Gustav R. Jansen

CONTACT INFORMATION

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

Mobile: +1 (865) 236-4652
Work: +1 (865) 241-7534
E-mail: jansengr@ornl.gov

RESEARCH INTERESTS

The theoretical study of atomic nuclei as interacting systems of protons and neutrons has been my main topic of interest and research for the past decade. The phenomenology is filled with emergent phenomena that can only be described by performing numerical experiments at a high level of accuracy and precision. In the end, my goal is to describe atomic nuclei from the fundamental degrees of freedom, quarks and gluons, through a series of controlled approximations with quantified uncertainties. By working towards simultaneous improvements in the fields of many-body methods, high-performance computing, and nuclear phenomenology, where new methods are being designed, implemented, and applied, I hope to make considerable contributions to develop predictive theories for nuclear physics.

EDUCATION

Centre of Mathematics for Applications, CMA, The University of Oslo, Norway

Ph.D., Computational quantum mechanics, Department of Physics, August 2012

- Thesis Topic: *Coupled-cluster theory for open-shell nuclei.*
- Adviser: Professor Morten Hjorth-Jensen
- Co-adviser: Dr. Gaute Hagen
- Area of Study: Computational quantum mechanics and nuclear structure.

The University of Oslo, Norway

M.S., Applied Mathematics, Mechanics and Numerical Physics, Department of Mathematics, August 2006 to June 2008.

- Thesis Topic: *A computational environment for Hypernuclear structure calculations.*
- Adviser: Professor Morten Hjorth-Jensen
- Area of Study: Computational quantum mechanics and nuclear structure.

B.S., Computational Science and Mathematics, Department of Mathematics, August 2003 to June 2006.

SCHOOLS

Argonne Training Program on Extreme-Scale Computing (ATPESC 2013), Argonne National Laboratory

ACADEMIC APPOINTMENTS

Computational scientist – Nuclear Physics **August 2015 to present**
National Center for Computational Sciences,
Oak Ridge National Lab
- Coupled-cluster theory for nuclei.
- Large scale HPC application development.
- Nuclear interactions from Chiral Effective Field Theory.
- Effective shell-model operators from Coupled-cluster theory.

Post doctoral research associate **September 2012 to July 2015**
Department of Physics and Astronomy,
The University of Tennessee, Knoxville
- Coupled-cluster theory for nuclei.
- Coupled-cluster theory using HPC systems. (Titan(with NVIDIA GPU's), Beacon(with Intel Phi))
- Chiral forces.

– Effective shell-model operators from Coupled-cluster theory.

Assistant professor (Universitetslektor) **January 2012 to July 2012**
Physics division,
The University of Oslo, Norway
– Lecturer in introductory electromagnetism and advanced computational physics.

Research fellow **August 2008 to January 2012**
Centre of Mathematics for Applications, CMA,
The University of Oslo, Norway
– Coupled-cluster theory for open-shell nuclei.
– Co adviser: Dr. Gaute Hagen
– Adviser: Professor Morten Hjorth-Jensen

Programmer - Summerjob **June 2008 to August 2008**
Computing in science education project, CSE,
The University of Oslo, Norway
– Evaluate and develop tools for automatic parallelization of C/C++ programs.

Programmer - Summerjob **June 2007 to August 2007**
Nuclear physics group,
The University of Oslo, Norway
– Develop a graphical user interface using Python for a collection of nuclear manybody programs.
– Available at http://www.computationalphysics.net/ under Software.

Refereed Journal Publications

J. G. Lietz, S. Novario, G. R. Jansen, G. Hagen, and M. Hjorth-Jensen, Computational Nuclear Physics and Post Hartree-Fock Methods, Lecture Notes in Physics, **936**, pp 293-399, Springer, (2017). https://link.springer.com/chapter/10.1007/978-3-319-53336-0_8

G. Hagen, G. R. Jansen, T. Papenbrock, Structure of ^{78} Ni from first-principles computations, Phys. Rev. Lett **117**, 172501, (2016). doi:10.1103/PhysRevLett.117.172501

M. Miorelli, S. Bacca, N. Barnea, G. Hagen, G.R. Jansen, G. Orlandini, T. Papenbrock, Electric dipole polarizability from first principles calculations, Phys. Rev. C 94, 034317 (2016). doi:10.1103/PhysRevC.94.034317

R. Kanungo *et. al.*, Proton distribution radii of 12-19C illuminate features of neutron halos, Phys. Rev. Lett. **117**, 102501 (2016). doi:10.1103/PhysRevLett.117.102501

G. R. Jansen, M. D. Schuster, A. Signoracci, G. Hagen, and P. Navrtil, Open sd-shell nuclei from first principles, Phys. Rev. C 94, 011301(R), (2016). doi:10.1103/PhysRevC.94.011301

G. Hagen, M. Hjorth-Jensen, G. R. Jansen, and T. Papenbrock, Emergent properties of nuclei from ab initio coupled-cluster calculations, Physica Scripta **91**, 6, 063006 (2016). http://stacks.iop.org/1402-4896/91/i=6/a=063006

R. F. Garcia Ruiz *et al.*, Unexpectedly large charge radii of neutron-rich calcium isotopes, Nature Physics 12, 594598 (2016). doi:10.1038/nphys3645.

B. D. Carlsson, A. Ekström, C. Forssén, D. F. Strömberg, G. R. Jansen, O. Lilja, M. Lindby, B.A. Mattsson, K. A. Wendt, Uncertainty Analysis and Order-by-Order Optimization of Chiral Nuclear Interactions, Phys. Rev. X 6, 011019 (2016). doi:10.1103/PhysRevX.6.011019

G. Hagen *et al.*, Neutron and weak-charge distributions of the ^{48}Ca nucleus, Nature Physics 12, 186190 (2016). doi:10.1038/nphys3529

Angelo Signoracci, Thomas Duguet, Gaute Hagen, Gustav Jansen, Ab initio Bogoliubov coupled cluster theory for open-shell nuclei, Phys. Rev. C **91**, 064320 (2015), doi:10.1103/PhysRevC.91.064320

A. Ekström, G. R. Jansen, K. A. Wendt, G. Hagen, T. Papenbrock, B. D. Carlsson, C. Forssén, M. Hjorth-Jensen, P. Navrátil, W. Nazarewicz, Accurate nuclear radii and binding energies from a chiral interaction, Phys. Rev. C 91, 051301(R) (2015). doi:10.1103/PhysRevC.91.051301

R. Kanungo *et. al.*, Evidence of soft dipole resonance in 11Li with isoscalar character, Phys. Rev. Lett. **114**, 192502 (2015). doi:10.1103/PhysRevLett.114.192502

A. Ekström, G. R. Jansen, K. A. Wendt, G. Hagen, T. Papenbrock, S. Bacca, B. Carlsson, D. Gazit, Effects of three-nucleon forces and two-body currents on Gamow-Teller strengths, Phys. Rev. Lett. **113**, 262504 (2014). doi:10.1103/PhysRevLett.113.262504

G. R. Jansen, J. Engel, G. Hagen, P. Navratil, and A. Signoracci, *Ab Initio* Coupled-Cluster Effective Interactions for the Shell Model: Application to Neutron-Rich Oxygen and Carbon Isotopes, Phys. Rev. Lett. **113**, 142502 (2014). doi:10.1103/PhysRevLett.113.142502

Zs. Vajta *et al.*, Excited states in the neutron-rich nucleus F25, Phys. Rev. C **89**, 054323 (2014). doi:10.1103/PhysRevC.89.054323

G. R. Jansen, Spherical coupled-cluster theory for open-shell nuclei, Phys. Rev. C **88**, 024305 (2013). doi:10.1103/PhysRevC.88.024305

A. Ekström, G. Baardsen, C. Forssén, G. Hagen, M. Hjorth-Jensen, G. R. Jansen, R. Machleidt, W. Nazarewicz, T. Papenbrock, J. Sarich, and S. M. Wild, Optimized Chiral Nucleon-Nucleon Interaction at Next-to-Next-to-Leading Order, Phys. Rev. Lett. **110**, 192502, (2013). doi:10.1103/PhysRevLett.110.192502

A. Lepailleur *et. al.*, Spectroscopy of 26F to Probe Proton-Neutron Forces Close to the Drip Line, Phys. Rev. Lett. **110**, 082502, (2013). doi:10.1103/PhysRevLett.110.082502

G. Hagen, M. Hjorth-Jensen, G. R. Jansen, R. Machleidt, and T. Papenbrock, Evolution of Shell Structure in Neutron-Rich Calcium Isotopes, Phys. Rev. Lett. **109**, 032502, (2012). doi:10.1103/PhysRevLett.109.032502

G. Hagen, M. Hjorth-Jensen, G. R. Jansen, R. Machleidt, and T. Papenbrock, Continuum Effects and Three-Nucleon Forces in Neutron-Rich Oxygen Isotopes, Phys. Rev. Lett. **108**, 242501, (2012). doi:10.1103/PhysRevLett.108.242501

G. R. Jansen, M. Hjorth-Jensen, G. Hagen, and T. Papenbrock, Towards open-shell nuclei with coupled-cluster theory, Phys. Rev. C, **83**, 054306, (2011). doi:10.1103/PhysRevC.83.054306

Talks at conferences, seminars etc.

Approaching the neutron dripline with chiral Hamiltonians, Open Quantum Systems: From atomic nuclei to ultracold atoms and quantum optics, July 10-14, 2017, ECT*, Trento, Italy.

Computational advances in nuclear coupled-cluster theory, NUCLEI, SciDAC-3 PI meeting, June 6-9, 2017, Santa Fe, NM, USA.

Computational advances in nuclear coupled-cluster theory, NUCLEI, SciDAC-3 PI meeting, June 6-9, 2016, Argonne National Lab, Chicago, IL, USA.

Computational Challenges in nuclear coupled-cluster theory, OLCF User Meeting, May 24-26, 2016, ORNL, TN, USA.

Nuclei from first principles, Nuclear theory seminar, April 19, Michigan state University, East Lansing, MI, USA.

Computational advances and challenges in nuclear coupled-cluster theory, NUCLEI, SciDAC-3 PI meeting, June 10-13, 2015, MSU, East Lansing, MI, USA.

Effective interactions and operators from coupled-cluster theory, ICNT: Theory for open-shell nuclei near the limits of stability, May 11-29, 2015, MSU, East Lansing, MI, USA.

Coupled-cluster effective interactiuons for nuclei, ESNT workshop, April 2, 2015, Saclay, France.

Effective operators from coupled-cluster theory, Topical meeting on neutrino-less double beta decay, March 9, Chapel Hill, NC, USA.

Effective interactions from coupled-cluster theory, TRIUMF workshop on *Nuclear Structure & Reactions: Experimental and Ab Initio Theoretical Perspectives*, February 18-21, 2014, TRIUMF, BC, Vancouver, Canada.

Exotic nuclei and nuclear forces, Gordon Research Conference on *Nuclear Chemistry*, June 09-14 2013, Colby-Sawyer college, New London, New Hampshire, USA.

Open-shell nuclei from coupled-cluster theory, INT Program INT-13-1a *Computational and Theoretical Advances for Exotic Isotopes in the Medium Mass Region*, INT, University of Washington, Seattle, Washington, USA.

Shell evolution in the neutron rich calcium isotopes, TRIMUF workshop on *Progress in ab-initio techniques in nuclear physics*, February 21-23, 2013, TRIUMF, BC, Vancouver, Canada.

Threebody forces in neutron rich isotopes in oxygen and fluorine, The 6th LACM-TORIJIN-JUSTIPEN Workshop, October 31 - November 2, 2012, Joint Institute for Heavy Ion Research, Oak Ridge, Tennessee, USA.

Neutron-rich (hyper)nuclei: Their structure and possible astrophysical implications, Dissertation UiO, August 23, 2012, Oslo, Norway.

Spherical coupled-cluster theory for open-shell nuclei, Dissertation UiO, August 23, 2012, Oslo, Norway.

Towards coupled cluster theory for open shell nuclei, Uio-MSU-ORNL-UT School on Topics in Nuclear Physics, *Many-Body Theory, Connections to Experiment and Nuclear Astrophysics*, January 3-7, 2012, ORNL, Oak Ridge, Tennessee, USA.

Open-shell nuclei with coupled-cluster theory. FUSTIPEN Topical Meeting, *Structure and reactions at the drip lines*, May 24-25, 2011, GANIL, Caen, France.

Coupled cluster theory for open shell nuclei. ECT* workshop, *Effective theories and the nuclear many-body problem* March 7-11, 20011, Villazano (TN), Italy.

CENS: A computational environment for nuclear structure. CNS-EFES08, Center for nuclear study, Graduate school of science, University of Tokyo. August 26. 2008 to September 1. 2008.

CENS: A computational environment for nuclear structure. Faculty of physics, University of Barcelona. April. 23 2008.

Teaching Experience

TALENT: Training in Advanced Low Energy Nuclear Theory

Lecturer **Summer 2017**

- Lectured for advanced undergraduate and graduate students.
- Covered effective interactions for use with the nuclear shell model.
- The course was over 3 weeks with 3 hours of lectures every day split between multiple lecturers. In addition the students had 3-5 hours of project work every day supervised by the lecturers.

The University of Oslo, Norway

Lectured FYS-4411 - Computational physics II: Quantum mechanical systems **Spring 2012**

- Lectured for advanced undergraduate and graduate students.
- Covered manybody methods applied to quantum dots.
- The course was over a full semester, with three hours of lecturing and five hours of programming lab work every week.
- As part of the semester project, the students developed a fully parallelized code to study quantum dots with Variational Monte Carlo and Diffusion Monte Carlo.

Introductory electromagnetism **Spring 2012**

- Lectured introductory electromagnetism for middle and high school teachers.
- The course was given over six full days, spread over three gatherings.

Lecture series on coupled-cluster theory **Autumn 2009, 2010, 2011**

- Developed a 12 hour lecture series on coupled-cluster theory for graduate students as part of their official curriculum.
- Lectured Autumn 2009, Autumn 2010 and Autumn 2011.

Teaching assistant for FYS-KJM4480 Quantum mechanics for many-particle systems **Autumn 2009, Autumn 2010**

- Evaluation and grading of compulsory projects.
- Instructor in problem solving sessions.
- 10-15 graduate and postgraduate students.

Crash course in Python programming **Autumn 2008**

- Developed lectures, example programs and assignments.
- 5 hours of lectures, 35 hours of computer lab.
- 40+ first year undergraduate students with no prior programming experience.

Lab assistant for FYS3150 - Computational Physics **Autumn 2007**

- Help with programming exercises and projects at computer lab.
- 10-15 undergraduate and postgraduate students.

Professional Experience

Chief Securiy Engineer/Consultant **May 2000 to August 2003**

Linux Communications AS, Norway (Does not exist today)

- Responsible for network security (firewalls, intrusion detection, antivirus etc.) locally and as a consultant.
- Design, implementation and maintenance of network and Internet infrastructure for the public school system in Oslo, Norway.
- Develop solutions needed for roaming between different GSM operators.
- General IT consulting work.

Systems consultant **July 1998 to May 2000**

Nextra AS (Telenor ASA), Snarøyveien 30, 1331 Fornebu, Norway. (Internet service provider)
- Handle cases of Internet abuse.
- Support on Internet access for business customers.
- Day to day maintenance of DNS, email and web servers.
- General support.

IT consultant **May 1997 to June 1998**

Olsten Datavikar AS (today Adecco IT Norway)
- Upgrade a network of computers on a local hospital from Windows 3.11 to Windows 95.
- Day to day maintenance of an accounting system running on AS/400.

Authorized agent **February 1997 to May 1997**

Norwegian Public Service Pension Fund
- Develop a set of standardized letters using MS Word 95 with macros for automatization.

Military service **January 1996 to December 1996**

Norwegian armed forces

Authorized agent **June 1995 to December 1995**

Norwegian Public Service Pension Fund
- Local computer support.
- Archive, mail etc.

Hardware and Software Skills

Computer Programming:
- Fortran, Python, C, C++, Java, Perl, PHP, UNIX shell scripting, SQL, Matlab, Maple, Mathematica, and others

Parallel platforms:
- MPI, OpenMP, CUDA, OpenACC

Debugging and profiling tools:
- Allinea DDT, gdb, valgrind, Tau, gprof, Perf tools

Version Control and Software Configuration Management:
- DVCS (Git/Gitolite), VCS (RCS, CVS)

Information/Internet Technology:
- Networking (UDP, TCP, ARP, DNS, Dynamic routing (OSPF)), Services (Apache, SQL, POP, IMAP, SMTP, Netfilter (FW), LDAP, Snort (IDS))

Productivity Applications:
- TEX (LATEX, BIBTEX, PSTricks, Beamer), Vim, Eclipse, Python, LibreOffice

References Available to Contact

Dr. Gaute Hagen (e-mail: hageng@ornl.gov; phone: +1 (865) 576-4295)
- Research Staff ORNL, Oak Ridge National Laboratory.
  - ◇ PO BOX 2008 MS6373, Oak Ridge TN 37831-6373.
  - ⋆ *Dr. Gaute Hagen is a collaborator and previous supervisor.*

Dr. Thomas Papenbrock (email: tpapenbr@utk.edu; phone: +1 (865) 974-3128)
- Associate Professor, Department of Physics and Astronomy University of Tennessee, Knoxville
  - ◇ 401 Nielsen Physics Building, Knoxville TN 37996-1200.
  - ⋆ *Dr. Papenbrock is a collaborator and previous supervisor.*

Dr. Morten Hjorth-Jensen (e-mail: hjensen@nscl.msu.edu ; phone: +1 (517) 908-7290/+47 22856458)
- Professor, Physics, University of Oslo
- Professor, Department of Physics and Astronomy, Michigan State University

⋆ *Dr. Hjorth-Jensen was my thesis adviser for both M.S. and Ph.D thesis and is a collaborator on current research.*

Dr. David J. Dean (e-mail: deandj@ornl.gov; phone: +1 (865) 576-5229)
- Division Director-Physics, Oak Ridge National Lab