

## ENP: Exploring New Physics

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The research topics investigated within the ENP project concern the phenomenology of particle physics at present and future colliders, taking particular care about new physics signals at the LHC. We studied the phenomenology of top quarks at the LHC and the theoretical uncertainties in the top-mass determination, paying special attention to bottom-quark fragmentation in top decays. We investigated the phenomenology of heavy neutral gauge bosons  $Z'$  in leptophobic and supersymmetric scenarios, which lower the current exclusion limits and open up new channels to search for physics beyond the Standard Model at the LHC. Bilepton production in 331 models was also explored, finding that pairs of two same-sign leptons can be a valuable final state to probe vector and scalar (Higgs-like) bileptons. Doubly-charged Higgs production was also studied in the framework of effective field theories at both low- and high-energy colliders. Finally, we worked on the computation of QCD multi-loop amplitudes in the high-energy regime. In particular, we computed the master integrals for the two-loop light-fermion electroweak corrections to Higgs+jet production and the seven-gluon amplitudes in multi-Regge kinematics, beyond the leading-logarithmic approximation.

The main achievements are summarized in the following publications:

1. G. Corcella, *Interpretation of the top-quark mass results*, PoS DIS2017 (2018) 134.
2. G. Corcella, *Supersymmetric signals in  $Z'$  decays*, PoS DIS2017 (2018) 280.
3. J. Araz, G. Corcella, M. Frank and B. Fuks, *Loopholes in  $Z$  searches at the LHC: exploring supersymmetric and leptophobic scenarios*, JHEP 1802 (2018) 092.
4. G. Corcella, *Non-standard heavy vectors at the LHC*, PoS EPS-HEP2017 (2018) 268.
5. G. Corcella, *Top-quark mass determination at the LHC: a theory overview*, PoS EPS-HEP2017 (2018) 437.
6. G. Corcella, R. Franceschini and D. Kim, *Fragmentation Uncertainties in Hadronic Observables for Top-quark Mass Measurements*, Nucl. Phys. B929 (2018) 485.
7. G. Corcella, C. Corianò, A. Costantini and P.H. Frampton, *Exploring Scalar and Vector Bileptons at the LHC in a 331 Model*, Phys. Lett. B785 (2018) 73.
8. G.M. Pruna, *Effective-field theories for charged lepton flavour violation*, EPJ Web Conf. 179 (2018) 01019.
9. G.M. Pruna, *LFV golden channels and effective-field theories*, PoS NuFact2017 (2018) 123.
10. A. Crivellin, M. Ghezzi, L. Panizzi, G.M. Pruna and A. Signer, *Low- and high-energy phenomenology of a doubly charged scalar*, Phys. Rev. D99 (2019) 035004.
11. J. de Blas, G.M. Pruna et al., *The CLIC Potential for New Physics*, CERN Yellow Rep. Monogr. Vol. 3 (2018).
12. V. Del Duca, *Iterating QCD scattering amplitudes in the high-energy limit*, JHEP 1802 (2018) 112.
13. V. Del Duca, S. Druc, J. Drummond, C. Duhr, F. Dulat, R. Marzucca, G. Papathanasiou and B. Verbeek, *The seven-gluon amplitude in multi-Regge kinematics beyond leading logarithmic accuracy*, JHEP 1806 (2018) 116.
14. V. Del Duca, S. Druc, J. Drummond, C. Duhr, F. Dulat, R. Marzucca, G. Papathanasiou and B. Verbeek, *Multi-Loop Amplitudes in the High-Energy Limit in  $N = 4$  SYM* PoS LL2018 (2018) 026.
15. V. Del Duca, *A tale of two Regge limits*, EPJ Web Conf. 19 (2018) 20000.

16. H.A. Frellesvig, R. Bonciani, V. Del Duca, F. Moriello, J. Henn and V. Smirnov, *Non-planar two-loop Feynman integrals contributing to Higgs plus jet production*, PoS LL2018 (2018) 076.
17. M. Becchetti, R. Bonciani, V. Del Duca, F. Moriello, J. Henn and V. Smirnov, *Planar master integrals for the two-loop light-fermion electroweak corrections to Higgs plus jet production*, JHEP 1812 (2018) 019.