

Pushing the boundaries of perturbative QCD (and more..) for LHC physics (24+6)

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The Large Hadron Collider (LHC) is currently in its third and final run, exceeding its design luminosity and producing an unprecedented amount of high-precision data. The remarkable accuracy of these measurements demands equally precise theoretical predictions to fully exploit the LHC's potential for new discoveries and precise characterization of the Standard Model. The pursuit of percent-level or even sub-percent-level theoretical accuracy necessitates advancements in theoretical calculations, particularly in perturbative Quantum Chromodynamics (QCD). The talk will delve into the current state-of-the-art in theoretical calculations for LHC phenomenology, highlighting recent breakthroughs in next-to-next-to-leading order (NNLO) and ongoing efforts to push the boundaries towards N³LO precision. The challenges and future directions in achieving the required theoretical accuracy for the LHC's high-precision era and future colliders will also be discussed.

Primary author(s) : CIERI, Leandro Javier (Universidad de Valencia - IFIC)

Presenter(s) : CIERI, Leandro Javier (Universidad de Valencia - IFIC)