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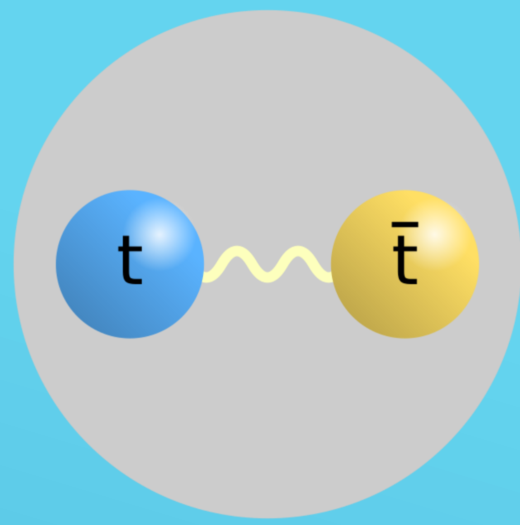

Highlight on Toponium II

« Toponium at the LHC: a new frontier in top-quark physics »

Prof. Benjamin Fuks – Sorbonne Université, LPTHE, France

The top quark, the heaviest known elementary particle, has long been thought unable to form bound states. However, intriguing hints in recent LHC data suggest that toponium, a short-lived quasi-bound state of a top-antitop pair, might have left observable traces in data and possibly even been discovered. In this talk, I will discuss why toponium is such a unique laboratory for studying the theory of the strong interaction in the non-relativistic regime, how modern techniques allow us to incorporate bound-state effects into state-of-the-art collider simulations, and what experimental signatures could reveal the presence of toponium in current and future LHC data. I will finally highlight recent results, ongoing searches and the exciting prospects for using toponium as a new window into the physics of the top quark.

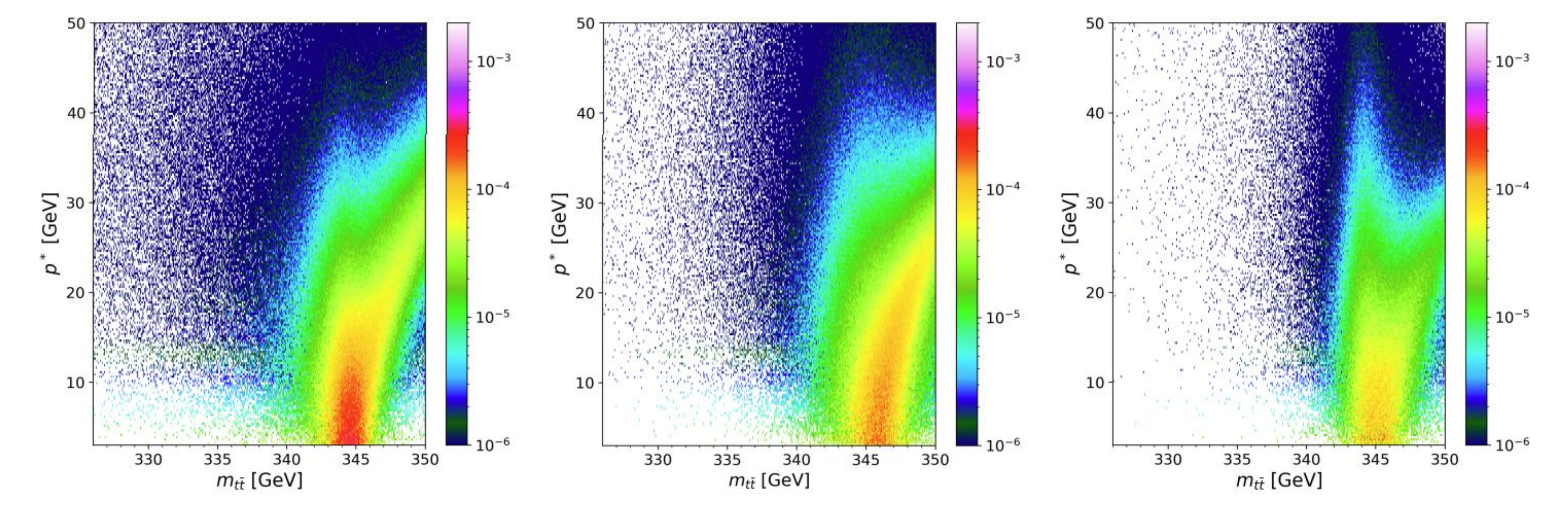

Figure 1 – Two-dimensional differential cross section $d^2\sigma/(p^*)^2$ for colour-singlet top-antitop production at $\sqrt{s} = 13$ TeV and di-leptonic decay, as a function of the top quark momentum p^* (in the toponium rest frame) and the invariant mass $m_{t\bar{t}}$. We compare predictions from non-relativistic QCD (left) with pseudo-scalar toy model predictions with Green's function re-weighting and a toponium width of 7 GeV (centre) and without Green's function re-weighting and a toponium width of 2.8 GeV (right).

B. Fuks, arXiv:2505.03869

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