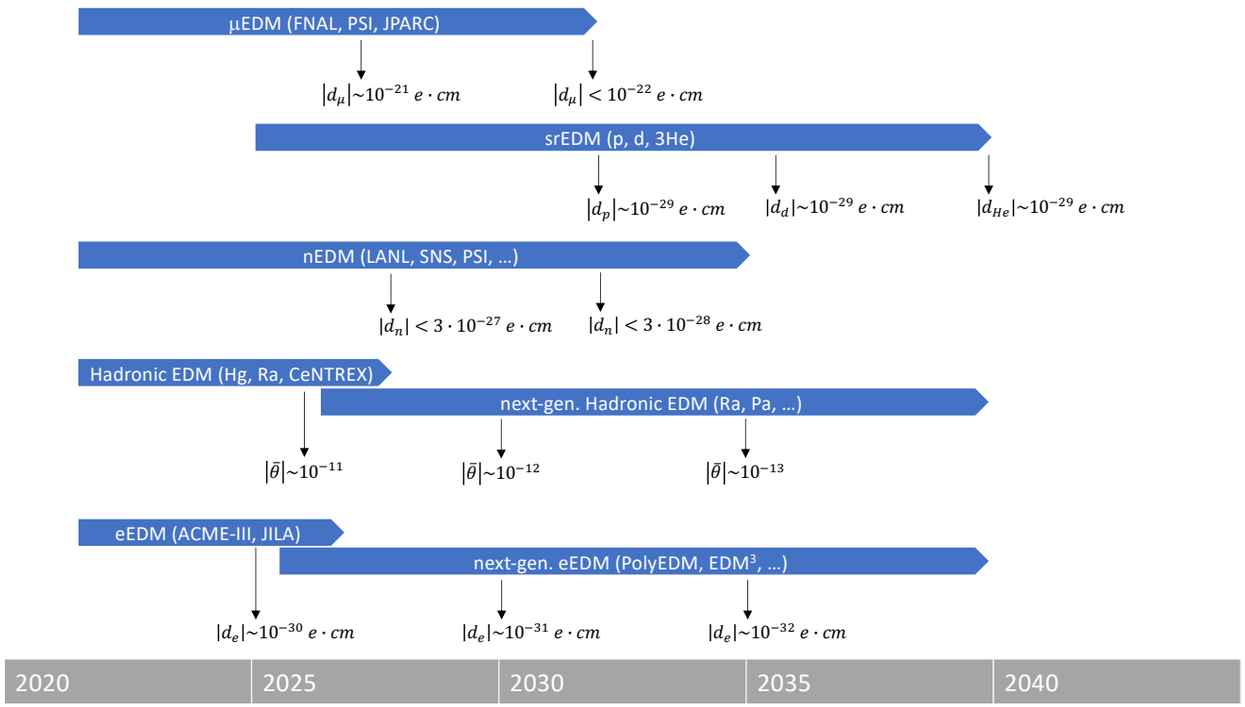
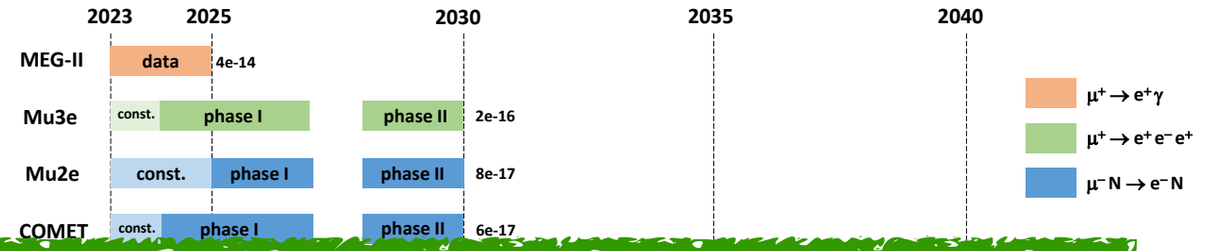


# An Exciting Future for Particle Physics

## Direct & Indirect Searches will dramatically increase sensitivity in coming years

Current LHC

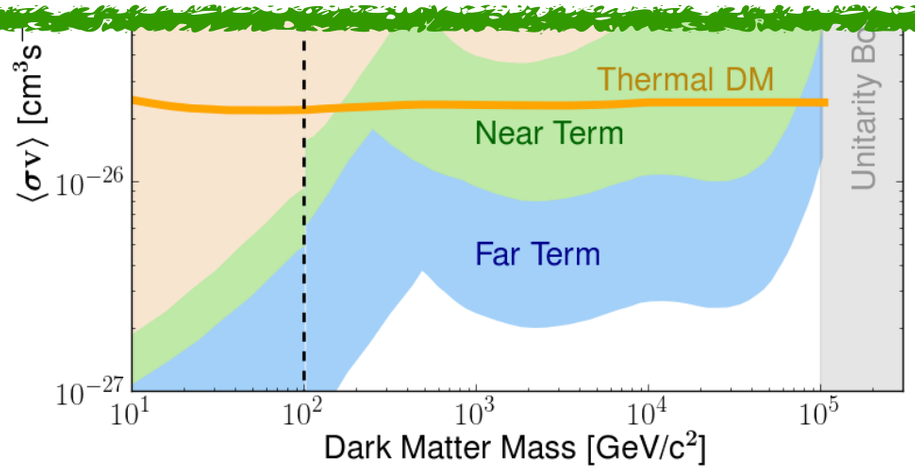
HL-LHC




**Best case scenario:**

Unambiguous signal of BSM physics in next 10-20 years

$\Longrightarrow$ Theory and Experiment must be ready to follow up at higher energies *as fast as possible!*

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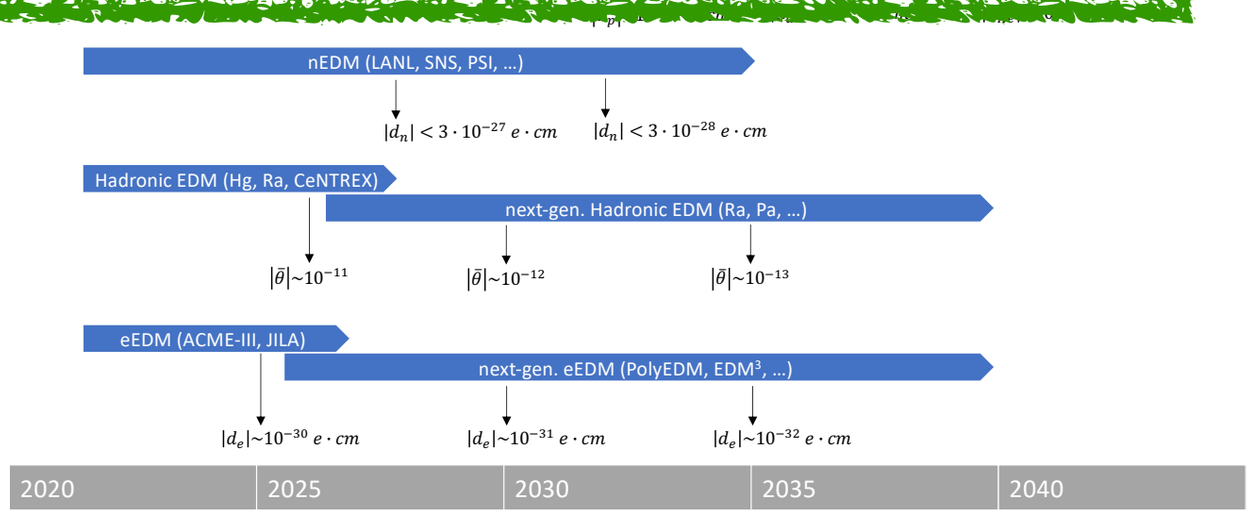
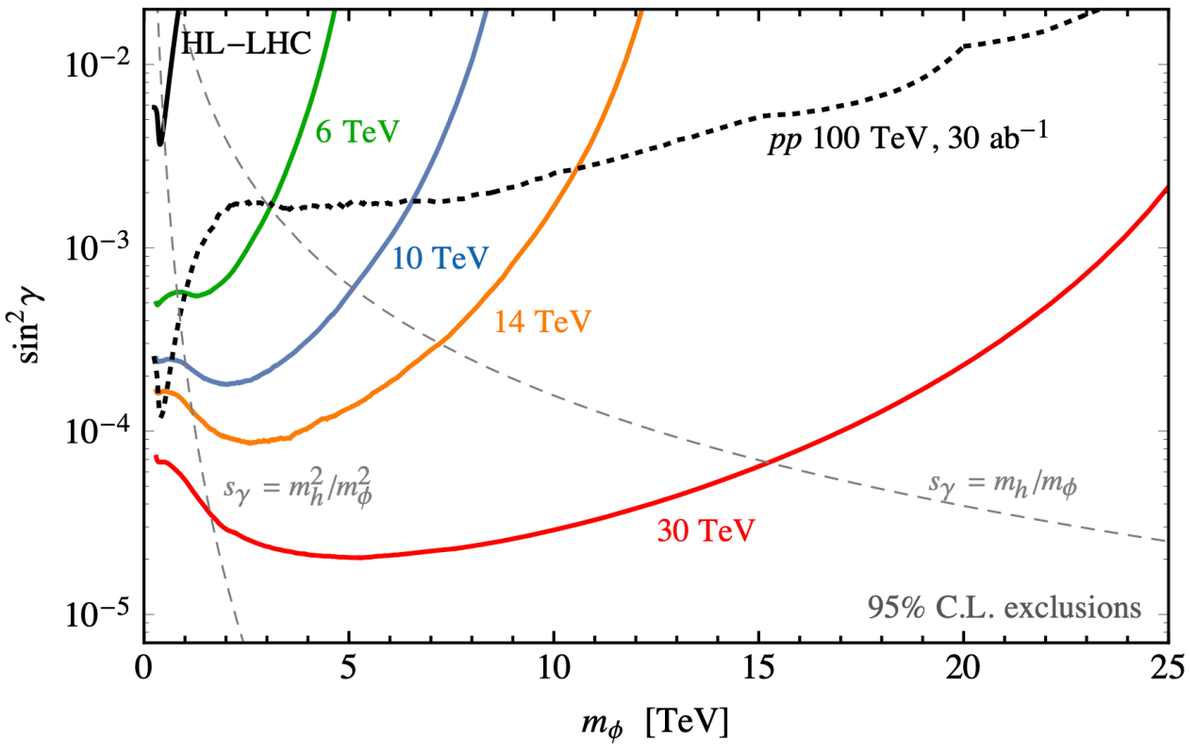
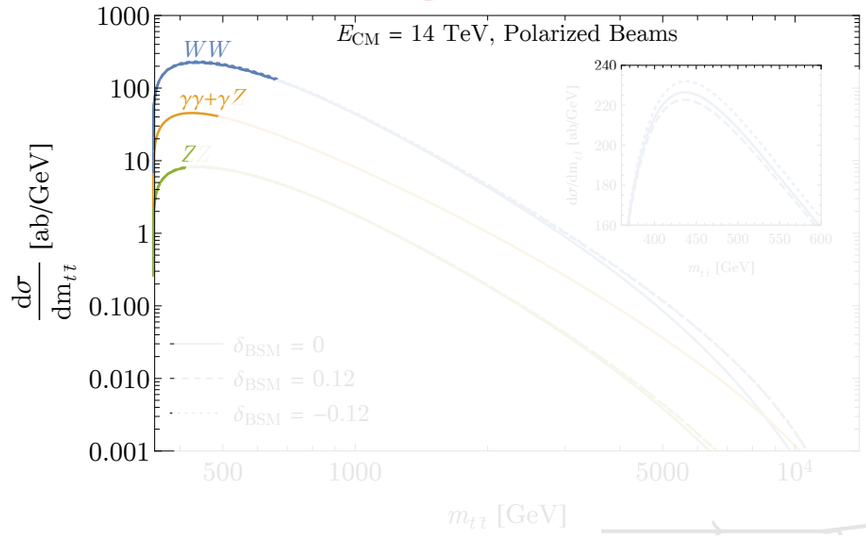
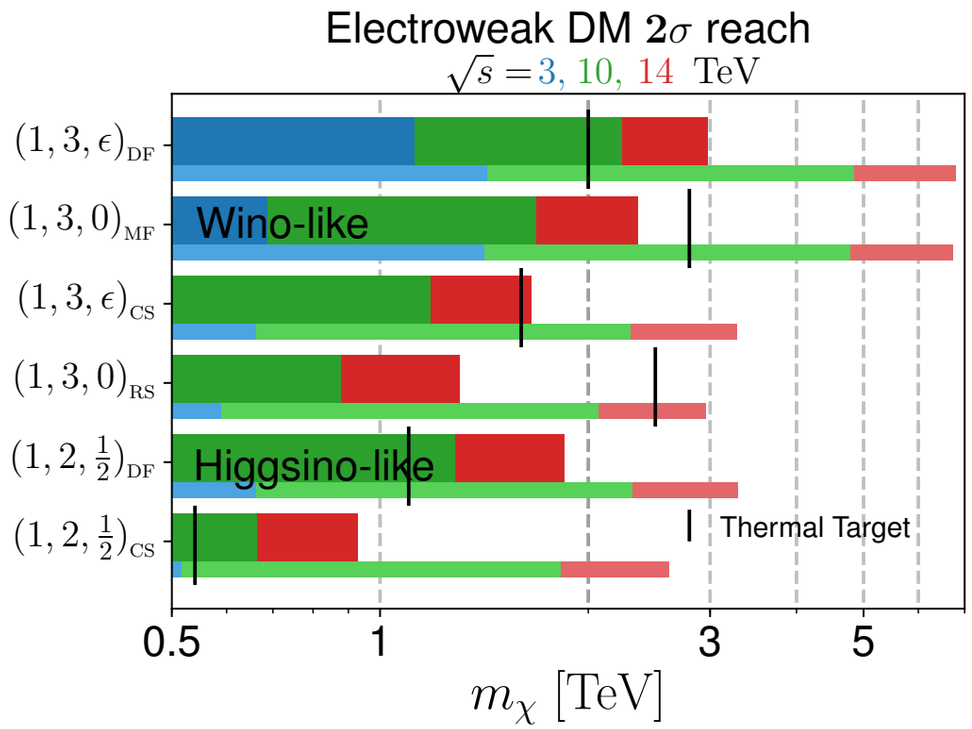
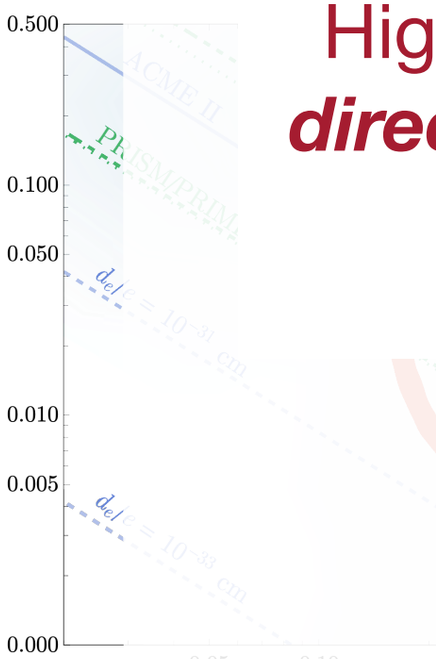


# Muon Collider Discovery Potential

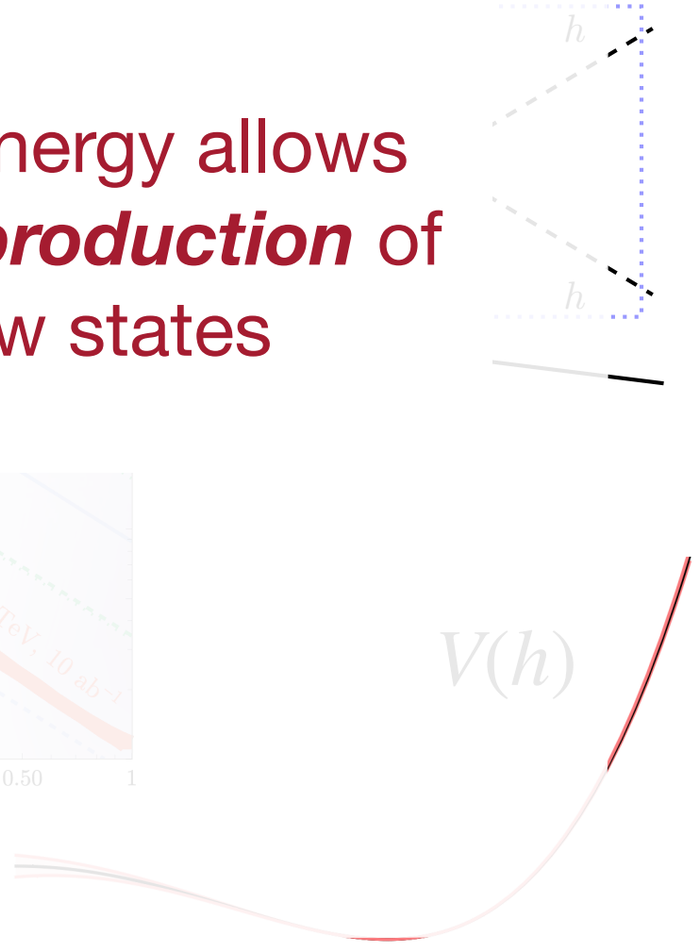



High energy allows ***direct production*** of new states




MuC Physics Summary [2203.07256] MuC Forum Report [2209.01318] Muon Smasher's Guide [2103.14043]

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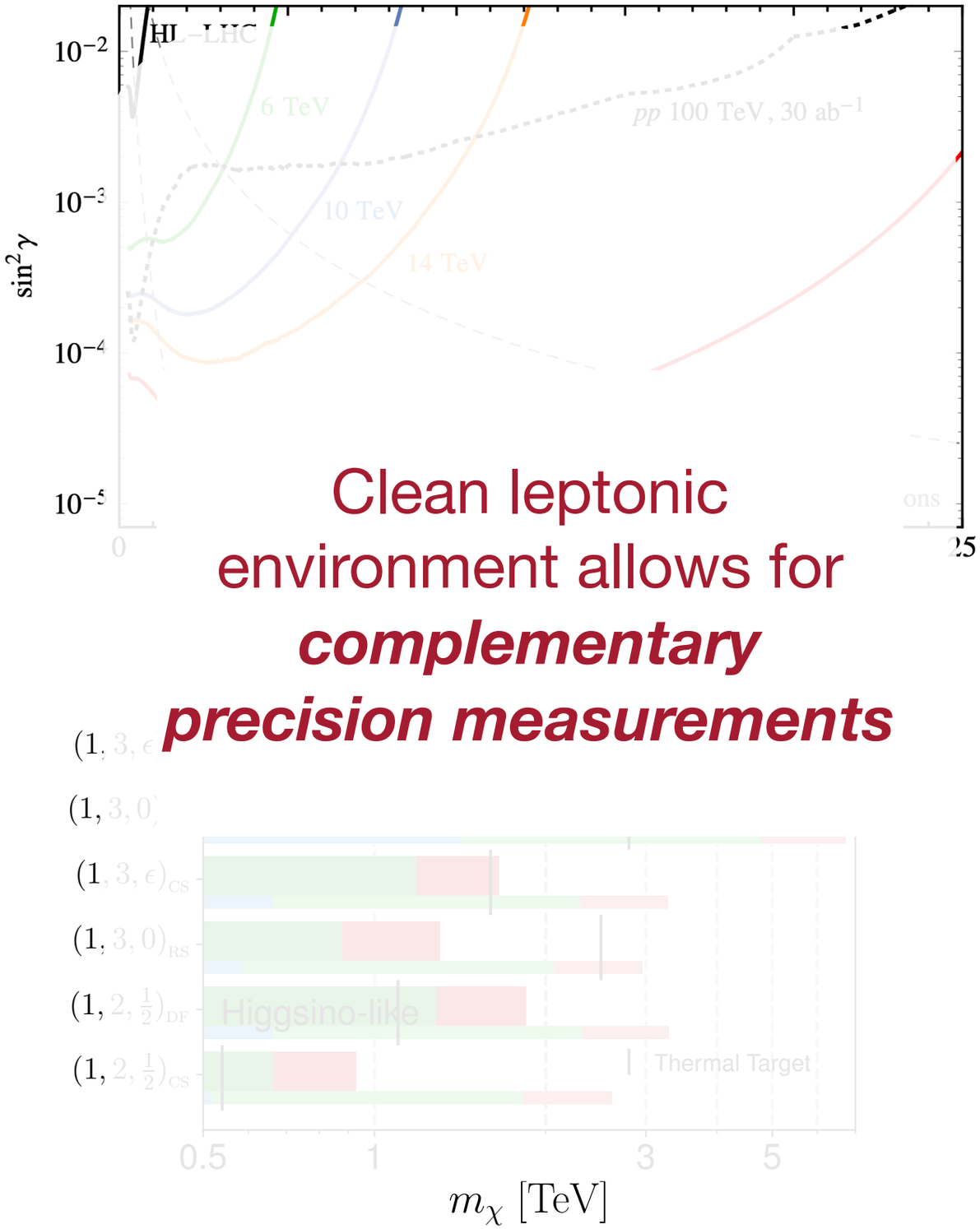
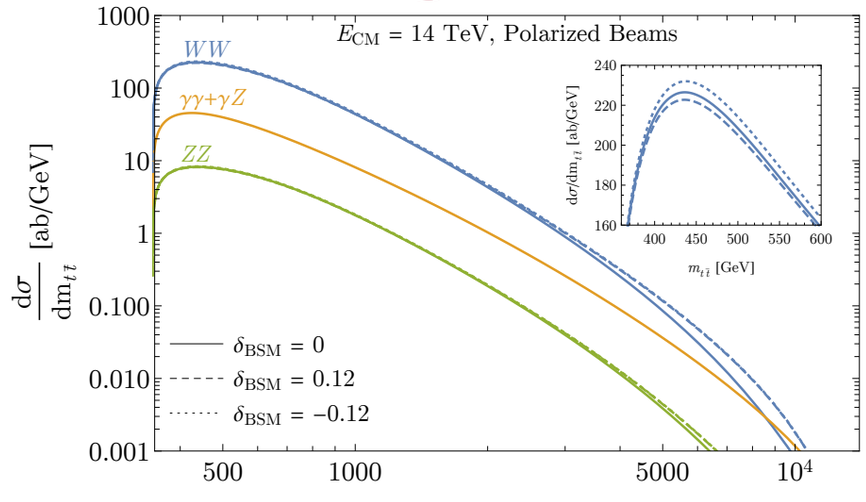
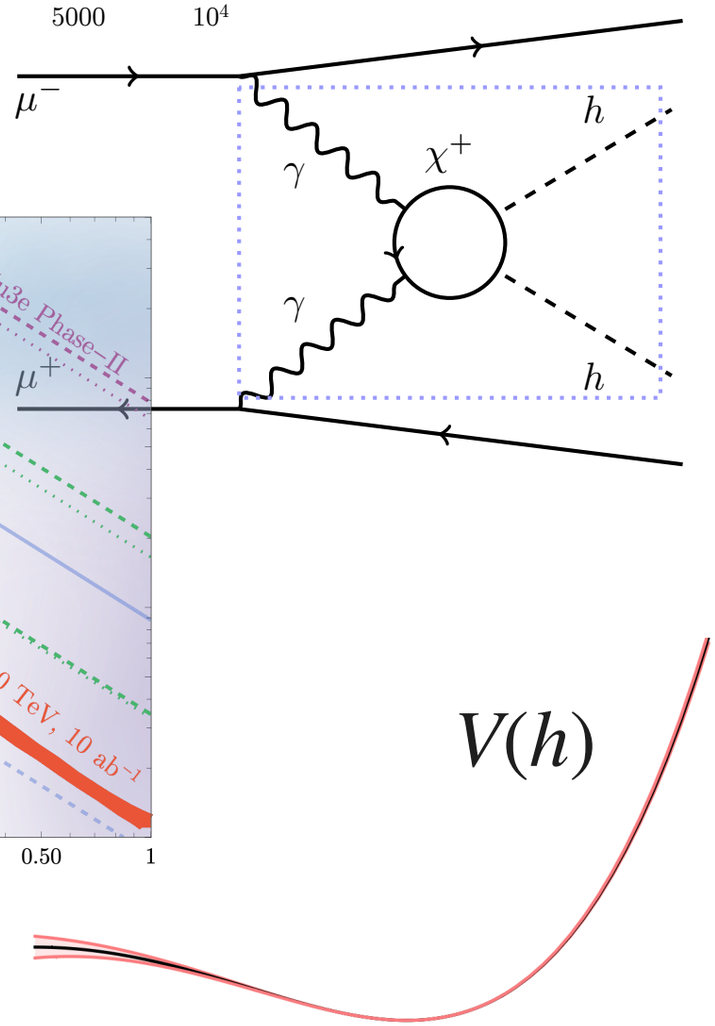
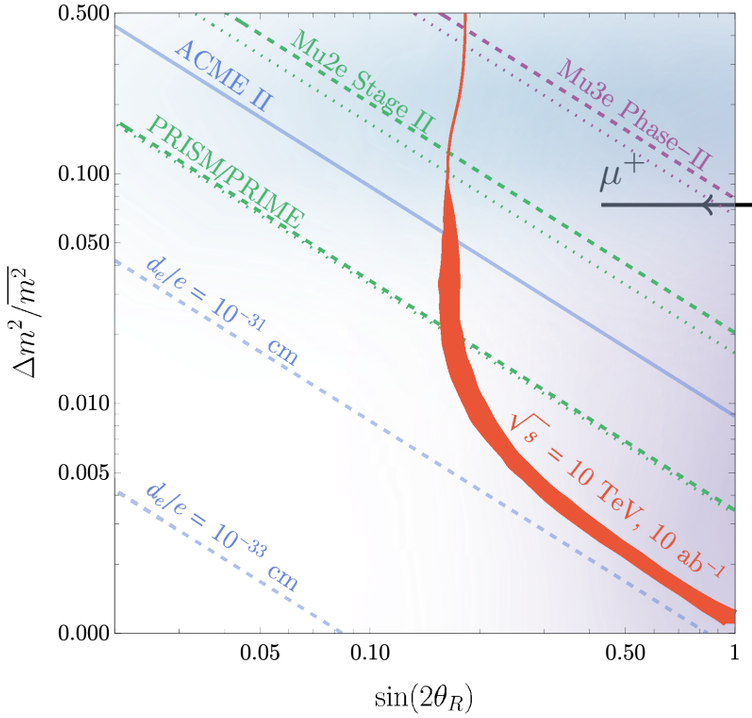



Clean leptonic environment allows for ***complementary precision measurements***




[MuC Physics Summary [2203.07256]](#) [MuC Forum Report [2209.01318]](#) [Muon Smasher's Guide [2103.14043]](#)

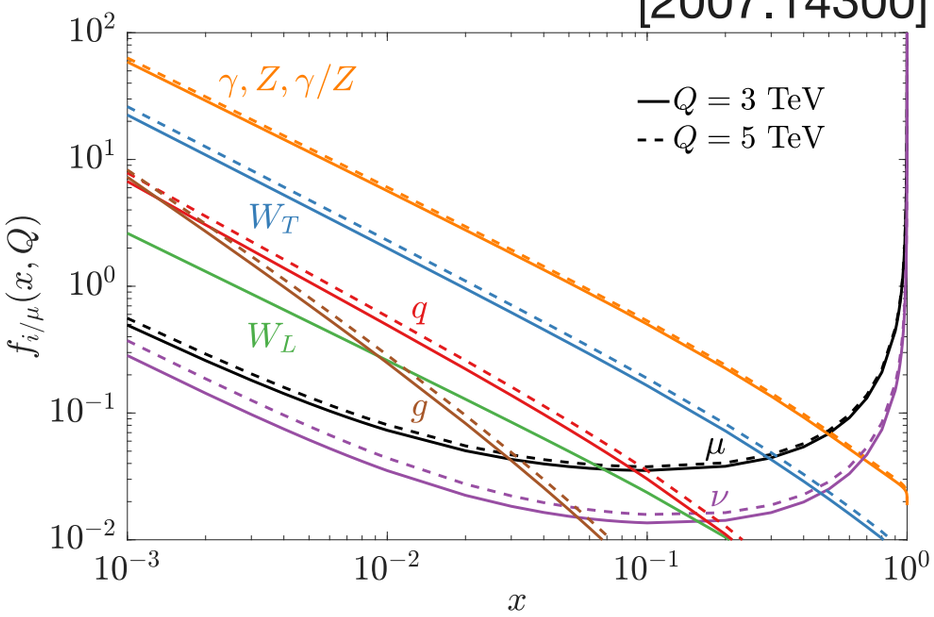
# High Energy Theory and Future Colliders

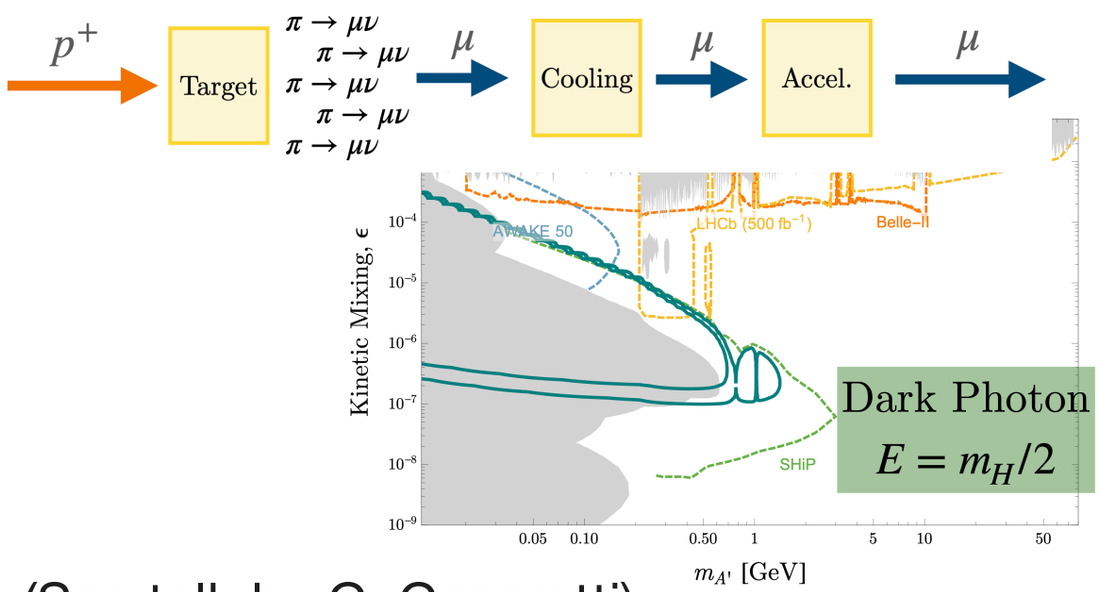
Thinking about what we can see at highest energies has been very productive for theoretical physics!

Conversely, theory input is crucial for high-energy experiment:

- Precise predictions needed to interpret data
- Identify new signals & searches in existing experiments

[2007.14300]




(See talk by C. Cesarotti)

A crucial part of the LHC program, and **already** happening in muon collider context!

(Physics case built by theorists in the last two years!)

# We Must Reach 10 TeV In Our ~~Lifetimes~~ Careers!

- There is a strong physics case for reaching 10 TeV
  (this has gotten *stronger* since the Higgs discovery)

- Muon Collider has strong complementarity with other probes

  - Development & Construction Synergistic with other experimental programs
    (Muon Beam Dump, $\nu$STORM, Advanced Muon Facility)

- Commitment to exploring highest energies crucial for a vibrant theory program

- **Need strong collaboration between Accelerator, Energy, Theory and Instrumentation Frontiers**

**The ask:**

- Support for Muon Collider R&D
- Robust support for theory research across all of HEP