Notice of the Final Oral Examination
for the Degree of Doctor of Philosophy

of

CLAIRE DAVID

MEng (Institut National des Sciences Appliquées de Toulouse, France, 2010)

"Search for Supersymmetry Using a Higgs Boson in the Decay Cascade
with the ATLAS Detector at the Large Hadron Collider"

Department of Physics and Astronomy

Friday, April 1
9:30 A.M.
Hickman Building
Room 120

Supervisory Committee:
Dr. Robert McPherson, Department of Physics and Astronomy, University of Victoria (Co-Supervisor)
Dr. Michel Lefebvre, Department of Physics and Astronomy, UVic (Co-Supervisor)
Dr. Adam Ritz, Department of Physics and Astronomy, UVic (Member)
Dr. Ian Putman, Department of Math, UVic (Outside Member)

External Examiner:
Dr. Aksel Hallin, Department of Physics, University of Alberta

Chair of Oral Examination:
Dr. Nikolai Dechev, Department of Mechanical Engineering, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

The Standard Model of particle physics is a successful theory, yet it is incomplete. Supersymmetry is one of the favored extensions of the Standard Model, elegantly addressing several unresolved issues. This thesis presents a search for the pair production of supersymmetric particles $pp \to \tilde{x}_1^{\pm} \tilde{x}_2^0$, where the neutralino two $\tilde{x}_2^0$ decays to the lightest neutralino and the 125 GeV Higgs boson. The final states considered for the search have large missing transverse momentum, an isolated lepton and two jets identified as originating from bottom quarks ($h \to b\bar{b}$ channel). The analysis is based on 20.3 fb^{-1} of $\sqrt{s} = 8\,\text{TeV}$ proton-proton collision data delivered by the Large Hadron Collider and recorded with the ATLAS detector. No excess over Standard Model predictions is observed. The analysis has been combined with three independent searches that probe other decay modes of the Standard Model Higgs boson. Limits are set at 95% confidence level in the context of a simplified supersymmetric model. Common masses of $\bar{x}_1^{\pm}$ and $\bar{x}_2^0$ are excluded up to 250 GeV for $m(\bar{x}_1^0) = 0$. The analysis of this dissertation ($h \to b\bar{b}$ channel) has been reinterpreted in the context of a large scan of the phenomenological Minimal Supersymmetric Standard Model, along with 22 other ATLAS Run 1 searches. The resulting summary paper represents the most comprehensive assessment of the ATLAS constraints on supersymmetry models to date.