

Tyler H. Ruggles, PhD

Postdoctoral Research Scientist

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Research Interests

- Energy systems modeling with a focus on understanding the correlations and interannual variability in electricity demand and wind and solar resource availability and their potential impacts on grid stability
- Coupled electric power–transportation systems with an emphasis on studying difficult to decarbonize sectors that could benefit from hydrogen and other synthetic transportation fuels

Education

University of Wisconsin–Madison, Madison, WI May 2018
PhD, Experimental High Energy Physics

The Colorado College, Colorado Springs, CO May 2009
Bachelor of Arts *cum laude*, Major: Physics

Energy Research

Postdoctoral Research Scientist, Carnegie Science, Caldeira Lab, Stanford, CA June 2019 – Present

Energy Systems Modeling

- Using linear programming optimization of a least-cost energy system model to explore fundamental questions about a near-zero carbon emissions energy transition
- Analyzing interannual variability of wind and solar resources and their impacts on electric power capacity markets and system reliability
- Exploring power-to-gas and synthetic liquid fuel technologies to utilize otherwise curtailed electric power using a coupled electrofuel–power system model
- Participated with Carnegie team in an inter-model comparison project with other research institutions

Data Improvement

- Led a project to clean EIA hourly demand data for use by energy modeling community
- Developed algorithms to identify outlier data values in time series of hourly demand data

Physics Research

Postdoctoral Researcher, University of Wisconsin–Madison, CMS group, CERN May 2018 – May 2019
Research Assistant, University of Wisconsin–Madison, CMS group, CERN Jan. 2014 – May 2018

Data Analysis

- Conducted and published numerous analyses of the Higgs boson Jan. 2014 – May 2019

- Responsible for statistical modeling and production of results
- Constructed, ran, and processed the results of complex computer models
- Developed novel background estimation techniques and uncertainty models
- Collaborated closely with an international analysis team

Tau Algorithm Convener

Sept. 2017 – May 2019

- Coordinated and led a group monitoring and improving tau particle algorithm performance for data taking
- Implemented, calibrated, and validated new tau particle identification techniques
- Led team which measured and published 2017 & 2018 performance results

Algorithm Development

May 2016 – May 2019

- Developed multiple identification algorithms targeting different physics scenarios
- Documented algorithms and their performance in published technical design reports

Teaching Experience

Visiting Lecturer

Colorado College, Colorado Springs, CO

Mar. 2017 – April 2017

- Co-taught one semester worth of calculus-based introductory physics for physics majors
- Developed and lead the majority of laboratory sections
- Delivered multiple class lectures

Teaching Assistant

University of Wisconsin–Madison, Madison, WI

Aug. 2013 – Dec. 2013

- Ran discussion sections and laboratory classes for a non-calculus-based general physics class
- Received a review of “excellent” from the TA Review Committee

Research Skills

Leadership Experience:

- Convening and leading researchers in algorithm calibration and measurements
- Leading an analysis team as the CMS contact person and primary editor of analysis paper
- Training and mentoring multiple University of Wisconsin graduate and undergraduate students

Computer Modeling:

- Linear programming and optimization
- Conducting statistical hypothesis test of multiple predicted scenarios
- Identifying and researching the largest uncertainties in models and their results

Data Analysis Experience:

- Data-mining using both small scale and grid computing resources
- Optimization of data selection increasing signal strength and reducing noise

Computation Experience:

- Python – 6 years as primary coding language
- C++ – 5 years as secondary coding language
- Using GitHub as primary version control and collaboration tool for analysis code

Publications

Ruggles, T. H., Farnham, D. J., Tong, D. *et al.* “Developing reliable hourly electricity demand data through screening and imputation.” *Sci Data* **7**, 155 (2020). <https://doi.org/10.1038/s41597-020-0483-x>

Ruggles, Tyler H.; Dasu, Sridhara; Smith, Wesley H.; Herndon, Matthew F.; Hashimoto, Aki; Onellion, Marshall F. “A Study of the Standard Model Higgs Boson Decaying to a Pair of Tau Leptons with the CMS Detector at the LHC.” PhD Dissertation (2018) <https://cds.cern.ch/record/2621366>.

CMS Collaboration. CMS-PAS-HIG-18-007, “Search for the standard model Higgs boson decaying to a pair of τ leptons and produced in association with a W or a Z boson in proton-proton collisions at $\sqrt{s}=13$ TeV.” (2018) <https://cds.cern.ch/record/2621550>, under review at the Journal of High Energy Physics.

CMS Collaboration. “Observation of the SM scalar boson decaying to a pair of τ leptons with the CMS experiment at the LHC.” *Physics Letters B* (2017) doi:10.1016/j.physletb.2018.02.004.

CMS Collaboration. “Measurement of the $Z\gamma^* \rightarrow \tau\tau$ cross section in pp collisions at $\sqrt{s} = 13$ TeV and validation of τ lepton analysis techniques.” *European Physics Journal C* (2018) <http://dx.doi.org/10.1140/epjc/s10052-018-6146-9>.

CMS Collaboration. CMS-PAS-HIG-16-006, “Search for a neutral MSSM Higgs boson decaying into $\tau\tau$ at 13 TeV.” (2016) <https://cds.cern.ch/record/2160252>.

CMS Collaboration. “Searches for a heavy scalar boson H decaying to a pair of 125 GeV Higgs bosons hh or for a heavy pseudoscalar boson A decaying to Zh, in the final states with h to tautau.” *Physics Letters B* (2015) doi:10.1016/j.physletb.2016.01.056.

CMS Collaboration. CERN-LHCC-2017-013; CMS-TDR-017, “The Phase-2 Upgrade of the CMS L1 Trigger Interim Technical Design Report.” (2017) <https://cdsweb.cern.ch/record/2283192>.

CMS Collaboration. CMS DP-2018/009, “Tau trigger performance plots on 2017 data.” (2018) http://cms.cern.ch/iCMS/jsp/db_notes/notestable1.jsp?CMSNoteID=DP-2018/009.

CMS Collaboration. CMS DP-2018/035, “2018 Tau Reconstruction Comparison at the HLT.” (2018) http://cms.cern.ch/iCMS/jsp/db_notes/notestable1.jsp?CMSNoteID=DP-2018/035.

Vandenbroucke, Justin et al. “Particle Identification In Camera Image Sensors Using Computer Vision.” *Astroparticle Physics* (2019) <https://doi.org/10.1016/j.astropartphys.2018.08.009>.

Vandenbroucke, J. et al. “Measurement of camera image sensor depletion thickness with cosmic rays.” *Journal of Instrumentation* (2016) doi:10.1088/1748-0221/11/04/P04019.

Lovins, Amory & Rocky Mountain Institute. *Reinventing Fire: Bold Business Solutions for the New Energy Era*. White River Junction, VT: Chelsea Green Publishing, (2011) Print.

Wierzba, Amanda L., Mark A. Morgenstern, Sally A. Meyer, Tyler H. Ruggles, and John Himmelreich. “A Study to Optimize the Potential Impact of Residential Building Energy Audits.” *Energy Efficiency* (2011) <http://dx.doi.org/10.1007/s12053-011-9106-x>.

Professional Memberships

American Physical Society, member since 2013

American Geophysical Union, member since 2019