

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
– Jul 2018 **National Science Centre research grant 2012/07/E/ST2/01389**
Spontaneous processes in ultracold gases at nonzero temperatures. At IF PAN.
(1458K PLN \approx 350K €)
- Dec 2010
– Mar 2013 **Polish government research grant 1697/7PRUE/2010/7**
Characterisation of the basic elements of BEC dynamics beyond mean-field. At IF PAN.
(239K PLN \approx 60K €)
- Sep 2010
– Aug 2012 **National Science Centre research grant N N202 128539**
Dynamic changes of coherence in quantum gases. Project involves 5 researchers at IF PAN.
(169K PLN \approx 42K €)
- Apr 2010
– Mar 2013 **E.U. 7th Framework program research grant PERG06-GA-2009-256291**
Quantum Dynamics at IF PAN, Poland.
(45K €)
- Apr 2007
– Mar 2009 **Marie Curie Intra-European Fellowship MEIF-CT-2006-041390**
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. **P. Deuar**, *A tractable prescription for large-scale free flight expansion of wavefunctions* Comput. Phys. Commun. 208, 92 (2016). (arXiv:1602.03395)
2. T. Świsłocki, **P. Deuar**, *Quantum fluctuation effects on the quench dynamics of thermal quasicondensates* J. Phys. B 49, 145303 (2016). (arXiv:1409.0146)
3. 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)
4. **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)
5. 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)
6. **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)
7. 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)
8. 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)

9. **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)
10. **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)
11. 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)
12. 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)
13. 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)
14. 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)
15. 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)
16. **P. Deuar**, *Simulation of complete many-body quantum dynamics using controlled quantum–semiclassical hybrids*, Phys. Rev. Lett. 103, 130402 (2009). (arXiv:0903.1309)
17. **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)
18. 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)
19. 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)
20. **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)
21. **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)
22. **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)
23. 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)
24. 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)
25. 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)
26. P. Badziąg, **P. Deuar**, M. Horodecki, P. Horodecki, and R. Horodecki, *Concurrence in arbitrary dimensions*, J. Mod. Opt. 49, 1289 (2002). (quant-ph/0107147)
27. **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)
28. **P. Deuar** and P. D. Drummond, *Stochastic gauges in quantum dynamics for many-body simulations*, Comput. Phys. Commun. 142, 442 (2001). (quant-ph/0203108)

29. **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)
30. **P. Deuar** and W. J. Munro, *Quantum copying can increase the practically available information*, Phys. Rev. A 62, 042304 (2000). (quant-ph/0008032)
31. **P. Deuar** and W. J. Munro, *Information transfer and fidelity in quantum copiers*, Phys. Rev. A 61, 062304 (2000). (quant-ph/0003054)
32. **P. Deuar** and W. J. Munro, *Improving detectors using entangling quantum copiers*, Phys. Rev. A 61, 010306(R) (2000). (quant-ph/9911103)
33. 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)
34. 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).
35. 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:

36. 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:

37. 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)
38. 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:

39. 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)
 40. 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* (arXiv:1703.06681)
 41. **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: 823, h-index: 18
(5 May 2017, 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

- 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.