Alan WILSON

High Energy Experimental Physics

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Education

2011 **Ph.D. Physics**, *University of Michigan*, Ann Arbor.

2003 **M.S. Mathematics**, *University of Michigan*, Ann Arbor.

1999 **B.S. Mathematical Sciences (Physics)**, *University of Washington*, Seattle.

1999 **B.S.E. Computer Engineering**, *University of Washington*, Seattle.

Ph.D. thesis

title *Search for a Supersymmetry Signature with the $Z\gamma$ plus Missing Transverse Energy Final State Using the DØ Detector*

supervisor Prof. Bing Zhou

description Over four years the DØ detector at Fermilab's Tevatron Collider collected 6.2 fb^{-1} of 1.96 TeV proton-antiproton collisions. Using this data I searched for a signature of certain gauge mediated supersymmetry breaking (GMSB) models: a high-p_T photon, a pair of electrons or muons from a Z boson decay, and large missing transverse energy produced by undetected particles. This was the first search of it's kind. The dominate background is from standard model $Z\gamma$ production, and these events were used as a control sample for data-Monte Carlo (MC) consistency checks. Background estimates were accomplished using data-driven methods and MC simulations. I obtained extra signal discrimination using boosted decision trees (a trained multivariate selection technique) and combined the analysis results from both electron and muon channels. The observed data are consistent with standard model predictions. No evidence for a supersymmetric signal is found. *Published as PRD 86, 071701.*

Experience

Research & Hardware Experience

2011–present **Post Doctoral Research Fellow**, *ATLAS Experiment*.

- Physics analyses involving four lepton:
  - *Higgs discovery via $H \to ZZ \to 4\ell$, measurements of $pp \to ZZ \to 4\ell$ and $Z \to 4\ell$.*
  - *Background estimates, study individual events via event displays, analysis code development*
- Installation of new muon detectors (MDT EE-): primarily testing and debugging from the muon control desk.
- Controlling ATLAS-wide data acquisition (DAQ) and ensuring high-quality data flows smoothly from all detectors to disk during substantial "run control" shifts.

2009–2010 **Graduate Student Research Assistant**, *DØ Experiment*.

- Searched for supersymmetry with the $Z\gamma$+missing E_T signature.
- Collaborating on standard model $Z\gamma$ cross section and anomalous couplings.
- Managing Monte Carlo production for the new phenomena group.
- Control rooms shifts for DAQ.

2005–2008 **Graduate Student Research Assistant**, *Atlas Experiment*.

- Primary contributor to diboson physics: prepared for cross-section measurement and estimated sensitivity to anomalous couplings.
  - *Contributed entire WZ analysis and substantial portions of WW and ZZ.*
  - *Worked with MC@NLO and BosoMC for event generation, cross-section systematics, and modeling of anomalous couplings.*
  - *Developed calculation of the confidence region for couplings.*
- Constructed the gas monitor chamber for the monitored drift tube (MDT) system:

  - *Working with an engineer and an undergraduate, assembled a complete table-top (6 layers of 16 tubes) drift tube detector from scratch including scintillator triggers and gas system.*
  - *Used to monitor the gas mixture flowing in and out of the ATLAS MDT system via features of the drift-time spectra from cosmic ray muon tracks.*
- Contributions to the $H \to WW$ analysis work.
- Applying boosted decision trees to electron identification and b-tagging.
  - *Testing of algorithm and integration into ATLAS software.*

2004–2005 **Research Assistant**, *ATLAS Experiment*, Univ. of Michigan, Geneva, Switzerland.
- Phase 1 commissioning of MDT detectors (for the muon precision measurement).
  - *Setup lab space from scratch: trained to operate cranes, supervised chamber movements, expert in the gas mixing and distribution system*
  - *Lead a team of undergraduates (as many of as five) finishing chamber assembly, leak checking, commissioning with cosmic rays, and working out repairs on the fly*
- Validating muon reconstruction software
  - *Compared muon reconstruction algorithms for resolution and efficiency in MC*

1994–1999 **Research Assistant**, *Space Sciences, Geophysics*, Univ. of Washington, Seattle.
- Developed DAQ hardware and software for balloon and satellite experiments.
- Research and simulations exploring coded aperture imaging using X-rays.

Teaching

1999–2003 **Graduate Student Instructor**, *Mathematics*, University of Michigan, Ann Arbor.
Courses: precalculus, calculus I & II, and differential equations

1998–1999 **Teaching Assistant**, *Computer Science and Engineering*, Univ. of Washington, Seattle.
Courses: Discrete Structures, Introduction to Computer Graphics, and Digital System Design

Publications and Talks

paper "Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC", Phys. Lett. B 716 (2012) 1-29

paper "Search for $Z\gamma$ events with large missing transverse energy in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV", Phys. Rev. D 86, 071701(R) (2012)

publication "The ATLAS Experiment at the CERN Large Hadron Collider." *JINST* 3 S08003 (2008)

publication "Expected Performance of the ATLAS Experiment - Detector, Trigger and Physics." CERN-OPEN-2008-020 (2009), arXiv:0901.0512

ATLAS note "Diboson physics studies with the ATLAS detector", ATL-PHYS-PUB-2009-038
Expanded version of "Expected Performance...."

proceedings "Diboson Physics in ATLAS", ATL-PHYS-PROC-2008-051

talk "Direct and Indirect Searches for New Physics with Diboson Final States ," LHC New Physics Signatures Workshop, University of Michigan, January 2008.

publication "Drift time spectrum and gas monitoring in the ATLAS Muon Spectrometer precision chambers." Nucl. Instrum. Methods A **588**, 347 (2008).

proceedings "Streamlined Calibration of the ATLAS Muon Spectrometer Precision Chambers", D. Levin for the ATLAS Collaboration, Nuclear Science Symposium Conf. Record, 2009 IEEE, 1040–1044

proceedings "Gas performance of the ATLAS MDT precision chambers", Nuclear Science Symposium Conference Record, 2008. NSS '08. IEEE, 19-25 Oct. 2008, 3213

publication "A Multivariate Training Technique with Event Reweighting." The ATLAS Collaboration, JINST3:P04004,2008

ATLAS note "B-tagging Based on Boosted Decision Trees and Performance Comparisons of ATLAS B-taggers", ATL-PHYS-INT-2009-072

ATLAS note "Performance of Electron Identification Based on Boosted Decision Trees", ATL-COM-PHYS-2009-160

ATLAS note "Study of the SM Higgs Discovery Potential through W-pair Leptonic Decay Modes with Boosted Decision Trees", ATL-PHYS-INT-2009-052

talk "$Z \to \mu\mu$ performance", ATLAS Physics Workshop, Rome, June 2005.