

MARK S. NEUBAUER

Office: 411 Loomis Laboratory
Phone: (217) 244-3913
msn@illinois.edu

Department of Physics
1110 West Green Street
Urbana, IL 61801

EDUCATION

- | | | |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| PhD | University of Pennsylvania, Physics
Dissertation: <i>Evidence for Electron Neutrino Flavor Change through Measurement of the ^8B Solar Neutrino Flux at SNO</i>
Advisor: Dr. Eugene Beier | June 2001 |
| BS | Kutztown University, Physics
Graduated <i>Summa Cum Laude</i>
Minored in Mathematics | May 1994 |

PROFESSIONAL APPOINTMENTS

- | | | |
|----------------------------|--------------------------------------------|-------------|
| Professor | University of Illinois at Urbana-Champaign | 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 | |
| <i>Building Collaborations for Machine Learning in HEP</i> Workshop, MIT | 2017 |
| <i>Practice & Experience in Advanced Research Computing (PEARC17)</i> Workshop | 2017 |
| Fermilab Operational Readiness Review Committee | 2017 |
| Chair, <i>Fostering HEP & Computer Science Collaboration</i> Workshop, U. Illinois | 2016 |
| Open Science Grid Campus Infrastructures Community Committee | 2016 |

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 [[PLB 765 \(2017\) 32](#), [JHEP 1609 \(2016\) 173](#), [PLB 755 \(2016\) 285](#), [JHEP 1601 \(2016\) 032](#), [EPJC 76 \(2015\) 263](#), [EPJC 75 \(2015\) 209](#), [JHEP 1501 \(2015\) 049](#), [PLB 737 \(2014\) 223](#), [PLB 718 \(2012\) 391](#), [PRL 107 \(2011\) 231801](#)]
- First measurement of ZZ production at a hadron collider [[PRL 100 \(2008\) 201801](#)]
- First observation of WZ production [[PRL 98 \(2007\) 161801](#)]

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

[[RMP 84 \(2012\) 1477](#)] and diboson physics at colliders [[ARNPS 61 \(2011\) 223](#)]

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](#) for its theoretical prediction

- My group contributed to this discovery (5.9σ) [[PLB 716 \(2012\) 1](#)] through analysis of the $h \rightarrow WW^* \rightarrow e\nu\mu\nu$ channel
- My group contributed to the $h \rightarrow WW^*$ observation (6.1σ) [[PRD 92 \(2015\) 012006](#)], 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 $h \rightarrow WW^*$ observation and the h couplings measurement

Constraints on Charged Higgs Bosons

2012

Charged Higgs bosons (H^\pm) often arise in new physics models. Through the work of Allison McCarn ([Ph.D. thesis](#)) and Anna Sfyrlla, my group lead searches for $H^\pm \rightarrow \tau\nu$ in top pair events using a direct mass reconstruction method [[JHEP 1206 \(2012\) 039](#)] and via an apparent violation of lepton universality [[JHEP 1303 \(2013\) 076](#)].

Resolution of a b-baryon Lifetime Puzzle

2007

On CDF, I lead an analysis of $\tau(\Lambda_b)$ in exclusive decay $\Lambda_b \rightarrow J/\psi\Lambda$. At the time of publication [[PRL 98 \(2007\) 122001](#)], this was the single most precise measurement of $\tau(\Lambda_b)$ 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 $\tau(\Lambda_b)$.

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](#)] was based on my thesis work and lead to the [2016 Breakthrough Prize in Fundamental Physics](#) and the [2015 Nobel Prize in Physics](#) (A. McDonald and T. Kajita) for observation of ν_e flavor change at SNO.

SELECTED PUBLICATIONS

Here I include some selected publications. A complete list of my publications is [here](#).

- M. Aaboud *et al.* [ATLAS Collaboration], “Search for WW/WZ resonance production in $lvqq$ final states in pp collisions at $\sqrt{s} = 13$ 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 $llbb$, $lvbb$ and νvbb channels with pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector,” *Phys. Lett.* **B765** (2017) 32.
- M. Aaboud *et al.* (ATLAS Collaboration), “Searches for Heavy Diboson Resonances in pp Collisions at $\sqrt{s} = 13$ TeV,” *JHEP* **1609** (2016) 173.
- G. Aad *et al.* (ATLAS Collaboration), “Observation and Measurement of Higgs Boson Decays to WW^* with the ATLAS Detector,” *Phys. Rev.* **D92** (2015) 012006.
- G. Aad *et al.* [ATLAS Collaboration], “Search for H^\pm through the Apparent Violation of Lepton Universality in top-pair events using pp collisions at $\sqrt{s}=7$ TeV with the ATLAS detector,” *JHEP* **03**, 76 (2013)
- G. Aad *et al.* [ATLAS Collaboration], “Search for charged Higgs bosons decaying via $H^\pm \rightarrow \tau \nu$ in top quark pair events using pp collisions at $\sqrt{s}=7$ 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 Physics at Colliders,” *Ann. Rev. Nucl. Part. Sci.* **61** (2011) 223.
- 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 $\nu_e + d \rightarrow p + p + e^-$ Interactions Produced by 8B Solar Neutrinos at SNO,” *Phys. Rev. Lett.* **87** (2001) 071301.