

Justin Gage Lietz - Curriculum Vitae

CONTACT INFORMATION

National Center for Computational Sciences
Oak Ridge National Lab
1 Bethel Valley Rd.
Oak Ridge, TN 37831-6008

Phone: +1-702-501-2015
E-mail: lietzjg@ornl.gov

RESEARCH INTERESTS

Computational Nuclear Many-Body Physics: I'm working on developing predictive theories of dense nuclear matter to better understand the nuclear equation of state, which plays an important role in understanding astrophysical processes like neutron star mergers and supernovae. Accurate simulations of the exotic states of matter inside neutron stars ($10^4 m$ in scale) require details that originate from quarks and gluons ($10^{-15} m$ in scale) —an incredibly challenging gap to bridge. To meet these challenges, I work on: improving quantum many-body methods for increased precision and uncertainty quantification, investigating effective field theories to provide cutting edge nuclear forces, and developing highly parallel algorithms and data structures to make these numerical experiments possible.

CURRENT APPOINTMENTS

**National Center for Computational Sciences
Oak Ridge National Laboratory**

September 2019 to present

Postdoctoral Research Associate in Scientific Computing

- Center for Accelerated Application Readiness (CAAR) - Preparing NUCCOR for the exascale supercomputer Frontier.
- Coupled cluster calculations of nuclei, nuclear matter, and electron gases.
- Parallel data structures and algorithms so that large scale tensor operations can run on thousands of GPUs.

PREVIOUS EDUCATION

Michigan State University, East Lansing, MI

July 2013 to August 2019

Dual Ph.D. in Physics and Computational Math, Science and Engineering

- Location: National Superconducting Cyclotron Laboratory
- Advisor: Morten Hjorth-Jensen
- Thesis Title: Computational Developments for *Ab Initio* Many-Body Theory
- Areas of study: Theoretical nuclear physics and computational quantum mechanics

The University of Arizona, Tucson, AZ

May 2013

B.S. in Physics and Mathematics

- Senior thesis in theoretical nuclear physics (no-core shell model for halo nuclei)
- Mathematics independent research in random matrix theory

Vanderbilt University, Nashville, TN

Summers of 2011 and 2012

REU Summer Program

- Analysis of various neutrino experiments
- Investigation of possibility of sterile neutrinos

- PUBLICATIONS J.G. Lietz, S. Novario, G.R. Jansen, G. Hagen and M. Hjorth-Jensen,
 “Computational Nuclear Physics and Post Hartree-Fock Methods”
An advanced course in computational nuclear physics - Bridging the scales from quarks to neutron stars, Eds. M. Hjorth-Jensen, M.P. Lombardo, U. van Kolck, Lecture Notes in Physics **936**, (2017) Pages 293-400
- H. Hergert, S.K. Bogner, J.G. Lietz, T.D. Morris, S.J. Novario, N.M. Parzuchowski, and F. Yuan
 “In-Medium Similarity Renormalization Group Approach to the Nuclear Many-Body Problem”
An advanced course in computational nuclear physics - Bridging the scales from quarks to neutron stars, Eds. M. Hjorth-Jensen, M.P. Lombardo, U. van Kolck, Lecture Notes in Physics **936**, (2017) Pages 477-570
- Many-Body Approaches to the Homogeneous Electron Gas in Two and Three Dimensions*
 J.G. Lietz, S.K. Bogner, G.R. Jansen, and M. Hjorth-Jensen (in prep.)
- Algorithms and Efficient Data Structures for Ab-Initio Calculations of Infinite Matter*
 J.G. Lietz, G.R. Jansen, and M. Hjorth-Jensen (in prep.)
- AWARDS AND TRAINING 2017 - DOE SCGSR Award: Office of Science Graduate Student Research Program,
 5 Months Funding to work at Oak Ridge National Lab,
 Project Title: Ab-Initio Theory for Dense Matter with Three-Body Forces
 Advisor: Gustav Jansen, Oak Ridge National Lab, August - December 2017
- 2016 - OLCF GPU Hackathon
 Oak Ridge National Lab, October 2016
- 2016 - Parallel Computing Summer Research Internship (PCSRI),
 Los Alamos National Lab, June - August 2016
- 2015 - TALENT Summer School,
 Many-Body Methods for Nuclear Physics, June-July 2015
 2014 - TALENT Summer School,
 Theory for Nuclear Structure Experiments, August 2014
 2014 - TALENT Summer School,
 Density Functional Theory and Self-Consistent Methods, July 2014
 2014 - TALENT Summer School,
 Nuclear Theory for Astrophysics, June 2014
- TALKS 2018 - J.G. Lietz, “Computational Developments for Coupled Cluster Theory With Triples and
 Three-Body Forces”, APS April Meeting, April 17th
 2017 - J.G. Lietz, “Many-Body Physics on Many Computers”, Physics Graduate Organization,
 March 16th, 2017
 2016 - J.G. Lietz, “Neutron Stars From Nucleons”, NSCL Graduate Seminar, March 28th, 2016
 2015 - J.G. Lietz, “Run Diffusion Monte Carlo”, Physics Graduate Organization,
 February 27th, 2015
- POSTER PRESENTATIONS 2016 - J.G. Lietz, Stephanie Lauber, Peter Ahrens, “Distributed Memory Implementation of
 Coupled Cluster”, Los Alamos National Lab Summer Student Symposium, August 2016
- SOFTWARE SKILLS Computer Programming:
 • C, C++, Fortran, Python, UNIX shell scripting, GNU make, Java

Parallel Computing:
• MPI, OpenMP, CUDA

Productivity:
• Git, Vim, gdb

TEACHING
EXPERIENCE

Summer 2017 - Nuclear Science Summer School, Guest Lecturer
Fall 2014 - Graduate Quantum Mechanics, Teaching Assistant
Spring 2014 - Physics Mechanics Lab, Teaching Assistant
Fall 2013 - Physics Mechanics Lab, Teaching Assistant

SERVICE

2015 - 2017 **Women and Minorities in the Physical Sciences (WaMPS) Treasurer:**
My responsibilities in this position were to help plan the yearly budget for the WaMPS student organization, and to frequently check in that we were spending at the proper rate to fall within our budget by the end of the fiscal year. I also acted as a bridge between the graduate students and the fiscal department of the university to handle reimbursements. Along with being treasurer for two terms, I attended the monthly WaMPS meetings, and went on several public outreach trips with the group each year.
2014 - 2016 **Physics Graduate Organization (PGO) Vice President:**
My responsibilities centered around representing the graduate student body to the department, and having quarterly discussions with the department chair about pushing forward changes to better the graduate student experience at MSU.

SELECTED
COURSES

2013 - 2015 Completed all standard graduate physics courses with a focus on nuclear theory
2015 - 2017 The Computational Math, Science and Engineering (CMSE) department is founded at MSU, and I decided to enroll in a dual Ph.D. and took additional courses such as:
Designing and Building Applications for Extreme Scale Systems:
Focused on learning MPI to leverage the power of the Blue Waters supercomputer at the University of Illinois.
Programming for Multi-Core Architectures:
Learned many classic linear algebra algorithms to target GPUs using CUDA.
Mathematical Foundations of Data Science:
Proof based course that went over several key theorems at the backbone of data science and machine learning.

REFERENCES
AVAILABLE TO
CONTACT

Dr. Gustav Jansen (email: jansengr@ornl.gov)
• Computational Scientist - Nuclear Physics,
National Center for Computational Sciences,
Oak Ridge National Lab
★ *Dr. Jansen is my ORNL mentor.*
Dr. Morten Hjorth-Jensen (email: hjensen@nscl.msu.edu)
• Professor of Physics,
National Superconducting Cyclotron Laboratory,
Michigan State University
★ *Dr. Hjorth-Jensen was my Ph.D. supervisor.*
Dr. Scott Bogner (email: bogner@nscl.msu.edu)
• Professor of Physics,
National Superconducting Cyclotron Laboratory,
Michigan State University
★ *Dr. Bogner was my Ph.D. co-supervisor.*