

# Piotr Paweł Deuar:

## Curriculum Vitae

Born: 27 October 1975, Warsaw, Poland

University address: Institute of Physics, Polish Academy of Sciences (PAN),  
Al. Lotników 32/46, 02-668 Warszawa, Poland

Phone: +48 22 116 3456

Fax: +48 22 843 0926

Email: [deuar@ifpan.edu.pl](mailto:deuar@ifpan.edu.pl)

Web: <http://www.ifpan.edu.pl/~deuar/>

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### ACADEMIC QUALIFICATIONS

- 25 Sep 2014     **Habilitation**     Institute of Physics, Polish Academy of Sciences     Warszawa, Poland  
*Stochastic methods for macroscopic quantum dynamics and their applications*
- 27 Feb 2005     **Doctor of Philosophy**     University of Queensland     Brisbane, Australia  
*First-principles quantum simulations of many-mode open interacting Bose gases using stochastic gauge methods.*  
(Submitted 29 June 2004). (cond-mat/0507023)  
Supervisor: Prof. Peter D. Drummond.
- 16 Dec 1996     **Bachelor of Science (Hons)**     University of Queensland     Brisbane, Australia  
*Tests of compatibility between quantum mechanics and macroscopic local realism.*  
(First Class Honours in Physics)  
Supervisor: Dr. Margaret D. Reid.
- 15 Dec 1995     **Bachelor of Science**     University of Queensland     Brisbane, Australia

### DISTINCTIONS

- 6 Dec 2010     The Stefan Pieńkowski Prize of the Polish Academy of Sciences in the field of physics for the year 2010

### EMPLOYMENT

- Oct 2015     Associate Professor (*prof. IF PAN*)     Institute of Physics, PAN, Warsaw, Poland  
– present
- Aug 2009     Assistant Professor (*Adiunkt*)     Institute of Physics, PAN, Warsaw, Poland  
– Sep 2015
- Apr – Jul 2009     Scientific Visitor,     Université Paris-Sud, Orsay, France
- Apr 2007     Marie Curie Research Fellow,     Université Paris-Sud, Orsay, France  
– Mar 2009
- Mar 2006     Postdoc,     Universiteit van Amsterdam, Amsterdam, Netherlands  
– Mar 2007
- Feb 2002     Technical advisor,     Deuar Pty. Ltd., Brisbane, Australia  
– Feb 2006
- Mar 1998     Tutor/PhD Student,     University of Queensland, Brisbane, Australia  
– Jan 2002

## POSITIONS OF RESPONSIBILITY

Jan 2022 – present	Deputy Director for Scientific Affairs, Institute of Physics, Polish Academy of Sciences
Oct 2021 – Dec 2021	Chairman of the Programme Board, Warsaw PhD School in Physical and Biomed Sciences
Oct 2019 – Dec 2021	Head of International PhD studies, Institute of Physics, PAN
May 2019 – Dec 2021	Head of the Physics Specialisation, Warsaw PhD School in Physical and Biomedical Sciences

## RESEARCH GRANTS LED

Jul 2019 – Jul 2024	<b>National Science Centre research grant 2018/31/B/ST2/01871</b> <i>Quantum droplets from first principles.</i> At IF PAN. (998K PLN $\approx$ 230K €)
Jul 2013 – Jul 2019	<b>National Science Centre research grant 2012/07/E/ST2/01389</b> <i>Spontaneous processes in ultracold gases at nonzero temperatures.</i> At IF PAN. (1458K PLN $\approx$ 350K €)
Dec 2010 – Mar 2013	<b>Polish government research grant 1697/7PRUE/2010/7</b> <i>Characterisation of the basic elements of BEC dynamics beyond mean-field.</i> At IF PAN. (239K PLN $\approx$ 60K €)
Sep 2010 – Aug 2012	<b>National Science Centre research grant N N202 128539</b> <i>Dynamic changes of coherence in quantum gases.</i> Project involves 5 researchers at IF PAN. (169K PLN $\approx$ 42K €)
Apr 2010 – Mar 2013	<b>E.U. 7th Framework program research grant PERG06-GA-2009-256291</b> <i>Quantum Dynamics</i> at IF PAN, Poland. (45K €)
Apr 2007 – Mar 2009	<b>Marie Curie Intra-European Fellowship MEIF-CT-2006-041390</b> Grant for independent research into quantum gases at Université Paris-Sud, France. (152K €)
Feb – Apr 2001	<b>University of Queensland Graduate School Research Travelling Award.</b> For travel to and research with Prof. Ryszard Horodecki, University of Gdańsk, Poland. ( $\sim$ 5K AU\$)

## PUBLICATIONS

1. M. Denys, **P. Deuar**, Zhizhao Che, P. E. Theodorakis, *A Lagrangian particle-based numerical model for surfactant-laden droplets at macroscales*, Physics of Fluids 34j, 095126 (2022) (arXiv:2203.12448)
2. J. A. Ross, **P. Deuar**, D. K. Shin, K. F. Thomas, B. M. Henson, S. S. Hodgman, A. G. Truscott, *On the survival of the quantum depletion of a condensate after release from a magnetic trap*, Scientific Reports 12, 13178 (2022) (arXiv:2103.15283)
3. **P. Deuar**, *Multi-time correlations in the positive- $P$ ,  $Q$ , and doubled phase-space representations*, Quantum 5, 455 (2021) (arXiv:2011.10107)
4. T. Świsłocki, M. Gajda, M. Brewczyk, **P. Deuar**, *Spin distillation cooling of ultracold Bose gases*, Scientific Reports 11, 6441 (2021) (arXiv:2011.03507)

5. **P. Deuar**, A. Ferrier, M. Matuszewski, G. Orso, M. H. Szymańska, *Fully quantum scalable description of driven-dissipative lattice models*, PRX Quantum 2, 010319 (2021) (arXiv:2012.02014)
6. J. Pietraszewicz, M. Stobińska, **P. Deuar**, *Correlation evolution in dilute Bose-Einstein condensates after quantum quenches*, Phys. Rev. A 99, 023620 (2019). (arXiv:1310.1301)
7. J. Pietraszewicz, **P. Deuar**, *Classical fields in the one-dimensional Bose gas: Applicability and determination of the optimal cutoff*, Phys. Rev. A 98, 023622 (2018). (arXiv:1707.01776)
8. J. Pietraszewicz, **P. Deuar**, *Complex wave fields in the interacting one-dimensional Bose gas*, Phys. Rev. A 97, 053607 (2018). (arXiv:1808.10251)
9. J. Pietraszewicz, **P. Deuar**, *Mesoscopic density grains in a 1D interacting Bose gas from the exact Yang-Yang solution*, New J. Phys. 19, 123010 (2017). (arXiv:1708.00031)
10. J. Pietraszewicz, E. Witkowska, **P. Deuar**, *Continuum of classical-field ensembles from canonical to grand canonical and the onset of their equivalence*, Phys. Rev. A 96, 033612 (2017). (arXiv:1706.02587)
11. S. Wüster, J. F. Corney, J. M. Rost, **P. Deuar**, *Quantum dynamics of long-range interacting systems using the positive- $P$  and gauge- $P$  representations*, Phys. Rev. E 96, 013309 (2017). (arXiv:1703.06681)
12. **P. Deuar**, *A tractable prescription for large-scale free flight expansion of wavefunctions*, Comput. Phys. Commun. 208, 92 (2016). (arXiv:1602.03395)
13. T. Świsłocki, **P. Deuar**, *Quantum fluctuation effects on the quench dynamics of thermal quasicondensates*, J. Phys. B 49, 145303 (2016). (arXiv:1409.0146)
14. J. Pietraszewicz, **P. Deuar**, *Classical field records of a quantum system: Their internal consistency and accuracy*, Phys. Rev. A 92, 063620 (2015). (arXiv:1504.06154)
15. **P. Deuar**, J-C. Jaskula, M. Bonneau, V. Krachmalnicoff, D. Boiron, C.I. Westbrook, and K.V. Kheruntsyan, *Anisotropy in  $s$ -wave Bose-Einstein condensate collisions and its relationship to superradiance*, Phys. Rev. A 90, 033613 (2014). (arXiv:1406.1327)
16. R. Ng, E. S. Sørensen, **P. Deuar**, *Simulation of the dynamics of many-body quantum spin systems using phase-space techniques*, Phys. Rev. B 88, 144304 (2013). (arXiv:1307.3786)
17. **P. Deuar**, T. Wasak, P. Ziń, J. Chwedeńczuk, M. Trippenbach, *Tradeoffs for number squeezing in collisions of Bose-Einstein condensates*, Phys. Rev. A 88, 013617 (2013). (arXiv:1301.3726)
18. T. Karpiuk, **P. Deuar**, P. Bienias, E. Witkowska, K. Pawłowski, M. Gajda, K. Rzążewski, M. Brewczyk, *Spontaneous solitons in the thermal equilibrium of a quasi-one-dimensional Bose gas*, Phys. Rev. Lett. 109, 205302 (2012). (arXiv:1205.2363)
19. K.V. Kheruntsyan, J-C. Jaskula, **P. Deuar**, M. Bonneau, G.B. Partridge, J. Ruaudel, R. Lopes, D. Boiron, C.I. Westbrook, *Violation of the Cauchy-Schwarz inequality with matter waves*, Phys. Rev. Lett. 108, 260401 (2012). (arXiv:1204.0058)
20. **P. Deuar**, P. Ziń, J. Chwedeńczuk, M. Trippenbach, *Mean field effects on the scattered atoms in condensate collisions*, Eur. Phys. J. D 65, 19 (2011). (arXiv: 1101.5533)
21. **P. Deuar**, J. Chwedeńczuk, M. Trippenbach, P. Ziń, *Bogoliubov dynamics of condensate collisions using the positive- $P$  representation*, Phys. Rev. A 83, 063625 (2011). (arXiv:1105.1324)
22. E. Witkowska, **P. Deuar**, M. Gajda, and K. Rzążewski, *Solitons as the early stage of quasicondensate formation during evaporative cooling*, Phys. Rev. Lett. 106, 135301 (2011). (arXiv:1101.0728)
23. J-C. Jaskula, M. Bonneau, G. B. Partridge, V. Krachmalnicoff, **P. Deuar**, K. V. Kheruntsyan, A. Aspect, D. Boiron, C. I. Westbrook, *Sub-Poissonian number differences in four-wave mixing of matter waves*, Phys. Rev. Lett. 105, 190402 (2010). (arXiv:1008.0845)
24. J. Dziarmaga, **P. Deuar**, K. Sacha, *Comment on “Quantum entangled dark solitons formed by ultracold atoms in optical lattices”*, Phys. Rev. Lett. 105, 018903 (2010). (arXiv:1001.1045)

25. V. Krachmalnicoff, J-C. Jaskula, M. Bonneau, G. B. Partridge, D. Boiron, C. I. Westbrook, **P. Deuar**, P. Ziń, M. Trippenbach, K. Kheruntsyan, *Spontaneous Four-Wave Mixing of de Broglie Waves: Beyond Optics*, Phys. Rev. Lett. 104, 150402 (2010). (arXiv:0911.4564)
26. S. Wüster, J. Stanojevic, C. Ates, T. Pohl, **P. Deuar**, J.F. Corney, J.M. Rost, *Correlations of Rydberg excitations in an ultracold gas after an echo sequence*, Phys. Rev. A 81, 023406 (2010). (arXiv:0911.0772)
27. **P. Deuar**, *Simulation of complete many-body quantum dynamics using controlled quantum–semiclassical hybrids*, Phys. Rev. Lett. 103, 130402 (2009). (arXiv:0903.1309)
28. **P. Deuar**, A. G. Sykes, D. M. Gangardt, M. J. Davis, P. D. Drummond, and K. V. Kheruntsyan, *Non-local pair correlations in the 1D Bose gas at finite temperature*, Phys. Rev. A 79, 043619 (2009). (arXiv:0812.4447)
29. P. D. Drummond, **P. Deuar**, T. Vaughan, and J. F. Corney, *Quantum dynamics in phase space: from coherent states to the Gaussian representation*, J. Mod. Opt. 54, 16 (2007). (arXiv:0710.2831)
30. P. D. Drummond, **P. Deuar**, and J. F. Corney, *Quantum Many-Body Simulations Using Gaussian Phase-Space Representations*, Optics and Spectroscopy 103, 7 (2007). (quant-ph/0608247)
31. **P. Deuar** and P. D. Drummond, *Correlations in a BEC collision: First-principles quantum dynamics with 150 000 atoms*, Phys. Rev. Lett. 98, 120402 (2007). (cond-mat/0607831)
32. **P. Deuar** and P. D. Drummond, *First-principles quantum dynamics in interacting Bose gases II: stochastic gauges*, J. Phys. A: Math. Gen. 39, 2723 (2006). (cond-mat/0501058)
33. **P. Deuar** and P. D. Drummond, *First-principles quantum dynamics in interacting Bose gases I: the positive P representation*, J. Phys. A: Math. Gen. 39, 1163 (2006). (cond-mat/0412174)
34. M. R. Dowling, P. D. Drummond, M. J. Davis, and **P. Deuar**, *Time-reversal test for stochastic quantum dynamics*, Phys. Rev. Lett. 94, 130401 (2005). (quant-ph/0411185)
35. P. D. Drummond, **P. Deuar**, and K. V. Kheruntsyan, *Canonical Bose Gas Simulations with Stochastic Gauges*, Phys. Rev. Lett. 92, 040405 (2004). (cond-mat/0308219)
36. P. D. Drummond and **P. Deuar**, *Quantum dynamics with stochastic gauge simulations*, J. Opt. B-Quant. and Semiclass. Opt. 5, S281-S289 (2003). (cond-mat/0309514)
37. P. Badziąg, **P. Deuar**, M. Horodecki, P. Horodecki, and R. Horodecki, *Concurrence in arbitrary dimensions*, J. Mod. Opt. 49, 1289 (2002). (quant-ph/0107147)
38. **P. Deuar** and P. D. Drummond, *Gauge P-representations for quantum-dynamical problems: Removal of boundary terms*, Phys. Rev. A 66, 033812 (2002). (quant-ph/0203025)
39. **P. Deuar** and P. D. Drummond, *Stochastic gauges in quantum dynamics for many-body simulations*, Comput. Phys. Commun. 142, 442 (2001). (quant-ph/0203108)
40. **P. Deuar**, W. J. Munro, and K. Nemoto, *Upper bound on the region of separable states near the maximally mixed state*, J. Opt. B: Quantum Semiclass. Opt. 2, 225 (2000). (quant-ph/0002002)
41. **P. Deuar** and W. J. Munro, *Quantum copying can increase the practically available information*, Phys. Rev. A 62, 042304 (2000). (quant-ph/0008032)
42. **P. Deuar** and W. J. Munro, *Information transfer and fidelity in quantum copiers*, Phys. Rev. A 61, 062304 (2000). (quant-ph/0003054)
43. **P. Deuar** and W. J. Munro, *Improving detectors using entangling quantum copiers*, Phys. Rev. A 61, 010306(R) (2000). (quant-ph/9911103)
44. A. Gilchrist, **P. Deuar**, M. D. Reid, *Contradiction of quantum mechanics with local hidden variables for quadrature phase measurements on pair-coherent states and squeezed macroscopic superpositions of coherent states*, Phys. Rev. A 60, 4259 (1999). (quant-ph/0010024)

45. M. D. Reid and **P. Deuar**, *Macroscopic Local Realism: How Do We Define It and Is It Compatible with Quantum Mechanics?*, Ann. Phys. 265, 52 (1998).
46. A. Gilchrist, **P. Deuar**, M. D. Reid, *Contradiction of Quantum Mechanics with Local Hidden Variables for Quadrature Phase Amplitude Measurements*, Phys. Rev. Lett. 80, 3169 (1998).

Book chapters:

47. P. Rungta, W. J. Munro, K. Nemoto, **P. Deuar**, G. J. Milburn, and C. M. Caves, *Qudit Entanglement*. LNP 561 “Directions in Quantum Optics: A Collection of Papers Dedicated to the Memory of Dan Walls” (Eds. H. Carmichael, R. Glauber, and M. O. Scully, Springer, Berlin, 2001, p. 149-164). (quant-ph/0001075)

In conference proceedings:

48. P. D. Drummond, T. Vaughan, J. F. Corney, G. Leuchs, and **P. Deuar**, *Coherence and Correlations in Atom Lasers*, Proc. 9th Rochester Conf. on Coherence and Quantum Optics (CQO9), paper IB-2 (2007). (arXiv:0710.2842)
49. P. D. Drummond, **P. Deuar**, J. F. Corney, and K. V. Kheruntsyan, *Stochastic gauge: a new technique for quantum simulations*, Proc. 16th Int. Conf. on Laser Spectroscopy, Australia, 13-18 July 2003 (Eds. P. Hannaford, A. Sidorov, H. Bachor, and K. Baldwin, World Scientific, Singapore, 2004, p. 161-170). (cond-mat/0309537)

Preprints:

50. **P. Deuar**, J. Pietraszewicz, *A semiclassical field theory that is freed of the ultraviolet catastrophe* (arXiv:1904.06266)
- **P. Deuar**, *First-principles quantum simulations of many-mode open interacting Bose gases using stochastic gauge methods* (PhD thesis)(arXiv:cond-mat/0507023)

**Citations:** 1161, h-index: 20  
(24 Sep 2022, ISI Web of Science)

## TEACHING

- Nov – Dec 2009 “Modern Research in Physics”, 5th year lectures, Warsaw University of Technology.
- 2009 – 2010 “Quantum Mechanics”, 4th year classes, Uni. Kard. Wyszyński, Warsaw, Poland.
- Sep 2009 “Ultracold Fermi Gases”, CIKAS summer school – Quantum Engineering, University of Warsaw.
- 1998 – 2000 Casual tutor at the Department of Physics, University of Queensland. Taught a variety of first-year physics and engineering courses to groups of 10–30 students. Included both laboratory, tutorial and marking.

## SUPERVISION

### PhD students

- 2020 - : Maciej Kruk
- 2019 - 2022 : Soheil Arbabi (auxiliary supervisor: Dr Panagiotis Theodorakis)  
(took over in 2022)
- 2020 - 2022 : Russell Kajouri (auxiliary supervisor: Dr Panagiotis Theodorakis)  
(took over in 2022)
- 2021 - 2022 : Luis Carnevale da Cunha (auxiliary supervisor: Dr Panagiotis Theodorakis)  
(took over in 2022)

### Postdocs

- 2021 - : King Lun Ng
- 2014-2019 : Joanna Pietraszewicz (now editor at Acta Physica Polonica)
- 2014-2015 : Tomasz Świsłocki (now faculty at SGGW)
- 2012-2013 : Magdalena Stobińska (now faculty at UW)

### Students

Intern research projects (students from Warsaw University):

- 2014-2016 : Igor Nowicki
- 2016 : Mateusz Mańko
- 2016-2017 : Karolina Borek (BSc supervisor, co-supervisor: Dr hab. Adam Bednorz)

2010-2015

Informally took part in supervising Ray Ng, a PhD student of Prof. Erik Sørensen from McMaster University in Canada.

2009-2011

I took scientific care of winners of the “First Step to Nobel Prize in Physics” competition, who as part of the prize would come to the IF PAN institute for a month of research experience. They were young students who has just finished high school or were starting their first year at university:

1. 2009: Ms Hadass Tzaban from the Ulpenat Bnei Akiva school, Netivot, Israel.
2. 2010: Mr Eli Gudinetsky from the Religious Comprehensive “Amit” High School / Ben-Gurion University of the Negev, Be’er-Sheva, Israel.
3. 2011: Mr Ivan Maslov from the Chelyabinsk Physics-Mathematical Lyceum 31.

## THESIS EXAMINER

PhD theses	3	(University of Queensland, Swinburne University of Technology, Newcastle University)
Habilitations	5	(Warsaw University (x2), Warsaw Technical University, Institute of Physics Polish Academy of Sciences, Jagiellonian University)