Guiding the search for new fundamental physics with field theory techniques

EFTforBSM

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Sezione di Trieste

Past experience

I have worked at:

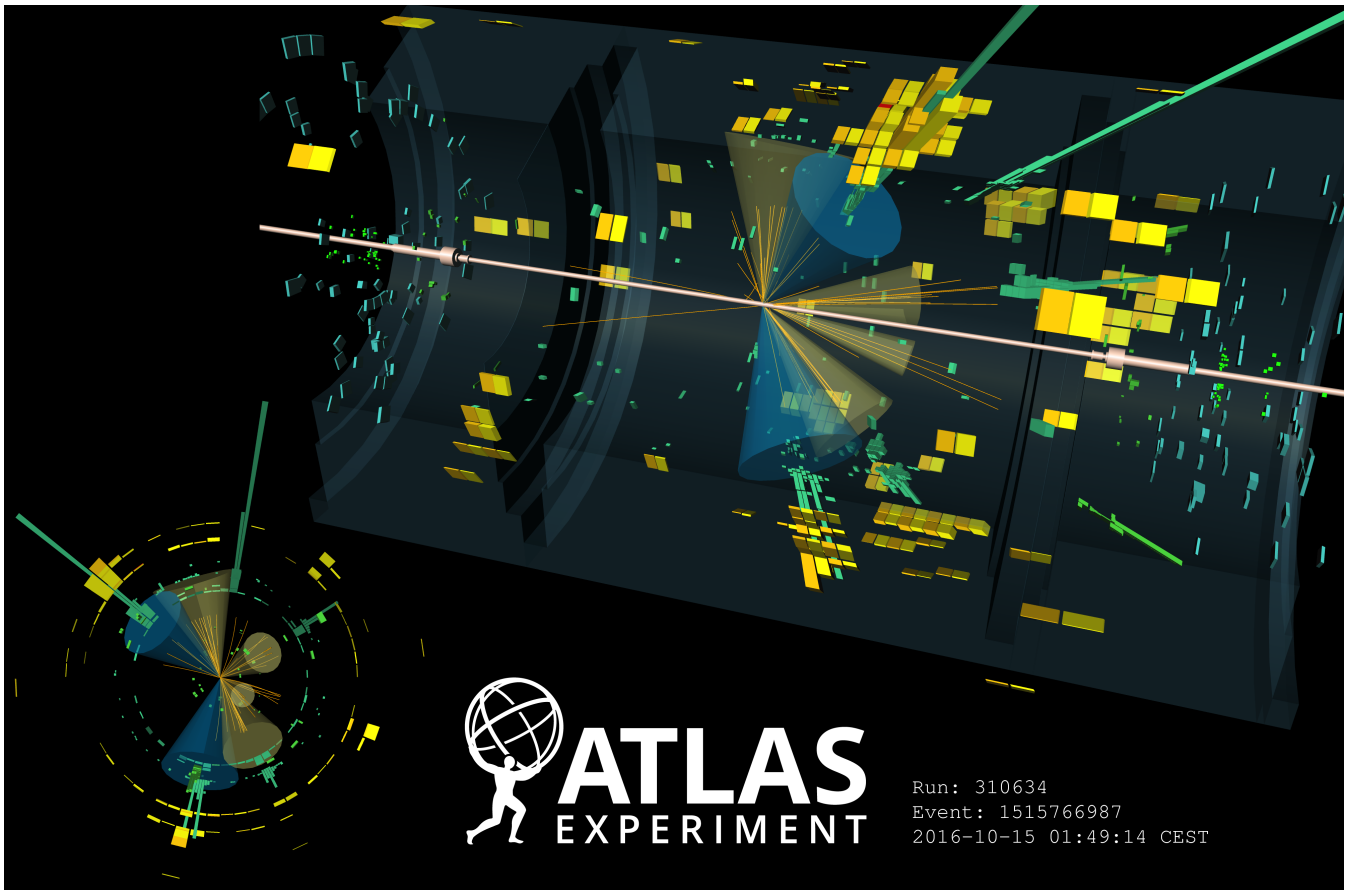
- **2012–2016** PhD, High Energy Physics group University of Cambridge, UK
- **2016–2019** Postdoc, High Energy Theory group, University of California Santa Barbara, USA

on various aspects of particle phenomenology, typically using

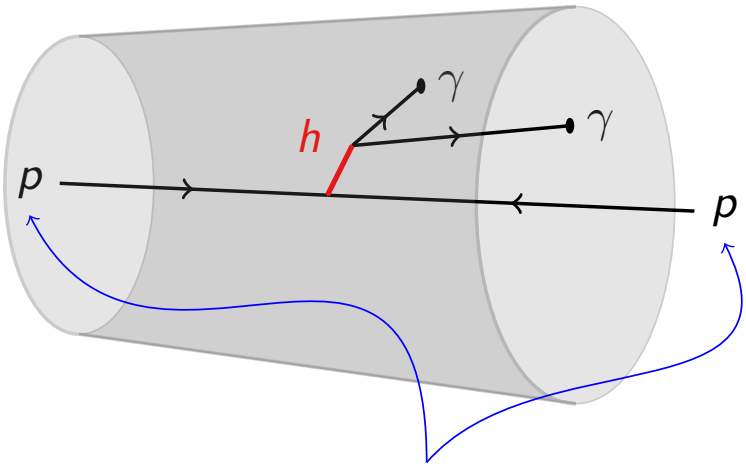
- analytic/numerical calculations
- effective field theories

to try to understand how to look for new particles at experiments such as the LHC.

Look for the remnants of new particles in high energy collisions



Colliders convert kinetic energy into matter (and back again)



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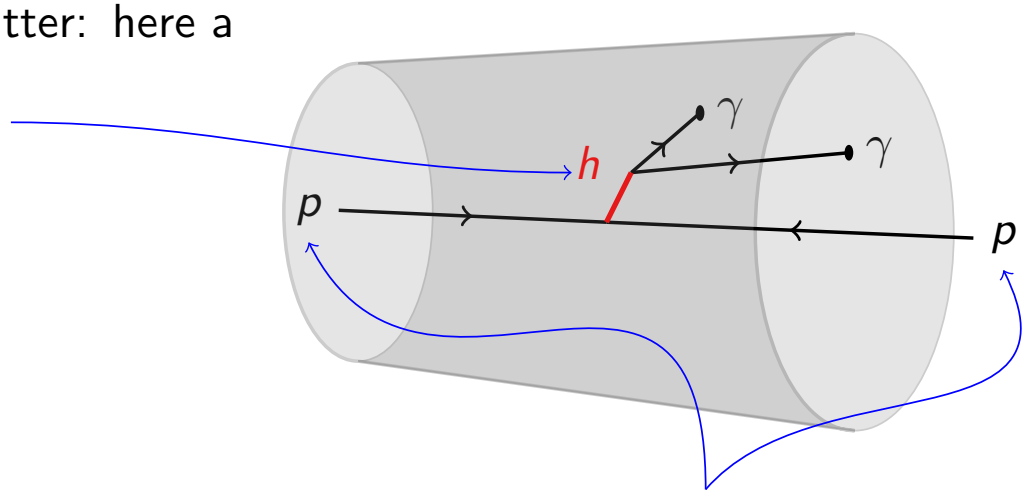
2) Some of that energy, **M**, is converted to matter: here a Higgs boson



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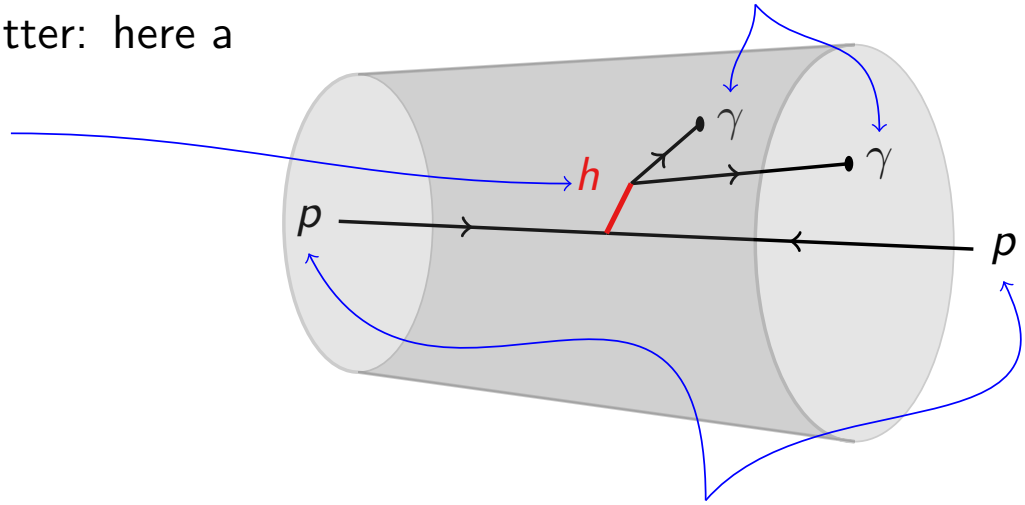

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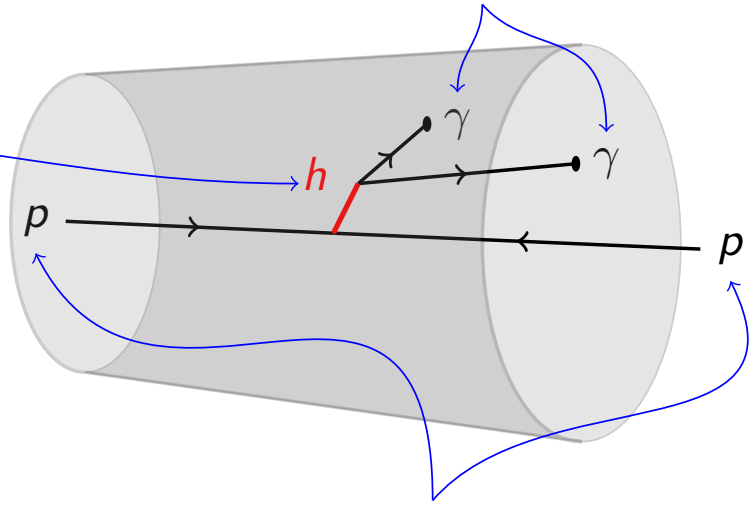

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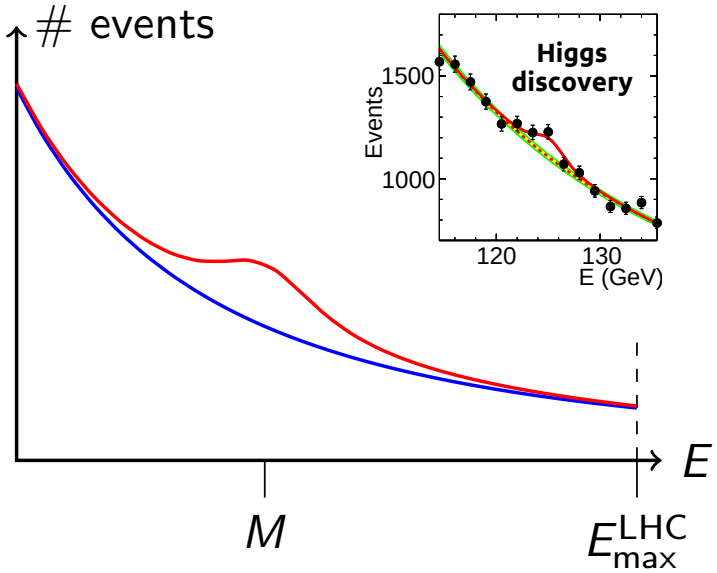
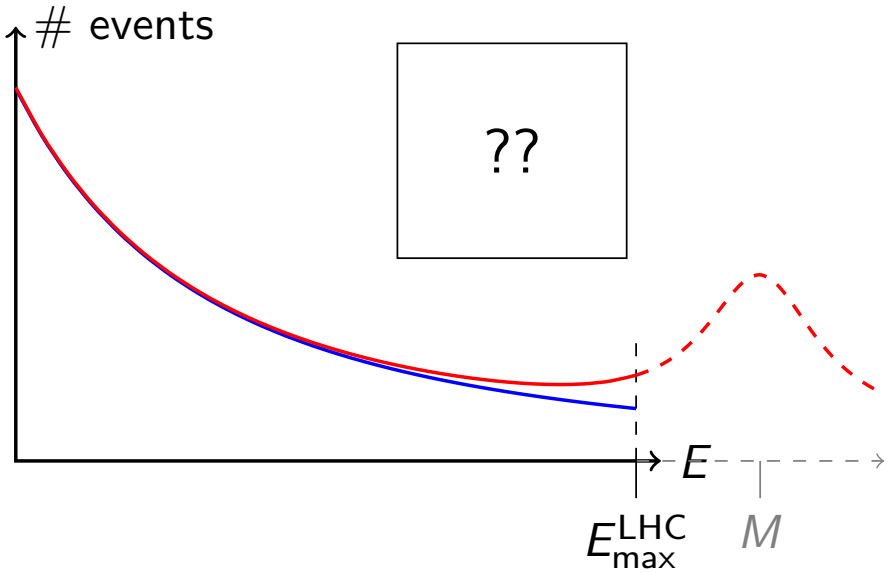
4) Look for a bump



New particles appear to be just out of reach

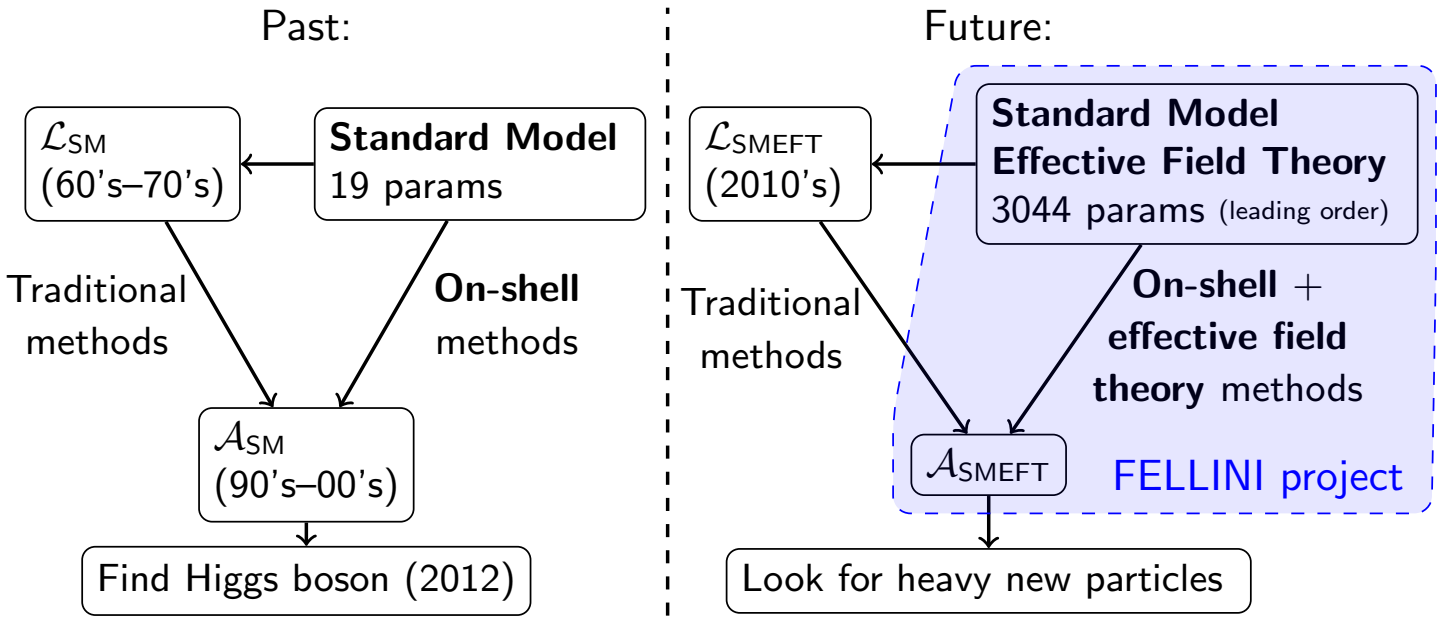
We have looked exhaustively for new light particles ($E_{\text{max}}^{\text{LHC}} > M$).
Now, look for **indirect effects** of **heavy particles** ($E_{\text{max}}^{\text{LHC}} < M$).



- **Simple, polynomial** signal shapes $\left(\frac{E}{M}\right)^n$
- This finite set of **universal** effects forms the **Standard Model Effective Field Theory (SMEFT)**
- We are beginning to systematically study SMEFT effects at experiments

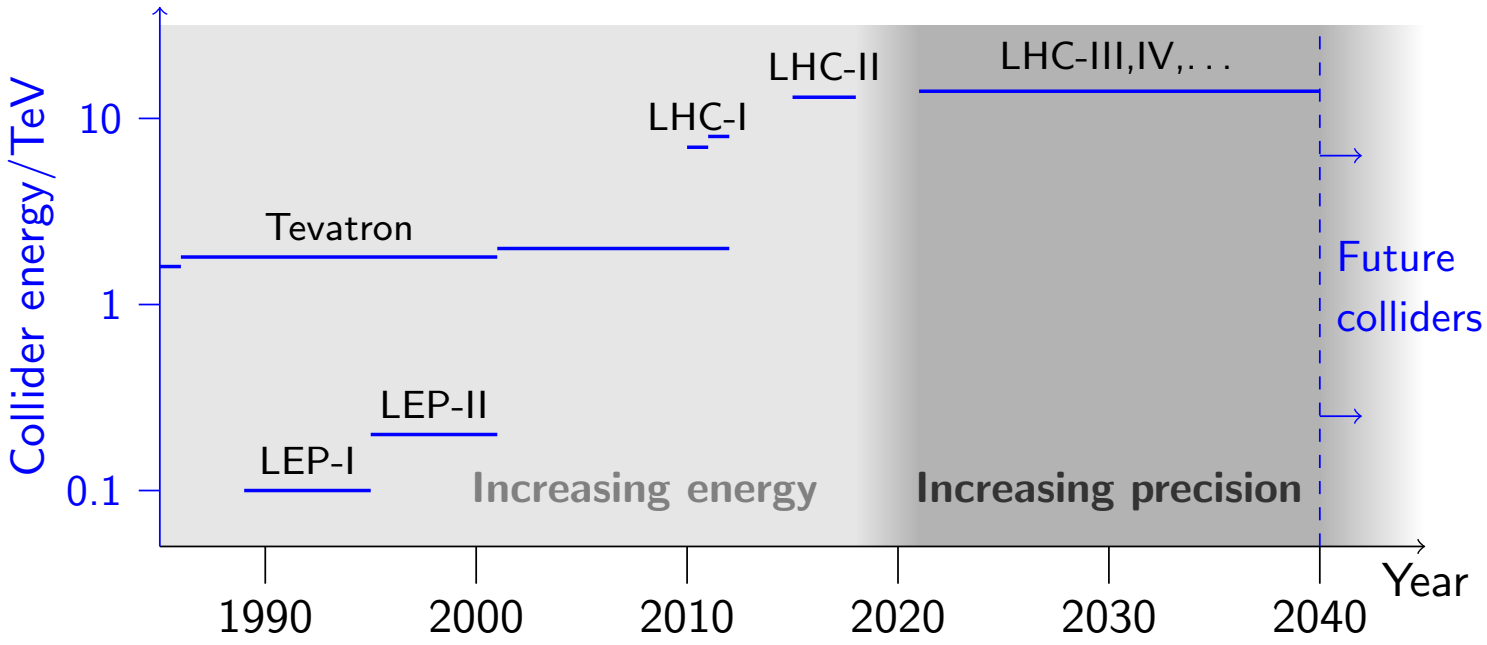
We want to make calculating these shapes easier

We think in $\mathcal{L}$; we measure $\mathcal{A}$



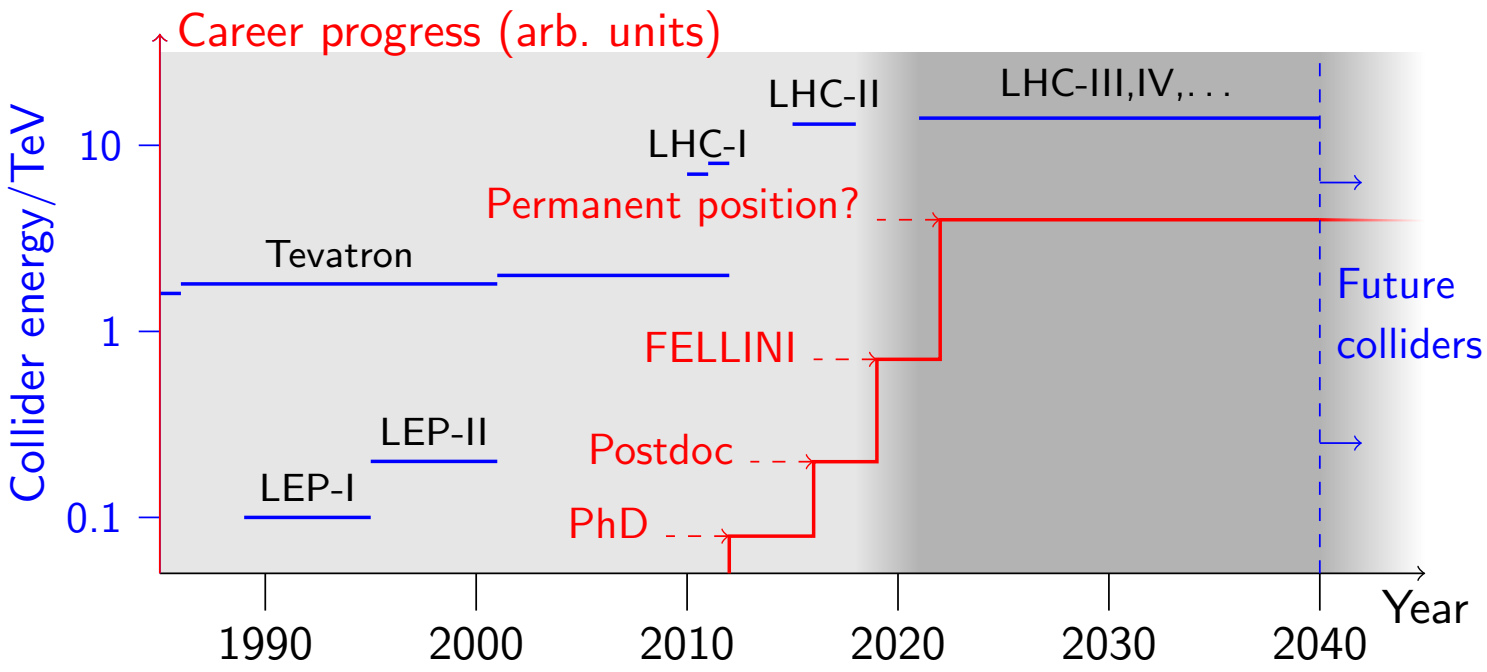
In summary: a timeline

The future is not in increasing energy, but in using **increasing precision** to look for **heavy new particles**.



We want to develop the associated theory to maximise the information we can extract about **heavy new particles**.

In summary: career prospects



For the secondment: a **scientific associateship** at **CERN**? Home to the LHC, the Higgs cross section working group, and large theoretical and experimental communities.