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A tool for automated perturbative cross section computations for nucleus+nucleus reactions at next-to-leading order using the MadGraph5_aMC@NLO framework

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Automated perturbative computations of cross sections for hard processes in asymmetric hadronic/nuclear $A + B$ collisions at the next-to-leading (NLO) order in α_s will offer a wide range of applications, such as more robust predictions for new experimental programs, the phenomenology of heavy-ion collisions, and the interpretation of the LHC and RHIC data. Such a goal can be achieved using MadGraph5_aMC@NLO [1], a well-established tool for automatic generation of matrix elements and event generation for high energy physics processes in elementary collisions, such as decays and $2 \to n$ scatterings.

We have extended the capabilities of MadGraph5_aMC@NLO capabilities by implementing computations for asymmetric collisions, for example $p + Pb$, $\pi + Al$ or $Pb + W$ reactions. These new capabilities will soon be made available via the EU Virtual Access NLOAccess (https://nloaccess.in2p3.fr).

In my talk, I will present the objectives of the NLOAccess initiative, the implementation of asymmetric computation computations in MadGraph5_aMC@NLO along with the computation of the nuclear PDF and scale uncertainties, our cross checks with previous results and codes (e.g. Helac-Onia [2], FEWZ [3,4]), and predictions for $p + Pb$ collisions at the LHC for charm, bottom and top quark production, as well as fancier observables now made predictable with these new capabilities.

References:

[1] J. Alwall, R. Frederix, S. Frixione, V. Hirschi, F. Maltoni, O. Mattelaer, H. S. Shao, T. Stelzer, P. Torrielli, and M. Zaro, "The automated computation of tree-level and next-to-leading order differential cross sections, and their matching to parton shower simulations,"JHEP 07 (2014) 079, arXiv:1405.0301 [hep-ph].

[2] H.-S. Shao, HELAC-Onia 2.0: an upgraded matrix-element and event generator for heavy quarkonium physics, Comput. Phys. Commun. 198, 238 (2016), doi:10.1016/j.cpc.2015.09.011, 1507.03435.

[3] R. Gavin, Y. Li, F. Petriello and S. Quackenbush, FEWZ 2.0: A code for hadronic Z production at next-to-next-to-leading order, Comput. Phys. Commun. 182 (2011) 2388 [1011.3540].

[4] Seth Quackenbush, Ryan Gavin, Ye Li, Frank Petriello, W physics at the LHC with FEWZ 2.1, Computer Physics Communications, Volume 184, Issue 1, 2013, Pages 209-214, ISSN 0010-4655, https://doi.org/10.1016/j.cpc.2012.09.005.

In-person participation

Yes

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