

DR. ANDREA TONONI

PERSONAL DETAILS

Birth: 21/05/1994 in Borgo Maggiore, San Marino
Nationality: Italian, Sammarinese
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SCIENTIFIC CAREER

Postdoctoral researcher,
ICFO, Barcelona, Spain. 11/2023 - present
Supervisor: Prof. Maciej Lewenstein.
Funding source: PASQuanS2.1 (EU Quantum Flagship).

Postdoctoral researcher,
Université Paris-Saclay, CNRS, LPTMS, France. 12/2021 - 10/2023
Supervisor: Dr. D. S. Petrov.
Funding source: ANR grant “Droplets”.

EDUCATION

PhD in Physics (excellent, *cum laude*),
University of Padova, Italy. 10/2018 - 12/2021
Supervisor: Prof. Luca Salasnich.
Thesis title: [Low-dimensional Quantum Gases in Curved and Flat Geometries](#)

Master of Science in Physics (110/110, L),
University of Padova, Italy. 10/2016 - 09/2018
Thesis: *Bose-Einstein condensation and Superfluidity in 3D and 2D bosons*
Supervisor: Prof. Luca Salasnich.

Bachelor of Science in Physics (105/110),
University of Padova, Italy. 09/2013 - 07/2016
Thesis: *On the diffusive approximation of the Master Equation*
Supervisors: Dr. Gianluigi Serrianni, Dr. Fabio Sattin.

PUBLICATIONS AND PREPRINTS

19. A. Tononi, L. Salasnich, and A. Yakimenko,
Quantum Vortices in Curved Geometries,
AVS Quantum Sci. **6**, 030502 (2024).

18. J. Givois, A. Tononi, and D. S. Petrov,
Heavy-light $N+1$ clusters of two-dimensional fermions,
SciPost Phys. **17**, 050 (2024).
17. A. Tononi, G. Astrakharchik, and D. S. Petrov,
Gas-to-soliton transition of attractive bosons on a spherical surface,
AVS Quantum Science **6**, 023201 (2024).
16. A. Tononi and L. Salasnich,
Shell-shaped atomic gases,
Physics Reports **1072**, 1 (2024).
15. A. Tononi and L. Salasnich,
Low-dimensional quantum gases in curved geometries,
Nature Reviews Physics **5**, 398 (2023).
14. J. Givois, A. Tononi, and D. S. Petrov,
Self-binding of one-dimensional fermionic mixtures with zero-range interspecies attraction,
SciPost Physics **14**, 091 (2023).
13. N. Lundblad, D. C. Aveline, A. Balaž, E. Bentine, N. P. Bigelow, P. Boegel, M. A. Efremov, N. Gaaloul, M. Meister, M. Olshanii, C. A. R. Sá de Melo, A. Tononi, S. Vishveshwara, A. C. White, A. Wolf, and B. M. Garraway,
Perspective on Quantum Bubbles in Microgravity,
Quantum Science and Technology **8**, 024003 (2023).
12. L. Salasnich, A. Cappellaro, K. Furutani, A. Tononi, and G. Bighin
First and Second Sound in Two-Dimensional Bosonic and Fermionic Superfluids,
Symmetry **14**, 2182 (2022).
11. A. Tononi, J. Givois, and D. S. Petrov,
Binding of heavy fermions by a single light atom in one dimension,
Physical Review A **106**, L011302 (2022).
10. A. Tononi,
Scattering theory and equation of state of a spherical two-dimensional Bose gas,
Physical Review A **105**, 023324 (2022).
9. A. Tononi, A. Pelster, and L. Salasnich,
Topological superfluid transition in bubble-trapped condensates,
Physical Review Research **4**, 013122 (2022).
8. A. Tononi, A. Cappellaro, G. Bighin, and L. Salasnich,
Propagation of First and Second Sound in a Two-Dimensional Fermi Superfluid,
Physical Review A **103**, L061303 (2021).
7. K. Furutani, A. Tononi, and L. Salasnich,
Sound modes in collisional superfluid Bose gases,
New Journal of Physics **23**, 043043 (2021).
6. A. Tononi, F. Toigo, S. Wimberger, A. Cappellaro, and L. Salasnich,
Dephasing-rephasing dynamics of one-dimensional tunneling quasicondensates,
New Journal of Physics **22**, 073020 (2020).
5. A. Tononi, F. Cinti, and L. Salasnich,
Quantum Bubbles in Microgravity,
Physical Review Letters **125**, 010402 (2020).

4. A. Tononi and L. Salasnich,
Bose-Einstein Condensation on the Surface of a Sphere,
Physical Review Letters **123**, 160403 (2019).
3. A. Tononi, Y. Wang, and L. Salasnich,
Quantum Solitons in Spin-Orbit Coupled Bose-Bose Mixtures,
Physical Review A **99**, 063618 (2019).
2. A. Tononi,
Zero-Temperature Equation of State of a Two-Dimensional Bosonic Quantum Fluid with Finite-Range Interaction,
Condensed Matter **4(1)**, 20 (2019).
1. A. Tononi, A. Cappellaro, and L. Salasnich,
Condensation and superfluidity of dilute Bose gases with finite-range interaction,
New Journal of Physics **20**, 125007 (2018).

GRANTS, PRIZES AND AWARDS

- **Postdoctoral fellowship** grant (181 k€) for the proposal “Quantum mixtures in flat and curved geometries”, submitted under the Horizon Europe Marie Skłodowska-Curie actions call MSCA-2023-PF. Starting date: 01/06/2025.
- **Seal of excellence**, delivered by the European Commission for the proposal “Self-binding and emergent structures in low-dimensional quantum mixtures” (score 90.6%/100%), submitted under the Horizon Europe Marie Skłodowska-Curie actions call MSCA-2022-PF.
- **Special mention**, awarded by the Italian Conference of Presidents and Directors of University Departments of Science and Technology to underline the scientific validity of my doctoral thesis. This mention was attributed within the framework of the “con.Sienze 2021-2022” prize (www.conscienze.it/premi_2122_vincitori.asp).

CONFERENCES AND SEMINARS

I gave **28 oral presentations** and I presented **15 posters**.

(full list at the end of the curriculum vitae)

PEER REVIEW

I have done 31 peer reviews in total (verifiable on [Web of Science](#)) for the following journals:

Physical Review Letters, Physical Review A, Physical Review B, New Journal of Physics, SciPost Physics, EPL.

TEACHING

- **Teaching 4 hours** to university first-year students within the course “Fundamentals of quantum mechanics” organized at ICFO by Prof. Maciej Lewenstein. Topics: wave-particle duality, quantum statistics, Bose-Einstein condensation, superfluidity. 11/07/2024 - 12/07/2024
- **Teaching 4 hours** to PhD students within the course “Bose-Einstein condensation, Superfluidity, Superconductivity”, held at the University of Padova by Prof. Luca Salasnich. Topics: Bose-Einstein condensation, superfluidity. 28/11/2019, 20/12/2019
- **Qualifying habilitation as high-school teacher of mathematics and physics** in Italy (competition classes A020, A026, A027, A047). since 08/2021

ACADEMIC DUTIES

- **Co-organizer of the LPTMS laboratory weekly seminar.** 09/2022 – 10/2023
- **PhD students representative** at the council of the Department of Physics and Astronomy, University of Padova. 10/2018 – 12/2021
- **Local organizing committee member** for the SuperFluctuations 2019 conference. 02/09/2019 – 04/09/2019

SUPERVISION ACTIVITIES

- Supervision of the BSc stage (6-weeks) of Pierre-Louis Premoli. 12/06/2023 – 28/07/2023

SCIENCE COMMUNICATION

- Writing a **non-specialist article on my paper** “Low-dimensional quantum gases in curved geometries” for the University of Padova’s press office. The science magazine “le Scienze” republished our **press release**. 05/07/2023
- **“Fête de la science”**: presenting quantum mechanics concepts to six high-school classes (in French). 07/10/2022
- Interview for a promotional video of the Physics PhD school at the University of Padova. 05/05/2022
- **“Percorsi Galileiani PhD Edition”**: videomaking of my research for a non-specialist public, <https://www.andreatononi.com/video.html>. 04/06/2021
- **“Veneto Research Night”**: local edition of the European Researchers’ Night (videomaking and discussion with the general public, <https://venetonightpadova.it/>). 27/11/2020
- Writing a **non-specialist article on my paper** “Quantum Bubbles in Microgravity” for the University of Padova’s press office. 02/07/2020

LANGUAGES

Italian (native); English (proficient); French (proficient); Spanish (independent).

TRAINING

- Workshop on “Becoming a Scientific Writer: Putting Why? before How?”, organized by ICFO and held by the specialized trainer Dr. Gavin Lucas (16 h). 09/07/2024 - 10/07/2024
- Workshop on “Impostor syndrome”, organized by the Barcelona Institute of Science and Technology (BIST) in collaboration with the specialized trainer Dr. Míriam Bayés (4,5 h). 03/05/2024
- Soft-skills “Mentorship training” for the mentor role, organized by BIST to support the personal development of young researchers (2 h). 13/03/2024
- Sensitization session on the prevention of gender-based violence, organized by the Paris-Saclay University (3,5 h). 06/04/2023
- Training course “PhD educational week on transferable skills”, organized by the University of Padova (1 week). 21/09/2020 – 25/09/2020
- Attending and passing the final exam of “Cultural anthropology” (9 ECTS) and “Psycho-social processes, development, culture” (9 ECTS), university courses delivered by the University of Padova. 03/2020 – 06/2020

FULL LIST OF PRESENTATIONS

Presentations at international conferences and workshops

12. **Atomtronics 2024**, (Benasque, Spain, May 19 - Jun 1 2024).
Contributed talk: *Gas-to-soliton transition of attractive bosons on the surface of a sphere.*
11. **Superfluctuations 2022**, (Padova, Italy, Jul 6-8 2022).
Invited talk: *How many heavy fermions can be bound by a single light atom in 1D?*
10. **ECT* workshop, Nuclear physics at the edge of stability** (Trento, Italy, Jul 4-8 2022).
Invited talk: *Binding of heavy fermions by a single light atom in 1D.*
9. **Palaiseau-Florence Workshop on Ultracold Atoms** (Florence, Italy, Apr 19-22 2022).
Invited talk: *Scattering theory and equation of state of a spherical 2D Bose gas.*
8. **Workshop on Prospects of Quantum Bubble Physics** (online, Apr 6-7 2022).
Invited talk: *Scattering theory and equation of state of a spherical 2D Bose gas.*
7. **SuperFluctuations 2021**, Fluctuations and Highly Non Linear Phenomena in Superfluids and Superconductors, (online conference, Jun 14-16 2021).
Invited talk: *Topological BKT transition in bubble-trapped condensates.*
6. **APS-DAMOP 2021**, 52nd Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics (online conference, May 31 - Jun 4 2021).
Talk: *Superfluid BKT transition of 2D bubble-trapped condensates*

5. **Virtual NASA workshop: New Directions for Cold Atoms in Space** (online workshop, Apr 23 2021).
Talk: *Quasi-2D shell-shaped condensates*
4. **APS March Meeting 2021** (online conference, Mar 15-19 2021).
Talk: *Quantum Statistics of a Shell-Shaped Bose-Einstein Condensate*
3. **Exploring Quantum Many-Body Physics with Ultracold Atoms and Molecules** (online conference, Dec 14-18 2020).
Talk: *Quantum statistical properties of shell-shaped Bose-Einstein condensates*
2. **SuperFluctuations 2020**, Fluctuations and Highly Non Linear Phenomena in Superfluids and Superconductors, (online conference, Jun 22-23 2020).
Talk: *Quantum bubbles in microgravity.*
1. **Spring online Workshop on Ultracold Quantum Matter** (online workshop, Jun 4 2020).
Invited talk: *Quantum bubbles in microgravity.*

Presentations at laboratory seminars

16. **Seminar at the LPTMC laboratory** (Paris, France, Feb 5 2024).
Talk: *Ultracold atomic gases: from curved geometries to quantum mixtures.*
15. **Seminar at the INPHYNI institute** (Nice, France, Nov 23 2023).
Invited talk: *Ultracold atomic gases: from curved geometries to quantum mixtures.*
14. **Quantum seminar at LPTMS** (Orsay, France, Sep 29 2023).
Talk: *Gas-to-soliton transition of attractive bosons on the surface of a sphere.*
13. **Seminar at LPMMC laboratory** (Grenoble, France, Sep 22 2023).
Invited talk: *Self-bound fermionic mixtures in 1D.*
12. **Seminar at the IJCLab** (Orsay, France, Sep 7 2023).
Invited talk: *Self-binding of a Fermi-Fermi atomic mixture with zero-range attraction in one dimension.*
11. **Seminar at the Universitat Politècnica de Catalunya (UPC)** (Barcelona, Spain, Jan 25 2023).
Invited talk: *Self-bound fermionic mixtures in 1D.*
10. **Seminar at ICFO** (Barcelona, Spain, Jan 24 2023).
Invited talk: *Self-bound fermionic mixtures in 1D.*
9. **Days of LPTMS** (Bordeaux, France, May 18-20 2022).
Talk: *Binding of heavy fermions by a single light atom in 1D.*
8. **SIFS Young Seminars** (online, Dec 9 2021).
Invited talk: *Quantum statistics and BKT transition of a shell-shaped superfluid.*
7. **Seminar for the Physics of Matter group at the University of Padova** (Padova, Italy, Nov 8 2021).
Talk: *Static and dynamic properties of one-dimensional quantum gases.*
6. **Seminars for the Condensed Matter Theory group at the University of Padova** (Padova, Italy, Nov 8 2021).
Talk: *Hydrodynamic excitations in bosonic and fermionic 2D superfluids.*
5. **Seminar for the Physics of Matter group at the University of Padova** (Padova, Italy, Oct 12 2021).
Talk: *Ultracold quantum gases: a brief overview and a focus on microgravity experiments.*
4. **Seminars for the Condensed Matter Theory group at the University of Padova** (Padova, Italy, Oct 12 2021).
Talk: *Regularized equation of state of a spherical two-dimensional Bose gas.*

3. **Seminar of Quantech group**, Universidade Federal do Rio Grande do Norte, (online, Sep 2 2021).
Invited talk: *Hydrodynamic excitations in bosonic and fermionic 2D superfluids*.
2. **Quantum seminar**, seminar series of the quantum theory group at the University of Padova, (online, Jun 21 2021).
Talk: *Hydrodynamic excitations in bosonic and fermionic 2D superfluids*.
1. **Kaiserslautern TU Theory Colloquium** (online, Feb 11 2021).
Invited talk: *The physics of shell-shaped Bose-Einstein condensates*

Posters

15. **Atomtronics 2024**, (Benasque, Spain, May 19 - Jun 1 2024).
Poster: *Few-body bound states in low-dimensional fermionic mixtures*.
14. **PASQuanS2.1 First Year Meeting**, (Castelldefels, Spain, Apr 16-17 2024).
Poster: *Binding of bosons with chiral zero-range interactions in one dimension*.
13. **Quantum simulators workshop @ Institut Henri Poincaré**, (Paris, France, Feb 5-9 2024).
Poster: *Few-body bound states in low-dimensional fermionic mixtures*.
12. **Cold atoms workshop**, (Barcelona, Spain, Jan 25-26 2024).
Poster: *Few-body bound states in low-dimensional fermionic mixtures*.
11. **EGAS 54 conference**, (Strasbourg, France, Jun 18-22 2023).
Poster: *Self-bound Fermi-Fermi mixtures in 1D*.
10. **Precision Many-Body Physics**, (Paris, France, Jun 12-14 2023).
Poster: *Self-binding in one- and two-dimensional mass-imbalanced fermionic mixtures*.
9. **Ultracold Quantum Matter: Basic Research and Applications**, (Bad Honnef, Germany, Dec 11-16 2022).
Poster: *Self-binding of one-dimensional fermionic mixtures*.
8. **Workshop of the French national research network on Quantum Gases**, (Lille, France, Oct 24-26 2022).
Poster: *Self-binding of one-dimensional fermionic mixtures*.
7. **BEC 2021 conference** (Sant Feliu de Guixols, Spain, Sep 11-17 2021).
Poster: *Equilibrium and nonequilibrium physics of bubble-trapped condensates*.
6. **QFC2019**, Quantum gases, fundamental interactions and cosmology, (Pisa, Italy, Oct 23-25 2019).
Poster: *Condensation in 2D: from nonuniversal effects to bubble traps*.
5. **SuperFluctuations 2019**, Fluctuations and Highly Non Linear Phenomena in Superfluids and Superconductors, (Padova, Italy, Sep 2-4 2019).
Poster: *Quantum solitons in one-dimensional spin-orbit coupled Bose-Bose mixtures*.
4. **Workshop on Quantum Mixtures** (Trento, Italy, Jul 15-17 2019).
Poster: *Condensation in 2D: from nonuniversal effects to bubble traps*.
3. **New Trends in Complex Quantum Systems Dynamics** (Venezia, Italy, Apr 9-12 2019).
Poster: *Beyond-mean-field functional integration for Bose-Einstein condensates*.
2. **Physics of Strongly Coupled Systems**, Bad Honnef Physics School, (Bad Honnef, Germany, Mar 31 - Apr 5 2018).
Poster: *Beyond-mean-field functional integration for Bose-Einstein condensates*.
1. **SuperFluctuations 2018**, Fluctuations and Highly Non Linear Phenomena in Superfluids and Superconductors, (San Benedetto del Tronto, Italy, Sep 5-7 2018).
Poster: *Low-temperature superfluid density expansion of three- and two- dimensional uniform Bose gases*.

Participation in conferences and schools

3. **Ultracold quantum gases**, Bad Honnef Physics School (Bad Honnef, Aug 8-14 2021).
2. **BECCAL Brainstorming Workshop** (Ulm, Germany, Dec 12-13 2019).
1. **Methods of Path Integration in Modern Physics**, Bad Honnef Physics School, (Bad Honnef, Germany, Aug 25 - 31 2019).