

Chasing new particles with GAMBIT and HPC

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Abstract

I will present the latest results from the GAMBIT project, which undertakes large-scale statistical analyses of new theories in particle physics, including supersymmetry and particle theories for dark matter. In particular, I will focus on how GAMBIT uniquely combines detailed simulations of particle collisions at the Large Hadron Collider (LHC) with smart exploration of high-dimensional theory parameter spaces. This combination of CPU-heavy simulations and high-dimensional inference – only possible through utilising HPC – enables us to study in detail what implications the combined results from the LHC have for realistic new particle theories. Also, it provides us with a method to search for correlated hints of new physics hiding in the vast collection of LHC results. I will discuss the HPC challenges of these analyses, as well as our use of machine learning-based regression to accelerate numerically expensive calculations. As the GAMBIT software package is highly modular and fully open-source, I will also discuss how it can be used for statistical analyses in fields beyond particle physics.