

Energy Frontier BSM Wishlist

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While the search for BSM physics is driven by experimental progress across many different frontiers, theory also plays an integral and inextricable role. In particular, the ability to compare across different experiments is driven by an underlying theoretical framework. Additionally, the search for physics beyond the SM is often guided by our best theoretical understanding of numerous unanswered questions which underpin the SM and Λ CDM description of our universe. Despite the intertwined nature of experiment and theory, theory inexorably outpaces experimental developments given the timescales involved. Therefore in planning future machines beyond the existing slate of potential LHC successor projects (CEPC[1], CLIC[2], ILC[3], FCC-ee[4], FCC-hh[5], and SPPC[6]), it's crucial to take stock of at least the *current* theory landscape, rather than rehashing old ideas.

In this LOI we propose to compile a BSM “wishlist” that reflects the current understanding of the theoretical possibilities for BSM physics. We will concentrate on a few areas that drive the understanding of BSM physics at the Energy Frontier. An example is Higgs Physics and its various implications for Flavor, Naturalness, and Baryogenesis. Our plan is to set out theory motivated benchmarks, that if achieved by future colliders, would signify a qualitative change in our understanding, not simply a quantitative improvement. This provides an alternative point of view to the usual input of theory for new collider proposals, where a proposed collider is the starting point and theorists investigate what could be achieved with it. Additionally, we will provide Energy Frontier benchmarks motivated by complementarity with other frontiers, and their proposed or running experiments. Some examples of this complementarity are for rare CP and flavor violating processes, dark matter, and gravitational waves. In all these examples there are potential advances which could point to scales well beyond current EF proposals and call for further EF and AF developments.

References

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