

Antoine Boulet

RESEARCH ASSOCIATE · THEORETICAL PHYSICS

Faculty of Physics, Warsaw University of Technology, Ulica Koszykowa 75, 00-662 Warsaw, Poland

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"I have doubts, do you have any?"

References

Available upon request.

Personal Details

FRENCH CITIZEN

- Married
- Born on 30 March 1993 [29y/o]
in Argentan (61), France

LANGUAGES *French (native), English (fluent)*

SPORTS *running, table tennis*

HOBBIES *chess, movies, musics, reading*

Computer Skills

OPERATING SYSTEM *MacOS, Unix*

PROGRAMMING *Python, C/C++, Fortran, Mathematica*

HPC CODE *Developer of W-SLDA Toolkit*

GITHUB *<https://github.com/AntoineBoulet>*

TECHNIQUES

- Monte Carlo methods for integration
- numerical methods for optimization problem
- diagonalization of HFB kernel

Research Interests

My research interests as theoretical physicist are mainly focused on the quantum many-body problems and the development of *ab initio* Density Functional Theories and their applications for nuclear and atomic physics.

SYSTEMS

- infinite nuclear matter
- ultracold atomic Fermi systems
- atomic nuclei, neutron stars

METHODS

- diagrammatic resummation
- path integral and effective action
- regularisation in effective field theory

THEORIES

- Density Functional Theory (DFT)
- Many-Body Perturbation Theory (MBPT)
- Variational Perturbation Theory (VPT)
- Superfluid Local Density Approximation (SLDA)

STUDIES

- equation of states and thermodynamics
- linear response and collective modes
- self-energy and Landau-Fermi liquid theory
- structure and dynamics of superfluid vortices
- quantum turbulence

Professional Experiences

RESEARCH

Faculty of Physics, Warsaw University of Technology

Warsaw, Poland

RESEARCH ASSOCIATE

Jan. 2021 – now

- development and implementation of an extended SLDA functional
- numerical simulation of dissipation processes in superfluid vortices systems, quantum turbulence, Higgs modes, and quantum quenches

FRIB/NSCL, Michigan State University

East Lansing, MI USA

RESEARCH ASSOCIATE

Nov. 2019 – Nov. 2020

- development of microscopically-motivated DFT using *ab initio* theories and their implementation for large-scale calculations of nuclei

IPN Orsay, Paris-Sud University

Orsay, France

PH.D. STUDENT

Oct. 2016 – Oct. 2019

- development of the DFT for Fermi systems with large s-wave scattering length and application to atomic and nuclear physics

TEACHING

IUT Orsay, Paris-Saclay University

Orsay, France

GRADUATE TEACHING ASSISTANT

Sep. 2017 – Aug. 2019

- Directed Studies: electromagnetism (36 h) and metrology, quality, statistics (12 h)
- Practical Works: metrology, quality, statistics (68 h) and chains of measurement, control, tests (12 h)

Education & Diplomas

Paris-Saclay University

PH.D. THEORETICAL PHYSICS

IPN Orsay

2019

- *Density Functional Theory for Fermi systems with large s-wave scattering length: application to atomic and nuclear physics*
- Advisor: D. Lacroix, Jury: G. Colò, D. Davesne, M. Grasso, D. Lacroix, D. Petrov, A. Rios Huguet, and V. Somà

Paris-Saclay University

M.SC. FUNDAMENTAL CONCEPTS OF PHYSICS

ENS Paris

2016

- ICFP master program, condensed matter physics speciality

Paris-Sud University

B.SC. FUNDAMENTAL PHYSICS

UFR sciences Orsay

2014

- *Magistère* of fundamental physics

Outreach & Professional Developments

SERVICE AND OUTREACH

- 2022 **Committee Member,**
International Experience at WUT
- 2018 **Organizer,**
Welcome day for new entrants at IPN Orsay
- 2017 **Organizing Committee Member,**
PHENIICS doctoral school conference

DOCTORAL SCHOOLS

- 2018 **Doctoral School of the GGI for Theoretical Physics,**
Frontiers in Nuclear and Hadronic Physics
Florence, Italy
- 2017 **ECT* Doctoral Training Program,**
Microscopic Theories of Nuclear Structure, Dynamics, and Electroweak Currents
Trento, Italy

RESEARCH INTERNSHIPS

LPTMS, Paris-Sud University

M.SC. TRAINING STUDIES

Orsay, France

2 months, 2016

- *Separation of Variables and Correlation Functions of Quantum Integrable Systems*
- Advisor: V. Terras

QGLab, University of Nottingham

M.SC. TRAINING STUDIES

Nottingham, UK

3 months, 2015

- *Hydrodynamic simulation of rotating black holes*
- Advisor: S. Weinfurter

LPT, Paris-Sud University

B.SC. TRAINING STUDIES

Orsay, France

2 months, 2014

- *Weak interaction and CP symmetry violation: mesons mixing*
- Advisor: S. Descotes-Genons

GANIL

B.SC. TRAINING STUDIES

Caen, France

2 weeks, 2013

- *Persistence of magic numbers far from stability*
- Advisor: J.-C. Thomas

Publications

PUBLISHED

A. Barresi, **A. Boulet**, P. Magierski, and G. Włazłowski, arXiv:2207.00870 (2022). [submitted to Phys. Rev. Lett.]
Investigation of dissipative dynamics of quantum vortices

A. Boulet, G. Włazłowski, and P. Magierski, arXiv:2201.07626 (2022). [submitted to Phys. Rev. A]
Local energy density functional for superfluid Fermi gases from effective field theory

A. Boulet, Ph.D. thesis, Paris-Saclay University (2019). ⟨NNT: 2019SACLS212⟩ ⟨tel-02355418⟩
*Density functional theory for Fermi systems with large s-wave scattering length:
Application to atomic and nuclear physics*

A. Boulet and D. Lacroix, J. Phys. G: Nucl. Part. Phys. **46**, 105104 (2019).
*Approximate self-energy for Fermi systems with large s-wave scattering length:
A step towards density functional theory*

A. Boulet and D. Lacroix, Phys. Rev. C **97**, 6337 (2018).
*Static response, collective frequencies, and ground-state thermodynamical properties
of spin-saturated two-component cold atoms and neutron matter*

D. Lacroix, **A. Boulet**, M. Grasso, and C.-J. Yang, Phys. Rev. C **95**, 22726 (2017).
*From bare interactions, low-energy constants, and unitary gas to nuclear density functionals without free parameters:
Application to neutron matter*

TO BE SUBMITTED SOON

A. Boulet, A. Barresi, P. Magierski, and G. Włazłowski.
Instability of Higgs mode in ultracold Fermi gases

IN PREPARATION

A. Boulet and S. K. Bogner.
*Variational Perturbation Theory for Density Functional Theory:
Towards a systematic improvement of the Hartree-Fock-Bogoliubov approximation*

A. Boulet.
*Beyond mean-field effective interaction via the many-body perturbation theory:
Application to the pairing Hamiltonian and unitary Fermi gas*

Presentations

CONFERENCES

INT program, University of Washington Seattle, WA USA
NUCLEAR STRUCTURE AT THE CROSSROADS 2019
Approximate self-energy for Fermi systems with large s-wave scattering length: A step towards density functional theory

GANIL symposium Caen, France
NUCLEAR STRUCTURE AND REACTIONS: THE NEXT SIGNIFICANT BREAKTHROUGHS 2019
Quasi-particle properties of Fermi gas from low density to unitary limits

WORKSHOPS

IPN Orsay, Paris-Sud University Orsay, France
BRIDGING NUCLEAR AB-INITIO AND EDF THEORIES 2017
Static and dynamical responses of neutron systems

SEMINARS

Hadron and Nuclear Theory group, University of Barcelona Barcelona, Spain
[VISIO-]SEMINAR 2022
Towards ab initio Density Functional Theory from atomic to nuclear systems

Nuclear Theory Group, Warsaw University of Technology Warsaw, Poland
[VISIO-]SEMINAR 2020
Density Functional Theory for Fermi systems with large s-wave scattering length: application to nuclear and atomic physics

FRIB/NSCL, Michigan State University

East Lansing, MI USA

[VISIO-]RESEARCH DISCUSSION

2020

Variational Perturbation Theory for Density Functional Theory:

Towards a systematic improvement of the Hartree-Fock-Bogoliubov approximation

DPhN/IRFU, CEA Saclay

Orme des Merisiers, France.

SNIF MEETING

2019

Connecting EFT to DFT for strongly interacting fermions

IPN Orsay, Paris-Sud University

Orsay, France.

THEORY GROUP SEMINAR

2019

Quasi-particle properties of Fermi gas from low density to unitary limits