University of Victoria | Graduate Studies

PROGRAMME

The Final Oral Examination
for the Degree of

DOCTOR OF PHILOSOPHY
(Department of Physics and Astronomy)

Eric Ouellette

2008 Mount Allison University BSc

"Search for the Higgs Boson in the Vector Boson Fusion Channel at the ATLAS Detector"

Thursday, January 9, 2014
11:00 AM
Elliott Building, Room 105

Supervisory Committee:
Dr. Justin Albert, Department of Physics and Astronomy, UVic (Supervisor)
Dr. Randall Sobie, Department of Physics and Astronomy, UVic (Member)
Dr. Richard Keeler, Department of Physics and Astronomy, UVic (Member)
Dr. Alexander Briggs, Department of Chemistry, UVic (Outside Member)

External Examiner:
Dr. Hirohisa Tanaka, Department of Physics and Astronomy, UBC

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

Abstract

The search for the Higgs boson has been a cornerstone of the physics program at the Large Hadron Collider in Geneva Switzerland. The ATLAS experiment successfully discovered the Higgs using the so-called "Golden Channels" of $H^0 \rightarrow \gamma\gamma$ and $H^0 \rightarrow ZZ^{(*)}$ using data samples collected during the 2011 and 2012 run periods. In order to check if the discovered Higgs is consistent with purely Standard Model behaviour, it is necessary to further confirm the existence of the Higgs in each production mode and decay channel predicted by the Standard Model.

For this dissertation, a search for the Higgs was conducted using the $H^0 \rightarrow b\underline{b}$ decay channel, where the Higgs is produced by the inverse pair decay of two weak bosons exchanged by a scattered quark pair, also known as Vector Boson Fusion (VBF). This analysis uses data samples collected during the 2011 run period by the ATLAS detector totaling 4.2 fb^{-1} of proton-proton collisions at $\sqrt{s} = 7$TeV. No excess of events above background expectation is observed and 95% confidence level upper limits on the Standard Model Higgs cross section times branching ratio, $\sigma(VBF) \times BR(H^0 \rightarrow b\underline{b})$, are derived for Higgs masses in the range $115 < m_H < 130$ GeV. An observed 95% confidence level upper limit of 18.7 times the Standard Model cross section is obtained for a Higgs boson mass of 125 GeV.

Awards, Scholarships, Fellowships

2010-2012 – NSERC PGS-D, *University of Victoria*
2009 – Petch Research Scholarship, *University of Victoria*
2008-2010 – NSERC CGS-M, *University of Victoria*

Presentations

1. Ouellette, E.A. "*The Search for the Higgs Particle: Advancing Science and Technology*" Capital City Executive's Association

guest speaker, Victoria, British Columbia, Canada. November 2013

2. Ouellette, E.A. "*The Search for the Higgs: A Graduate Student's Perspective Working at the LHC at CERN*" Fall 2013 University of Victoria Dean's Lunchtime Lecture Series, Victoria, British Columbia, Canada. October 2013
3. Ouellette, E.A. "*Higgs in ATLAS: A Look at* $H^0 \rightarrow b\underline{b}$" Lake Louise Winter Institute, Lake Louise, Alberta, Canada. February 2013
4. Ouellette, E.A. "*The Vector Boson Fusion* $H^0 \rightarrow b\underline{b}$ *Channel at the ATLAS Detector*" Canadian Association of Physicists Congress, Calgary, Alberta, Canada. June 2012
5. Ouellette, E.A. "*Data Quality Summary for Calorimeters and CP Groups*" ATLAS Data Quality Workshop, CERN, Geneva, Switzerland. December 2011

Publications

1. Lessard, J.-R.; Ouellette, E.A.; Petteni, M.; Rezvani, R.,"Jet Data Quality Monitoring" *ATLAS Note, ATL-COM-DAPR-2011-007* **2011**

2. Ouellette, E.A.; Harris, A., "Thermal conductivity of diamond-loaded glues for the ATLAS particle physics detector" *arXiv: 1008.0876 [physics.ins-det]* **2010**