Professor Andrew Whitbeck

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EDUCATION

2013	Ph.D.	Physics, Johns Hopkins University
2007	B.S.	Physics, University of Rochester
2007	B.A.	Mathematics, University of Rochester

ACADEMIC POSITIONS

2018 - present	Assistant Professor, Department of Physics, Texas Tech University
2013 - 2018	Research Associate, Fermi National Accelerator Laboratory
2009 - 2013	Research Assistant, Department of Physics, Johns Hopkins University
2007 - 2009	Teaching Assistant, Department of Physics, Johns Hopkins University
2006 - 2007	Teaching Assistant, Department of Physics, University of Rochester
2006 - 2007	Research Assistant, Department of Physics, University of Rochester

RESEARCH AND PROFESSIONAL EXPERIENCE

- Convener of the Inclusive Supersymmetry Group (2018-present)
- Visiting Scholar at Johns Hopkins University (2017-2018)
- Integration & Commissioning Coordinator, CMS Forward Calorimeter Phase I Upgrades (2014-2015)
- LHC Physics Center Event Committee Co-coordinator (2014)

RESEARCH HIGHLIGHTS

Searches for Supersymmetry (SUSY):

- Inclusive search for SUSY in the γ+MET final state (2017-2018) This work expands existing searches to include b-quark identification, which is relevant to natural SUSY, and has improved sensitivity to strong-production of Supersymmetry by up to 200 GeV in mass.
- Inclusive search for SUSY in the jet+MET final state (2015-2017) Involved in all aspects of the analysis. Focused on designing & performing data-driven estimation of irreducible backgrounds. Helped lead overall analysis through the first 13 TeV results including both 2015 and 2016 publications.
- Search for boosted Higgs bosons plus MET (2016-2017) Use state-of-the-art jet substructure techniques to identify high momentum Higgs bosons decaying to pairs of bottom quarks produced in Supersymmetric cascades. Published in PRL.
- Multi-jet+MET phenomenology (2015-2016) Understanding correlations among commonly used kinematic discriminants for jet +MET searches using boosted decision trees and a unique method for more generically modeling SUSY-like phenomenology.

Jet calibration with deep learning: Optimization studies of jet energy calibrations employing deep learning techniques commonly used for image recognition. Convolutional neural network-based regressions were used to calibrate jet energies with the goal of minimizing common standard model backgrounds in searches for Supersymmetry which arise from fake MET.

New ideas for discovering light dark matter: Design studies for the Light Dark Matter Experiment (2016-present) Design/optimize materials and geometries for a calorimeter to veto hadrons produced by rare EM showers which mimic missing energy signatures indicative of dark matter signals. Development of simulation software and background rejection optimizations.

Calorimeter readout electronics: Leader in the design, prototyping, production, and commissioning of CMS hadron calorimeter (HCal) readout electronics. Constructed first test stand with prototype readout electronics. Led beam experiment at Fermi National Accelerator Laboratory meson test beam facility. Led effort to commission & install a pilot system for validating the efficacy of new electronics using LHC collisions. Developed & validated HCal reconstruction software. Data quality monitoring of HF pilot system.

Di-boson resonance searches:

- Discovery and characterization of the Higgs boson (2011-2014) Pioneered matrix element tools for the Higgs discovery and spin, parity, and anomalous coupling measurements. Proposed new metrics for constraining various HVV anomalous couplings. Compared sensitivity of LHC, HL-LHC, and future colliders to these couplings.
- Searches for ZZ resonances (2009-2011) Developed data-driven background estimation technique & kinematic discriminants for high mass resonance searches in the $2\ell 2j$ final state. Ruled out high-mass Higgs hypothesis and placed constraints on extra scalars from BSM scenarios.

CONFERENCE & SEMINAR TALKS

1. *The Light Dark Matter Experiment* Division of Particles and Fields Meeting, August 2017
2. *Latest SUSY results from CMS* New Physics Interpretations at the LHC 2 Workshop, April 2017
3. *Observing the invisible: missing energy/momentum signatures at colliders & their implications for new physics*particle physics seminar at Johns Hopkins University, March 2017
4. *Status of the Search for Supersymmetry*, 28th Rencontres de Blois on Particle Physics and Cosmology, May 2016
5. *A search for supersymmetry in the all-hadronic final state with 13 TeV pp collisions at CMS*, particle physics seminar at UIUC and University of Notre Dame, March 2016
6. *Qualification of the CMS Phase 1 Upgrade HF Front-end Electronics*, Topical Workshop on Electronics for Particle Physics, Lisbon, Portugal, September 2015.
7. *Status and Prospects of Higgs CP Properties with CMS and ATLAS*, The CP Nature of the Higgs Boson, U. Mass. Amherst, May 2015.
8. *Higgs J/CP projections for Run2 and HL-LHC (ATLAS+CMS)*, BSM Higgs Workshop at LPC, FNAL, November 2014.
9. *The CMS Central Hadron Calorimeter DAQ System Upgrade*, Topical Workshop on Electronics for Particle Physics, Aix en Provence, France, September 2014.
10. *CMS Higgs width determination, status and prospects*, Americas Workshop on Linear Colliders, FNAL, May 2014.

11. *Properties of the Higgs-like boson with CMS*, Johns Hopkins Particle Physics Seminar, March 2013.

12. *Higgs Candidate Property Measurements with the Compact Muon Solenoid*, Rencontres de Moriond, La Thuile, Italy, March 2013.

13. *Characterization of a single-produced resonance at the LHC: Prospects for 2012 and Beyond*, Phenomenology 2012 Symposium, University of Pittsburgh, May 2012.

14. *Higgs properties analyses in ATLAS and CMS*, Implications of LHC results for TeV-scale physics, CERN, August 2011.

15. *Discovery prospects for Higgs→ ZZ→ 2ℓ 2j and implications for other resonances* APS April Meeting, Anaheim CA, May 2011.

SELECTED PUBLICATIONS

1. CMS Collaboration, *Search for supersymmetry in events with a photon, jets, and missing transverse momentum in proton-proton collisions at 13 TeV,* publication in preparation

2. LDMX Collaboration, *Light Dark Matter eXperiment (LDMX),* publication in preparation, confluence.slac.stanford.edu/display/MME/

3. Y. Kahn, G. Krnjaic, N. Tran, A. Whitbeck, *M^3: A New Muon Missing Momentum Experiment to Probe $(g-2)_\mu$ and Dark Matter at Fermilab,* arXiv:1804.03144

4. CMS Collaboration, *Search for supersymmetry in events with Higgs bosons and missing transverse momentum in proton-proton collisions at 13 TeV,* Phys. Rev. Lett. **120**, 241801 (2018)

5. CMS Collaboration, *Search for supersymmetry in multijet events with missing transverse momentum in proton-proton collisions at 13 TeV,* Phys. Rev. D **96**, 032003 (2017)

6. T. Cohen, M.J. Dolan, S. El Hedri, J. Hirschauer, N. Tran, and A. Whitbeck *Dissecting Jets and Missing Energy Searches Using n-body Extended Simplified Models,* JHEP **08**, 038 (2016)

7. CMS Collaboration, *Search for supersymmetry in the multijet and missing transverse momentum final state in pp collisions at 13 TeV,* Phys. Lett. B **758**, 152 (2016)

8. CMS Collaboration, *Commissioning the performance of key observables used in SUSY searches with the first 13 TeV data,* CMS-DP-2015-035 (2015)

9. J. Hirschauer, A. Whitbeck, *The CMS Central Hadron Calorimeter DAQ System Upgrade,* JINST, **10**, C05019 (2015)

10. Khachatryan et al., *Constraints on the spin-parity and anomalous HVV couplings of the Higgs boson in proton collisions at 7 and 8 TeV,* Phys. Rev., vol. D92, no. 1, p. 012004, 2015

11. I. Anderson et al., *Constraining anomalous HVV interactions at proton and lepton colliders,* Phys. Rev., vol. D89, no. 3, p. 035007, 2014

12. S. Chatrchyan et al., *Study of the Mass and Spin-Parity of the Higgs Boson Candidate Via Its Decays to Z Boson Pairs,* Phys. Rev. Lett., vol. 110, no. 8, p. 081803, 2013

13. S. Bolognesi, Y. Gao, A. V. Gritsan, K. Melnikov, M. Schulze, N. V. Tran, and A. Whitbeck, *On the spin and parity of a single-produced resonance at the LHC,* Phys. Rev., vol. D86, p. 095031, 2012

14. S. Chatrchyan et al., *Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC,* Phys. Lett., vol. B716, pp. 30–61, 2012

15. S. Chatrchyan et al., *Search for a Higgs boson in the decay channel* $\mathrm{H} \to \mathrm{ZZ}^* \to \mathrm{q\bar{q}}\ell^+\ell^-$ *in pp collisions at* $\sqrt{s}$ *= 7 TeV,* JHEP, vol. 04, p. 036, 2012

16. J. Boersma and A. Whitbeck, *Decays of the Littlest Higgs ZH and the Onset of Strong Dynamics,* Phys. Rev., vol. D77, p. 055012, 2008

SYNERGISTIC ACTIVITIES

- *The Science of the Large Hadron Collider*, USA Science and Engineering Festival, Washington DC, USA, October 2010 and April 2012, April 2018
- Instructor at CMS Data Analysis School (2013, 2014, 2015)
- CMS masterclass moderator with University of Rochester (2017)
- *A Career As a Scientist*, career day talk at Wredling Middle School, St. Charles, IL, (2014, 2015)