J. J. Sakurai Prize for Theoretical Particle Physics Lecture: Improving the precision of high-energy simulation and analysis tools
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Comparing theoretical predictions with experimental data on particle collisions like those at the Large Hadron Collider is far from straightforward. The predictions usually concern fundamental objects (quarks, gluons, leptons, . . . ) whereas the colliding hadrons are complicated bound states. Furthermore, final states of interest often contain high-energy jets of many hadrons, together with underlying lower-energy hadron production. The jets may come from primary interactions producing energetic quarks and gluons, or from the decays of heavy or highly boosted objects, possibly new forms of matter. I will discuss the development of computer simulations of jet production in hard collisions, and of jet-finding algorithms that aim to reconstruct the fundamental collision and decay dynamics from hadronic final states. In both cases, improvements in the underlying theoretical framework have led to a better description of Standard Model processes at the LHC, and better tools for the discovery of any new processes that may lie within its reach.