

Piotr Paweł Deuar:

Curriculum Vitae

Born: 27 October 1975, Warsaw, Poland

University address: Institute of Physics, Polish Academy of Sciences (PAN),
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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 Piekowski Prize of the Polish Academy of Sciences in the field of physics for the year 2010

EMPLOYMENT

Oct 2015 Associate Professor, Polish Academy of Sciences, Warsaw, Poland.
– present (*prof. IF PAN*)

Aug 2009 Assistant Professor, Polish Academy of Sciences, Warsaw, Poland.
– Sep 2015 (*Adiunkt*)

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

RESEARCH GRANTS LED

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

PUBLICATIONS

1. 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)
2. **P. Deuar**, *A tractable prescription for large-scale free flight expansion of wavefunctions* Comput. Phys. Commun. 208, 92 (2016). (arXiv:1602.03395)
3. T. Świsłocki, **P. Deuar**, *Quantum fluctuation effects on the quench dynamics of thermal quasicondensates* J. Phys. B 49, 145303 (2016). (arXiv:1409.0146)
4. 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)
5. **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)
6. 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)
7. **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)
8. T. Karpiuk, **P. Deuar**, P. Bienias, E. Witkowska, K. Pawłowski, M. Gajda, K. Rzażewski, M. Brewczyk, *Spontaneous solitons in the thermal equilibrium of a quasi-one-dimensional Bose gas* Phys. Rev. Lett. 109, 205302 (2012). (arXiv:1205.2363)

9. K.V. Kheruntsyan, J-C. Jaskula, **P. Deuar**, M. Bonneau, G.B. Partridge, J. Ruauudel, 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)
10. **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)
11. **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)
12. E. Witkowska, **P. Deuar**, M. Gajda, and K. Rzażewski, *Solitons as the early stage of quasicondensate formation during evaporative cooling* Phys. Rev. Lett. 106, 135301 (2011). (arXiv:1101.0728)
13. 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)
14. 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)
15. 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)
16. 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)
17. **P. Deuar**, *Simulation of complete many-body quantum dynamics using controlled quantum–semiclassical hybrids*, Phys. Rev. Lett. 103, 130402 (2009). (arXiv:0903.1309)
18. **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)
19. 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)
20. 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)
21. **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)
22. **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)
23. **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)
24. 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)
25. 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)
26. 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)
27. P. Badziąg, **P. Deuar**, M. Horodecki, P. Horodecki, and R. Horodecki, *Concurrence in arbitrary dimensions*, J. Mod. Opt. 49, 1289 (2002). (quant-ph/0107147)
28. **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)

29. **P. Deuar** and P. D. Drummond, *Stochastic gauges in quantum dynamics for many-body simulations*, Comput. Phys. Commun. 142, 442 (2001). (quant-ph/0203108)
30. **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)
31. **P. Deuar** and W. J. Munro, *Quantum copying can increase the practically available information*, Phys. Rev. A 62, 042304 (2000). (quant-ph/0008032)
32. **P. Deuar** and W. J. Munro, *Information transfer and fidelity in quantum copiers*, Phys. Rev. A 61, 062304 (2000). (quant-ph/0003054)
33. **P. Deuar** and W. J. Munro, *Improving detectors using entangling quantum copiers*, Phys. Rev. A 61, 010306(R) (2000). (quant-ph/9911103)
34. 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)
35. 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).
36. 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:

37. 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:

38. 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)
39. 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:

40. J. Pietraszewicz, **P. Deuar**, *Mesoscopic density grains in the 1d interacting Bose gas from the exact Yang-Yang solution* (arXiv:1708.00031)
41. J. Pietraszewicz, **P. Deuar**, *Complex wave fields in the interacting 1d Bose gas: when do they apply, and where to cut off the coherent region?* (arXiv:1707.01776)
42. J. Pietraszewicz, E. Witkowska, **P. Deuar**, *A continuum of c-field ensembles from canonical to grand canonical and the onset of their equivalence* (arXiv:1706.02587)
43. **P. Deuar**, M. Stobińska, *Correlation waves after quantum quenches in one- to three-dimensional BECs* (arXiv:1310.1301)
 - **P. Deuar**, *First-principles quantum simulations of many-mode open interacting Bose gases using stochastic gauge methods* (PhD thesis)(cond-mat/0507023)

Citations: 854, h-index: 18

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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

- 2010-2015 Informally took part in supervising Mr Ray Ng, a PhD student of Prof. Erik Sørensen from McMaster University in Canada.
- 2014-2016 Intern research projects (students from Warsaw University):
- 2014-2016: Mr Igor Nowicki
 - 2016: Mr Mateusz Mańko
 - 2016-2017: Ms Karolina Borek
- 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, Beer-Sheva, Israel.
 3. 2011: Mr Ivan Maslov from the Chelyabinsk Physics-Mathematical Lyceum 31.