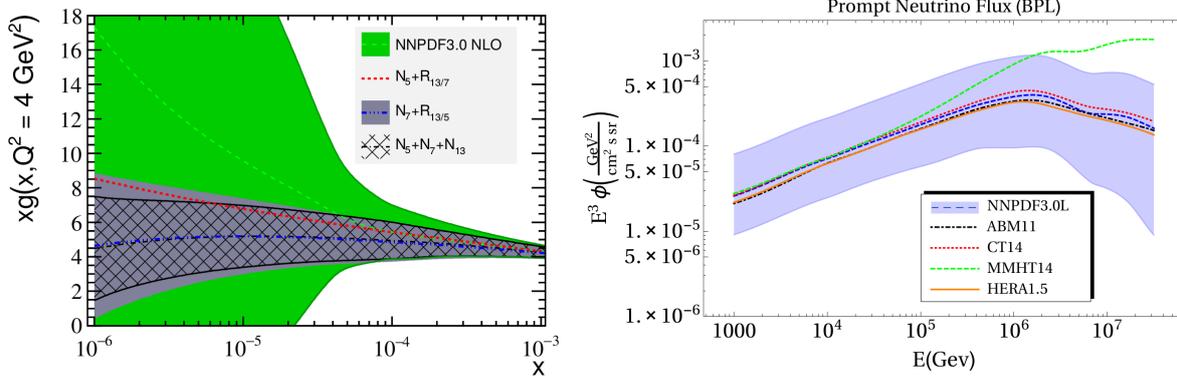


Fragmentation functions of D^* -mesons

Master project, Theoretical Physics & GRAPPA tracks, MSc Physics and Astronomy

Supervisors: Dr. Emanuele R. Nocera and Dr. Juan Rojo.

The hadronisation of quarks and gluons into charged D^* -mesons is of particular relevance in the era of the Large Hadron Collider (LHC). For example, production cross sections are used to constrain the gluon parton distribution function (PDF) at small momentum fractions [1, 2], they play a vital rôle in cosmic-ray and neutrino astrophysics [3], and they provide the background to study modifications of heavy flavour yields in heavy-ion collisions [4]. In perturbative Quantum Chromodynamics (QCD), the hadronisation of partons into hadrons is encoded in nonperturbative fragmentation functions (FFs). In the case of charmed hadrons, like D^* -mesons, the heavy quark mass introduces an additional large scale – apart from some other hard scale that characterises the process – whose effects are perturbatively computable.



This project is about a determination of the FFs of D^* -mesons from a QCD analysis of data. Measurements of cross sections in a broad range of single-inclusive hadron production will be considered, namely in electron-positron annihilation, and in hadron-hadron collisions (including in-jet fragmentation). The analysis will be carried through the well-established NNPDF framework [5]. Its main pillars are Monte Carlo sampling for the representation of data uncertainties, and neural networks for the parametrisation of PDFs. The project will allow for the acquisition of a broad set of data analysis computational techniques, widely used in high-energy physics and beyond.

For more information about this project, please contact Dr. Juan Rojo at j.rojo@vu.nl.

References

- [1] R. Gauld, J. Rojo, L. Rottoli and J. Talbert, JHEP **1511** (2015) 009 [arXiv:1506.08025].
- [2] R. Gauld and J. Rojo, Phys. Rev. Lett. **118** (2017) no.7, 072001 [arXiv:1610.09373].
- [3] R. Gauld, J. Rojo, L. Rottoli, S. Sarkar and J. Talbert, JHEP **1602** (2016) 130 [arXiv:1511.06346].
- [4] A. Andronic *et al.*, Eur. Phys. J. C **76** (2016) no.3, 107 [arXiv:1506.03981].
- [5] For information, see <http://nnpdf.mi.infn.it/>