Mark S. Neubauer

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# Education

**PhD** University of Pennsylvania, Physics June 2001

Dissertation: *Evidence for Electron Neutrino Flavor Change through Measurement of the 8B Solar Neutrino Flux at SNO*

Advisor: Dr. Eugene Beier

**BS** Kutztown University, Physics May 1994

Graduated *Summa Cum Laude*

Minored in Mathematics

# Professional Appointments

**Professor** University of Illinois at Urbana-Champaign 2018 –

**Faculty Affiliate** National Center for Supercomputing Applications 2018 –

**Associate Professor** University of Illinois at Urbana-Champaign 2013 – 2018

**Assistant Professor** University of Illinois at Urbana-Champaign 2007 – 2013

**Postdoctoral Fellow** University of California at San Diego 2003 – 2007

Massachusetts Institute of Technology 2001 – 2003

# Honors and Awards

**Breakthrough Prize in Fundamental Physics** 2016

**Dean’s Award for Excellence in Research** (U. Illinois) 2013

**Fellow, Center for Advanced Study** (U. Illinois) 2012 – 2013

**NSF Career Award** 2011

**Fellow, National Center for Supercomputing Applications** 2008 – 2009

**Arnold O. Beckman Research Award** (U. Illinois) 2007

**Member, Sigma Xi** (Massachusetts Institute of Technology) 2002

**Chairman’s Teaching Award** (University of Pennsylvania) 1995

# Professional Service

**Committees / Co-Organizer**

*Building Collaborations for Machine Learning in HEP* Workshop, MIT 2017

*Practice & Experience in Advanced Research Computing (PEARC17)* Workshop 2017

Fermilab Operational Readiness Review Committee 2017

Chair, *Fostering HEP & Computer Science Collaboration* Workshop, U. Illinois 2016

Open Science Grid Campus Infrastructures Community Committee 2016

# Research Highlights

**Diboson Production as a Sensitive Probe of New Physics** 2007 – 2018

The search for diboson resonances is a sensitive probe of new physics. My group has been at the forefront of studying diboson production at colliders, producing:

* Stringent limits on the production of new heavy particles decaying to heavy boson pairs (*WW*, *WZ*, *ZZ*, *hW*, *hZ*) and constraints on new physics models predicting these signatures at the LHC [[PRD 98 (2018)](https://arxiv.org/abs/1808.02380), [JHEP 1803 (2018)](https://arxiv.org/abs/1710.07235), [PLB 765 (2017)](http://inspirehep.net/record/1477027), [JHEP 1609 (2016)](http://inspirehep.net/record/1469453), [PLB 755 (2016)](http://inspirehep.net/record/1409918), [JHEP 1601 (2016)](http://inspirehep.net/record/1391323), [EPJC 76 (2015)](http://inspirehep.net/record/1356730), [EPJC 75 (2015)](http://inspirehep.net/record/1352826), [JHEP 1501 (2015)](http://inspirehep.net/record/1324374), [PLB 737 (2014)](http://inspirehep.net/record/1300821), [PLB 718 (2012)](http://inspirehep.net/record/1120014), [PRL 107 (2011)](http://inspirehep.net/record/927667)]
* First measurement of ZZ production at a hadron collider [[PRL 100 (2008) 201801](http://inspirehep.net/record/778518))]
* First observation of WZ production [[PRL 98 (2007) 161801](http://inspirehep.net/record/744786))]

I have also authored two review articles on tests of electroweak physics

[[RMP 84 (2012) 1477](http://link.aps.org/pdf/10.1103/RevModPhys.84.1477)] and diboson physics at colliders [[ARNPS 61 (2011) 223](http://inspirehep.net/record/1084754)]

**Higgs Boson Discovery**! 2012

The ATLAS and CMS experiments announced the discovery of a Higgs boson *h*. This discovery lead to the [2013 Nobel Prize in Physics](https://www.nobelprize.org/nobel_prizes/physics/laureates/2013/) for its theoretical prediction

* My group contributed to this discovery (5.9σ) [[PLB 716 (2012)](https://inspirehep.net/record/1124337) 1] through analysis of the h→*WW*\*→*e*νμν channel
* My group contributed to the *h*🡪*WW*\* observation (6.1σ) [[PRD 92 (2015) 012006](http://inspirehep.net/record/1333228)], providing the most precise single-channel measurement of *h* couplings. My graduate student Philip Chang received the 2014 US ATLAS Graduate Student Achievement Award for his work on the *h*🡪*WW\** observation and the *h* couplings measurement

**Constraints on Charged Higgs Bosons** 2012

Charged Higgs bosons (*H*+) often arise in new physics models. Through the work of Allison McCarn ([Ph.D. thesis](https://www.ideals.illinois.edu/handle/2142/45384)) and Anna Sfyrla, my group lead searches for *H+→τν* in top pair events using a direct mass reconstruction method [[JHEP 1206 (2012) 039](http://inspirehep.net/record/1110689)] and via an apparent violation of lepton universality [[JHEP 1303 (2013) 076](http://inspirehep.net/record/1207451)].

**Resolution of a b-baryon Lifetime Puzzle** 2007

On CDF, I lead an analysis of τ(Λ*b*) in exclusive decay Λ*b* →J/ψΛ. At the time of publication [[PRL 98 (2007) 122001](https://inspirehep.net/record/725884)], this was the single most precise measurement of τ(Λ*b*) and higher than the previous world average by 3.2σ. Our measurement resolved the “Λ*b* Lifetime Puzzle” in favor of earlier theory calculations of τ(Λ*b*).

**Resolution of the Solar Neutrino Problem** 2001

On the SNO experiment, my analysis of 8B solar neutrino data provided first direct evidence for *ν*e flavor change, resolving the decades-long “Solar Neutrino Problem”. The first SNO paper [[*PRL* 87 (2001) 71301](http://inspirehep.net/record/558620)] was based on my thesis work and lead to the [2016 Breakthrough Prize](https://breakthroughprize.org/Laureates/1/P1/Y2016) in Fundamental Physics and the [2015 Nobel Prize in Physics](https://www.nobelprize.org/nobel_prizes/physics/laureates/2015/) (A. McDonald and T. Kajita) for observation of *ν*e flavor change at SNO.

# Selected Publications

A complete list of my publications can be found [here](http://msn.web.cern.ch/msn/pubs.pdf).

* M. Aaboud *et* *al*. [ATLAS Collaboration], “Search for resonance production in final states in collisions at TeV with the ATLAS detector,” *JHEP* **1803**(2018) 042.
* M. Aaboud *et* *al*. (ATLAS Collaboration), “Search for new resonances decaying to a *W* or *Z* boson and a Higgs boson in the , and channels with collisions at TeV with the ATLAS detector,” *Phys*. *Lett*. **B765** (2017) 32.
* M. Aaboud *et al.* (ATLAS Collaboration), "Searches for Heavy Diboson Resonances in Collisions at TeV,” *JHEP* **1609**(2016) 173.
* G. Aad *et* *al*. (ATLAS Collaboration), “Observation and Measurement of Higgs Boson Decays to with the ATLAS Detector,” *Phys*. *Rev*. **D92** (2015) 012006.
* G. Aad *et al.* [ATLAS Collaboration], "Search for H± through the Apparent Violation of Lepton Universality in top-pair events using pp collisions at √s=7 TeV with the ATLAS detector”, *JHEP* ***03****, 76* (2013)
* G. Aad *et al.* [ATLAS Collaboration], "Search for charged Higgs bosons decaying via H+→τν in top quark pair events using pp collisions at √s=7 TeV with the ATLAS detector”, *JHEP* ***1206****, 039* (2012)
* G. Aad *et* *al*. [ATLAS Collaboration], “Observation of a New Particle in the Search for the Higgs Boson with the ATLAS detector,” *Phys*. *Lett*. **B716** (2012) 1.
* A. Andreani, *et.al.*, ”The FastTracKer Real Time Processor and Its Impact on Muon Isolation, Tau, *b*-Jet Online Selections at ATLAS,” *IEEE* *Trans*. *Nucl*. *Sci*. **59** (2012) 348.
* J. Hobbs, M.S. Neubauer, and S. Willenbrock, “Tests of the Standard Electroweak Model at the Energy Frontier,” *Rev*. *Mod*. *Phys*. **84** (2012) 1477.
* M.S. Neubauer, “Diboson Production at Colliders,” *Ann*. *Rev*. *Nucl*. *Part*. *Sci*. **61** (2011) 223.
* T. Aaltonen *et* *al*. (CDF Collaboration), “First Measurement of ZZ Production in p anti-p collisions at TeV,” *Phys*. *Rev*. *Lett*. **100** (2008) 201801.
* A. Abulencia *et* *al*. (CDF Collaboration), “Observation of WZ Production,” *Phys*. *Rev*. *Lett*. **98** (2007) 161801.
* Q. R. Ahmad *et* *al*. (SNO Collaboration), “Measurement of the Rate of  Interactions Produced by 8*B* Solar Neutrinos at SNO,” *Phys*. *Rev*. *Lett*. **87** (2001) 071301.