

Preface

This thesis presents a search for new phenomena in proton–proton collisions at $\sqrt{s} = 7$ TeV and 8 TeV recorded with the ATLAS experiment at the LHC collider. The final state under investigation is defined by the presence of one energetic jet and large missing transverse momentum. Events with such a final state constitute a clean and distinctive signature at colliders, and are studied to test various scenarios for physics beyond the Standard Model (SM), such as Large Extra Dimensions, Supersymmetry, and the production of Weakly Interacting Massive Particles, among others. In order to achieve the highest sensitivity to new physics signals, data-driven techniques are employed to estimate the background contributions.

This thesis is organized as follows. Chapter 1 gives an introduction to the SM theory, the QCD phenomenology at hadron colliders, and to several scenarios for physics beyond the SM. The LHC collider and the ATLAS experiment are described in Chap. 2. Chapter 3 details the search for new physics in mono-jet events based on 4.7 fb^{-1} of 7 TeV collisions collected in 2011. Chapter 4 describes the results based on 10.5 fb^{-1} of 8 TeV collisions recorded in 2012. Finally, Chap. 5 is devoted to conclusions.

The document is complemented with several appendices. Performance studies on the Tile hadronic calorimeter, and the luminosity measurement with its data, are described in appendices A and B, respectively. Previous results on mono-jets based on 33 pb^{-1} and 1 fb^{-1} of 7 TeV collisions are presented in Appendices C and D. Appendix E includes additional information on the analysis at 7 TeV. The main results on a mono-photon search are collected in Appendix F, and are regarded as a complementary study to the mono-jet analysis. Finally, Appendix G at the end of the book documents the analyses published by ATLAS using the full 2012 dataset (20 fb^{-1}).

Search for Exotic Mono-jet Events
in Proton-Proton Collisions at $\sqrt{s}=7$ TeV and 8 TeV with
the ATLAS Detector

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