Karen V. Kheruntsyan

Curriculum Vitae

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EMPLOYMENT HISTORY

01/01/2018–present	***Professor,*** School of Mathematics and Physics (SMP), University of Queensland (UQ), Brisbane, Australia
01/01/2015–31/12/2017	***Associate Professor,*** SMP, UQ
01/01/2011–31/12/2014	***Australian Research Council (ARC) Future Fellow and UQ ResTeach Affiliate,*** SMP, UQ
01/01/2008–31/12/2010	***Senior Research Fellow and UQ ResTeach Affiliate,*** Chief Investigator in the ARC Centre of Excellence for Quantum-Atom Optics (ACQAO), UQ
01/01/2004–31/12/2007	***Senior Research Fellow,*** Chief Investigator, ACQAO, UQ.
01/01/2001–31/12/2003	***ARC Senior Research Associate***, UQ.
01/07/2000–31/12/2000	***Lecturer***, UQ.
01/01/2000–31/06/2000	***ARC Senior Research Associate***, UQ.
01/10/1997–31/09/1999	***UQ Postdoctoral Research Fellow***, UQ.
04/10/1996–31/09/1997	***ARC Research Associate***, UQ.
1992–1996	***Junior Research Scientist (with interruptions),*** Institute for Physical Research, National Academy of Science, Armenia

EDUCATION

1989–1992 *PhD studies*, Institute for Physical Research, National Academy of Science, Armenia

1983–1988 *Undergraduate/Postgraduate studies*, Yerevan State University, Yerevan, Armenia

DEGREES AWARDED

1993 *PhD in Physics*, Institute for Physical Research, National Academy of Science, Armenia

1988 *MSc*, Yerevan State University, Yerevan, Armenia

AWARDS / PRIZES / FELLOWSHIPS

2016 UQ Faculty of Science Teaching Excellence Award
2010 ARC Future Fellowship Award
2005 ARC Centre of Excellence Fellow

1997 UQ Postdoctoral Research Fellowship

1994 Finalist (winner in Physics) for the Young Scientists'94 award by the Pan-Armenian Fund ''Hayastan''

1993 International Science Foundation Award – Individual Grants Program for the Scientists from the Former USSR, Institute for Physical Research, Armenia

1988 MSc Diploma with Excellence (*Cum Laude*), Yerevan State University, Yerevan, Armenia

COMPETITIVE RESEARCH AND TEACHING GRANTS RECEIVED

2018 **$2,038** for 1 year, SMP Teaching and Learning grant "An online reading quiz module for PHYS2041- Quantum Physics".

2017 **$119,570** for 1 year (2017), UQ Major Equipment and Infrastructure Grant "Upgrading cryogenic characterisation facility for optoelectronic measurements in a full range of cryogenic temperatures"; Chief Investigators: E. Nambas, A. Fedorov, S. C. Lo, J. Clegg, B. Powell, W. Boswen, A. White, T. Stace, T. Plakhotnik, A. Rakic, K.V. Kheruntsyan.

2016 **$586,828** for 3 years (2017-2019), UQ Precision Sensing Initiative; Chief Investigators: W. Bowen, M. Bromley, M. Bruenig, J. Carpenter, M.J. Davis, A. Fedorov, K.V. Kheruntsyan, Y.-L. Lim, G. Milburn, E. Nambas, T. Niemenen, T. Plakhotnik, A. Rakic, H. Rubinsztein-Dunlop, T. Stace, A. White, S. Wilson.

2016 **$366,000** for 3 years (2017-2019), ARC Discovery Project "Quantum matter far-from-equilibrium", Chief Investigator: K. V. Kheruntsyan; Partner Investigator: J. Schmiedmayer

2015 **$161,229** for 1 year, UQ Major Equipment and Infrastructure Grant "Advanced superfluid physics facility". Chief Investigators: W. Bowen, M. Bromley, M. Davis, A. Fedorov, K.V. Kheruntsyan, I. McCulloch, L. Madsen, G. Milburn, E. Moore, E. Nambas, T. Plakhotnik, B. Powell, A. Rakic, M. Riley, H. Rubinsztein-Dunlop, T. Stace, A. White.

2015 **$3,271** for 1 year, SMP Teaching and Learning grant "Conceptual Checkpoints: an Interactive eLearning Module for PHYS3020 – Statistical Mechanics"

2013 **$330,000** for 3 years (2014-2016), ARC Discovery Project "Emergent physics in quantum transport with ultracold atoms". Chief Investigator: K.V. Kheruntsyan

2013 **$20,000** for 2 years (2014-2015), Group of Eight Australia – DAAD Germany Joint Research Cooperation Grant "Einstein-Podolsky-Rosen entanglement in ultracold atomic gases". Chief Investigator: K.V. Kheruntsyan; Partner Investigator: M. Oberthaler

2011 **$385,000** for 3 years (2012-2014), ARC Discovery Project Grant "Quantum nonlocality tests with untracold atoms". Chief Investigators: A.G. Truscott, K.V. Kheruntsyan, K.G. Baldwin. Partner Investigators: A. Aspect, C.I. Westbrook

2010 **$791,192** for 4 years (2011-2014, including salary), ARC Future Fellowship "Fundamental tests of quantum mechanics with ultracold atomic gases". Chief Investigator: K.V. Kheruntsyan

2010 **$405,000** for 3 years (2011-2013), ARC Discovery Project Grant "Quantum Equilibration". Chief Investigators: K.V. Kheruntsyan and M.J. Davis; Partner Investigators: G.V. Shlyapnikov, M. Rigol, J-S. Caux, and N.J. van Druten

2006 **$68,000** for 3 years (2007-2010), ARC Linkage International Award "Quantum correlations in ultra-cold Fermi gases". Chief Investigators: P.D. Drummond, X.-J. Liu, J.F. Corney, and K.V. Kheruntsyan.

2004 **$10,000** ARC Networks, "Quantum Many-Body Systems Network: Breakthrough Science and Frontier Technologies". Chief Investigators: D. Hannan, M. Gould, S. Bartlett, M.T. Batchelor, V. Bazhanov, P. Bouwknegt, A.J. Bracken, K. Burrage, A.L. Carey, M.Cowling, P.D. Drummond, O. Foda, P. Forrester, A. Guttmann, C.J. Hamer, P.D. Jarvis, D. Jayatilaka, I. Jensen, K. Kheruntsyan, J.R. Links, I. McArthur, R. McKenzie, G.J. Milburn, M. Nielsen, A. Owczarek, P.A. Pearce, K. Seaton, R.H. Street, Y.-Z. Zhang, H.-Q. Zhou.

2003 **$750,000** over 5 years (2003-2007), Queensland Government matching funds to the UQ Node of the ARC Centre of Excellence for Quantum-Atom Optics. Chief Investigators: P.D. Drummond, K. Kheruntsyan, J.F. Corney, M.J. Davis, M. Reid.

2003 **$16,950,000** over 8 years (2003-2010), ARC Centre of Excellence Grant – Australian Centre for Quantum-Atom Optics (UQ component: $2,554,000). Chief Investigators: H.A. Bachor, K.G. Baldwin, J.D. Close, J.J. Hope, Y.S. Kivshar, P.K. Lam, E.A. Ostrovskaya, C.M. Savage, A.G. Truscott, J.F. Corney, M.J. Davis, P.D. Drummond, K.V. Kheruntsyan, M.D. Reid, M.K. Olsen, B.J. Dalton, P. Hannaford, T.D. Kieu, R. McLean, W.J. Rowlands, A. Sidorov.

2002 **$25,000** - UQ Research Development Grant "Quantum correlations in degenerate Bose gases". Chief Investigators: P.D. Drummond, A. Bracken, M. Reid, M. Gould, K.V. Kheruntsyan and Y-Zh. Zhang.

2001 **$15,000** - UQ Early Career Researcher Grant "Prospects for superchemistry: Non-linear mater-wave optics with interacting atomic and molecular quantum gases". Chief Investigator: K.V. Kheruntsyan.

2000 **$18,000** - ARC Small Grant "Coherent bosonization in Fermi gases". Chief Investigators: P.D. Drummond and K.V. Kheruntsyan.

1999 **$19,350** - ARC Small Grant "Vortices and solitons in Bose-Einstein condensates". Chief Investigators: P.D. Drummond and K.V. Kheruntsyan.

1997 **$10,000** plus salary - UQ Postdoctoral Research Fellowship "Quantum optical solitons in higher dimensions". Chief Investigator: K.V. Kheruntsyan.

1995 Travel grant from the EC Action for Cooperation in Science and Technology with Central and Eastern European countries for attending the European Research Conference on Quantum Optics, Davos, Switzerland (23–28 September 1995).

1993 **US$500** - Grant from the International Science Foundation – Individual Grants Program for the Scientists from the Former USSR, Institute for Physical Research, National Academy of Science, Armenia. Chief Investigator: K.V. Kheruntsyan.

TEACHING AND STUDENT SUPERVISION

- Courses taught:
  - PHYS2041 – 2nd year Quantum Physics, since 2017 (course coordinator, lecturer)
  - PHYS3020 – 3rd year Statistical Mechanics, since 2008 (course coordinator, lecturer)
  - PHYS4030 – 4th year Condensed Matter Physics, since 2015 (lecturer)
  - PH341 – 3rd year Statistical Mechanics, 1998-2000 (lecturer)
  - PH454 – 4th year Quantum Optics, 1999 (lecturer)
- Student supervision:
  - 13 PhD students (12 completed, 1 current)
  - 13 Honours students (11 completed, 2 University Medalists)
  - 12 Summer Vacation and International Exchange Students (all completed)

PUBLICATIONS AND IMPACT

- Total number of publications in international refereed journals: 80 (see **Appendix A** for the list of 10 career-best publications with citations, and **Appendix B** for the full list)
  - total number of citations received: >2,300 (Web of Science)
  - *h*-index: 28 (WoS); average number of citations per publication: 28.43 (WoS)
  - 35% of publications in the last ten years are published in the discipline's leading journals Physical Review Letters, Nature Physics, and Nature Communications.
  - Five most highly cited papers received 291, 185, 149, 125 and 104 citations, respectively
  - Received more than 100 citations per year in the last 14 consecutive years
  - For updated citation metrics, see www.researcherid.com/rid/A-1725-2010

- Co-Editor (with R.E. Robson and P.D. Drummond) of the *Proceedings of the Conference on Computational Physics 2000*, published as a Special Issue of the *Journal of Computer Physics Communications*, Vol. **142**, No. 1–3 (2001)

INVITED CONFERENCE TALKS AND VISITING POSITIONS

2016 Invited Talk, 25th Intern. Laser Physics Workshop (11–16 July 2016, Yerevan, Armenia)

2015 Invited Talk, Kangaroo Island Cold Atoms Workshop (26 - 29 November 2015, Kangaroo Island, SA, Australia)

2015 Invited Talk, International Workshop on Nonlinear Physics at the Nanoscale: A Cross-Fertilization on Stochastic Methods (2-6 February 2015, Rotorua, New Zealand)

2014 Invited Talk, International Workshop on Nonlinear Physics at the Nanoscale: A Cross-Fertilization on Stochastic Methods (12-16 May 2014, Dresden, Germany)

2009 Visiting Research Professor, Institut d'Optique, CNRS, Palaiseau, France

2008 Visiting Research Professor, Institut d'Optique, CNRS, Palaiseau, France

2008 Invited talk, ICO-21: 21st Congress of the International Commission for Optics (7-10 July 2008, Sydney, Australia)

2007 Invited Talk, International Workshop "Non-equilibrium behavior in superfluid gases at finite temperature" (10–13 June 2007, Sandbjerg, Denmark)

2007 Invited Talk, International Workshop "Quantum Engineering based on Atoms and Photons" (26 March–2 February 2007, Hannover, Germany)

2007 Participant, "Quantum Gases" Research Program, Institut Henri Poincare, Paris, France

2006 Invited Talk, 15th International Laser Physics Workshop (24–28 July 2006, Lausanne, Switzerland)

2004 Invited Talk, 13th Intern. Laser Physics Workshop (12–16 July 2004, Trieste, Italy)

2004 Participant, "Quantum Gases" Research Program, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, USA

2003 Visiting Researcher, FOM-Instituut AMOLF, Amsterdam, Netherlands

2002 Participant, "Physics of Ultracold Dilute Atomic Gases" Research Program, Benasque Centre of Science, Spain

2001 Visiting Researcher, The University of Texas, Austin, USA

SERVICE

- Acting Chair of the UQ School and Mathematics and Physics (SMP) Engagement Committee and Ex-officio member of the SMP Executive Committee (07-12/2016)
- Member of the SMP Engagement Committee (2015–current)
- Academic Supervisor of the UQ Science Demo Troupe (2015–current)
- Member of the Postgraduate Confirmation Committee for Physics (2011–current)
- Member of the SMP Curriculum Review Committee for Thermodynamics – Statistical Mechanics – Condensed Matter stream (2011, 2013)
- Chair of the Student-Staff Liaison Committee for Physics (2010-11)
- Expert of International Standing – referee for the Australian Research Council
- Member of the External Review Committee for the 2016 review of the Quantum Systems Unit of the Okinawa Institute of Science and Technology (OIST) Graduate University
- International Assessor for the Foundation for Polish Science
- International Assessor for the Austrian Science Fund
- International Assessor for the Laboratoire d'Excellence Physique: Atomes Lumiere Matière, France
- Member of the Australian Institute of Physics
- Member of the American Physics Society

- Referee for professional journals: *Nature Communications; Physical Review Letters; Physical Review A*; *Journal of Physics B: Atomic, Molecular and Optical Physics*, *Optics Communications, Journal of Modern Optics*
- Member of the Program Committee for the International Workshop "Quantum-Atom Optics Beyond Bells" (26-28 November 2008, Lorne, Australia)
- Member of the Organising Committee for the Australasian Workshop On Emergent Quantum Matter (24–28 November 2014, North Stradbroke Island, Queensland, Australia)
- Chair of the Program Committee for the International Workshop on Quantum Noise (14–18 May 2007, Caloundra, Australia)
- Member of the Program Committee and Deputy-Chair of the Organizing Committee for the Workshop on Bose-Einstein Condensation and Quantum Information (16–20 February 2003, Caloundra, Australia)
- Member of the Program Committee and Secretary-Treasurer of the Organizing Committee for the IUPAP Conference on Computational Physics 2000 (3–8 December 2000, Gold Coast, Australia)

MOST SIGNIFICANT CONTRIBUTIONS TO THE RESEARCH FIELD

A/Prof Kheruntsyan is recognised internationally for his pioneering contributions in theoretical quantum atom optics within the field of degenerate quantum gases, most notably: (i) in the theory of coherently coupled atomic-molecular Bose-Einstein condensates, (ii) theory of atom-atom correlations and thermodynamics of one-dimensional (1D) Bose gases, and (iii) foundational tests of quantum mechanical entanglement with mater waves. His work has often inspired breakthrough experiments in the leading laboratories worldwide and influenced subsequent trends in theory. More specifically, Kheruntsyan's most significant contributions are:

1. Theory of coherently coupled atomic-molecular Bose-Einstein condensates. In 1998 Kheruntsyan (with Drummond and He) introduced a new field-theoretic model for the description of coherently coupled atomic and molecular Bose-Einstein condensates (BECs) [*Phys. Rev. Lett.* **81**, 3055 (1998)]. This work, together with a follow-up groundbreaking proposal of "super-chemistry" [*Phys. Rev. Lett.* **84**, 5029 (2000)], has inspired the development of novel approaches to the creation of molecular condensates from atomic condensates, leading to the production of such condensates in more than 12 laboratories worldwide. Subsequent developments in the theory and experiments on coherently coupled atomic-molecular systems helped to solve a long-standing problem from condensed matter physics – "the BCS-BEC crossover" problem, which pertains to the understanding of the nature of the transition from the Bardeen–Cooper–Schrieffer (BCS) to Bose–Einstein condensate superfluidity.

2. Theory of atom-atom correlations and thermodynamics of one-dimensional (1D) Bose gases. In 2003, Kheruntsyan produced the world-first exact calculation of atom-atom pair correlations in a 1D Bose gas [*Phys. Rev. Lett.* **91**, 040403 (2003)]. The 1D Bose gas is of fundamental importance to quantum many-body physics as the underlying theoretical model belongs to an important class of exactly integrable models. By calculating the atom-atom correlation functions for arbitrary interaction strengths and temperatures, Kheruntsyan and co-workers (D. Gangardt, P. D. Drummond, and G. V. Shlyapnikov) have been able for the first time to map out the complete phase diagram of the system and to propose simple correlation measurements that could test the theoretical predictions experimentally. These predictions were confirmed in 2004 in the NIST group of Nobel laureate W. Phillips. In 2008, Kheruntsyan and the experimental group of N. van Druten (University of Amsterdam) published another high-impact paper on the thermodynamic properties of 1D Bose gases created on an atom chip [*Phys. Rev. Lett.* **100**, 090402 (2008)]. The team has succeeded in comparing the temperature and atom number density of the 1D quantum gas to the exact theory developed by C.N. Yang (Nobel 1957) and C.P. Yang back in 1969. Further insights into thermodynamic properties of 1D Bose gases came through Kheruntsyan's contribution to the interpretation of experimental measurements of density fluctuations [*Phys. Rev. Lett.* **106**, 230405 (2011), *Phys. Rev. Lett.* **105**, 230402 (2010)] performed in Dr I. Bouchoule's lab at the Institut d'Optique of France. This series of works probed one of cornerstone theorems of statistical mechanics – the fluctuation-dissipation theorem, in addition to proposing a new (higher-order) version of the theorem based on the measurements of the third-order moment of density fluctuations. The experimental and theoretical methods developed in these papers for measuring and describing atom-number fluctuations have now become a 'must-have' tool in many laboratories around the world, studying the phase diagrams of other important ultracold atom systems.

3. Foundational tests of quantum mechanical correlations and entanglement with massive particles. In the area of fundamental tests of quantum mechanical entanglement, Kheruntsyan (with Olsen and Drummond) has made a pioneering proposal for demonstrating the famous Einstein-Podolsky-Rosen (EPR) paradox using correlated atom-laser beams produced via coherent dissociation of a molecular condensate [*Phys. Rev. Lett.* **95**, 150405 (2005)]. This process is the atom-optics analog of parametric down-conversion with photons, which played a pivotal role in the advancement of quantum optics in the 1980s and led to the modern understanding of foundational principles of quantum mechanics with photons. Kheruntsyan has also established research collaboration with a world-renowned experimental group of Aspect and Westbrook (Institut d'Optique, France) aiming at an experimental demonstration of EPR entanglement and Bell inequality violation in a related ultracold atom system – colliding metastable helium condensates. To this end, the team has reported an observation and characterisation of two important precursors of such entanglement – reduction of atom number fluctuations below the Poissonian level [*Phys. Rev. Lett.* **105**, 190402 (2010] and violation of the classical Cauchy-Schwartz inequality [*Phys. Rev.*

Lett. **108**, 260401 (2012)]. Kheruntsyan's most recent work in this area include novel theoretical proposals for demonstrating an atomic analog of the celebrated Hong-Ou-Mandel effect [*Nature Comms.* **5**, 3752 (2014)] and violating a motional-state Bell inequality with ultracold atoms [*Phys. Rev. A* **91**, 052114 (2015)].

4. Stochastic phase-space methods for simulating quantum many-body dynamics. Kheruntsyan is an internationally recognised expert in using stochastic phase-space methods for simulating the quantum dynamics of interacting Bose-Einstein condensates. He was the first to perform *ab initio* simulations of coherent dissociation of molecular condensates [*Phys. Rev. Lett.* **95**, 150405 (2005), *Phys. Rev. Lett.* **99**, 220404 (2007), *Phys. Rev. A* **74**, 033620 (2006)] and to provide the first accurate quantitative models of the experiments on collisions of metastable helium condensates [*New J. Phys.* **10**, 045021 (2008), *Phys. Rev. A* **79**, 021606 (2009)] using the positive-*P* representation. He is also a co-inventor (with P. D. Drummond and P. Deuar) of two new theoretical approaches to many-body simulations: (*i*) the 'stochastic gauge' approach [Phys. Rev. Lett. **92**, 040405 (2004)] for studying equilibrium properties of interacting many-body systems using 'imaginary-time' evolution, and (*ii*) the stochastic Bogoliubov approach [*Phys. Rev. Lett.* **104**, 150402 (2010), *Phys. Rev. Lett.* **108**, 260401 (2012)] for dynamical simulations using the linearized treatment of quantum fluctuations [*Phys. Rev. Lett.* **105**, 190402 (2010), *Nature Comms.* **5**, 3752 (2014), *Phys. Rev. A* **90**, 033613 (2014)], which is an alternative to the standard (but often numerically intractable) Bogoliubov-de Genes approach.

APPENDIX A

TEN CAREER-BEST PUBLICATIONS WITH CITATIONS

The citation statistics below are according to the Web of Science (WoS) as at 6 December 2017.

Citation metrics are updated at: www.researcherid.com/rid/A-1725-2010

1. *Coherent molecular solitons in Bose-Einstein condensates.*
   P. D. Drummond, K. V. Kheruntsyan, and H. He,
   Physical Review Letters **81**, 3055 (1998). [185 citations]

   – *This pioneering work introduced a field-theoretic description of coherently coupled atomic-molecular Bose-Einstein condensates (BECs) and helped to understand the physics of the BCS-BEC crossover with Feshbach resonance molecules.*

2. *Superchemistry: dynamics of coupled atomic and molecular Bose-Einstein condensates.*
   D. J. Heinzen, R. H.Wynar, P. D. Drummond, and K. V. Kheruntsyan,
   Physical Review Letters **84**, 5029 (2000). [291 citations]
   Highly Cited Paper in the 2000 decade according to WoS/Essential Science Indicators

   – *We have proposed a new type of **coherent** chemical reaction dubbed "superchemistry"; the work has significantly impacted the development of experimental methods to create molecular BECs.*

3. *Pair correlations in a finite-temperature 1D Bose gas.*
   K. V. Kheruntsyan, D. M. Gangardt, P. D. Drummond, and G. V. Shlyapnikov,
   Physical Review Letters **91**, 040403 (2003). [149 citations]

   – *This work solved a long-standing problem of atom-atom correlations in a 1D Bose gas, which is an integrable model and therefore is of fundamental importance to quantum many-body physics.*

4. *Einstein-Podolsky-Rosen correlations via dissociation of a molecular Bose-Einstein condensate.*
   K. V. Kheruntsyan, M. K. Olsen, and P. D. Drummond,
   Physical Review Letters **95**, 150405 (2005). [69 citations]

   – *A pioneering proposal to use dissociation of a molecular BEC as a new method for demonstrating the Einstein-Podolsky-Rosen paradox with a macroscopic number of atoms in the matter-wave regime.*

5. *Quantum atom optics with fermions from molecular dissociation.*
   K. V. Kheruntsyan,
   Physical Review Letters **96**, 110401 (2006). [29 citations]

   – *This is the first theoretical model to describe the dissociation of a BEC of molecular dimers into strongly correlated fermionic atoms. It outlines a new paradigm of **fermionic** quantum-atom optics.*

6. *Yang-Yang thermodynamics on an atom chip.*
   A. H. van Amerongen, J. J. P. van Es, P. Wicke, K. V. Kheruntsyan, and N. J. van Druten,
   Physical Review Letters **100**, 090402 (2008) [136 citations]
   PRL Editors' Suggestion

   – *This is the first direct comparison between experiment and the nearly 40-year-old Yang-Yang theory of the 1D Bose gas at finite temperature.*

7. *Sub-Poissonian fluctuations in a 1D Bose gas: from the quantum quasicondensate to the strongly interacting regime.*
   T. Jacqmin, J. Armijo, T. Berrada, K. V. Kheruntsyan, and I. Bouchoule,
   Physical Review Letters **106**, 230405 (2011). [70 citations]
   Highly Cited Paper in 2011-2013 according to WoS

– We have characterized and performed the first in-situ measurement of atom-number fluctuations in a single 1D Bose gas, spanning the crossover from the weakly interacting to the strongly interacting regime.

8. *Violation of the Cauchy-Schwarz inequality with matter waves.*
   K. V. Kheruntsyan, J.-C. Jaskula, P. Deuar, M. Bonneau, G. B. Partridge, J. Ruaudel, R. Lopes, D. Boiron, and C. I. Westbrook,
   Physical Review Letters **108**, 260401 (2012). [42 citations]
   PRL Editors' Suggestion; Featured as Viewpoint Commentary
   in *Physics* **5**, 70 (2012). *Out of a total of about 18,000 articles published by the American Physical Society per year, only around 100 Viewpoints will appear each year, placing this paper "in an elite subset of very best papers".*

   – First experimental demonstration and a theoretical analysis of the violation of the classical Cauchy-Schwarz inequality with massive particles in the matter-wave regime.

9. *Nonequilibrium dynamics of one-dimensional hard-core anyons following a quench: Complete relaxation of one-body observables.*
   T. M. Wright, M. Rigol, M. J. Davis, and K. V. Kheruntsyan,
   Physical Review Letters **113**, 050601 (2014) [32 citations]

   – We showed that interatomic interactions in integrable models lead to the complete relaxation of all one-body observables to the predictions of the Generalised Gibbs Ensemble.

10. *Proposal for demonstrating the Hong-Ou-Mandel effect with matter waves.*
    R. J. Lewis-Swan and K. V. Kheruntsyan,
    Nature Communications **5**, 3752 (2014). [23 citations]
    Featured in Phys.Org as a Science News commentary

    – First theoretical proposal to demonstrate an atomic analog of the celebrated optical Hong-Ou-Mandel effect using colliding Bose-Einstein condensates.

APPENDIX B

LIST OF PUBLICATIONS

a) Book Chapters

1. *Phase-space methods for fermions.*
   P. Corboz, M. Ögren, K. V. Kheruntsyan, and J. F. Corney,
   Chapter in: Quantum Gases: Finite Temperature and Non-Equilibrium Dynamics (Vol. 1 Cold Atoms Series). Eds. N.P. Proukakis, S.A. Gardiner, M.J. Davis, and M.H. Szymanska (Imperial College Press, London, 2013)

   Invited Book Chapter

b) Papers in refereed journals

2. *Quantum quench dynamics of the attractive one-dimensional Bose gas via the coordinate Bethe ansatz.*
   J. C. Zill, T. M. Wright, K. V. Kheruntsyan, T. Gasenzer, and M. J. Davis
   arXiv:1705.09168; Accepted for publication in SciPost on 23 December 2017
3. *Collective many-body bounce in the breathing-mode oscillations of a Tonks-Girardeau gas.*
   Y. Y. Atas, I. Bouchoule, D. M. Gangardt, and K. V. Kheruntsyan
   Phys. Rev. A **96**, 041605(R) (2017)
4. *Solving the quantum many-body problem via correlations measured with a momentum microscope.*
   S. S. Hodgman, R. I. Khakimov, R. J. Lewis-Swan, A. G. Truscott, and K. V. Kheruntsyan
   Phys. Rev. Lett. **118**, 240402 (2017)

   PRL Editors' Suggestion;
   Featured in Physics for a Synopsis
   and in PhysicsWorld.com for a News Commentary
5. *Exact nonequilibrium dynamics of finite-temperature Tonks-Girardeau gases.*
   Y. Y. Atas, D. M. Gangardt, I. Bouchoule, and K. V. Kheruntsyan
   Phys. Rev. A **95**, 043622 (2017)
6. *Finite-temperature hydrodynamics for one-dimensional Bose gases: Breathing mode oscillations as a case study.*
   I. Bouchoule, S. S. Szigeti, M. J. Davis, and K. V. Kheruntsyan
   Phys. Rev. A **94**, 051602(R) (2016)
7. *Approximate particle number distribution from direct stochastic sampling of the Wigner function.*
   R. J. Lewis-Swan, M. K. Olsen, and K. V. Kheruntsyan,
   Phys. Rev. A **94**, 033814 (2016)
8. *Quantum-enhanced sensing based on time reversal of non-linear dynamics.*
   D. Linnemann, H. Strobel, W. Muessel, J. Schulz, R. J. Lewis-Swan, K. V. Kheruntsyan, and M. K. Oberthaler,
   Phys. Rev. Lett. **117**, 013001 (2016)

   PRL Editors' Suggestion
9. *A coordinate Bethe ansatz approach to the calculation of equilibrium and nonequilibrium correlations of the one-dimensional Bose gas.*
   J. C. Zill, T. M. Wright, K. V. Kheruntsyan, T. Gasenzer, and M. J. Davis
   New Journal of Physics **18,** 045010 (2016)

   Invited article to a Focus Issue on
   "Strongly interacting quantum gases in one dimension"
10. *Proposal for a motional-state Bell inequality test with ultracold atoms.*
    R. J. Lewis-Swan and K. V. Kheruntsyan,
    Phys. Rev. A **91**, 052114 (2015)

11. *Sudden expansion of a one-dimensional Bose gas from power-law traps.*
A. S. Campbell, D. M. Gangardt, and K. V. Kheruntsyan,
Phys. Rev. Lett. **114**, 125302 (2015)

12. *Relaxation dynamics of the Lieb-Liniger gas following an interaction quench: A coordinate Bethe-ansatz analysis.*
J. C. Zill, T. M. Wright, K. V. Kheruntsyan, T. Gasenzer, M. J. Davis,
Phys. Rev. A **91**, 023611 (2015)

13. *Anisotropy in s-wave Bose-Einstein condensate collisions and its relationship to superradiance.*
P. Deuar, J.-C. Jaskula, M. Bonneau, V. Krachmalnicoff, D. Boiron, C. I. Westbrook, and K. V. Kheruntsyan,
Phys. Rev. A **90**, 033613 (2014)

14. *Nonequilibrium dynamics of one-dimensional hard-core anyons following a quench: Complete relaxation of one-body observables.*
T. M. Wright, M. Rigol, M. J. Davis, and K. V. Kheruntsyan,
Phys. Rev. Lett. **113**, 050601 (2014)

15. *Proposal for demonstrating Hong-Ou-Mandel effect with matter waves.*
R. J. Lewis-Swan and K. V. Kheruntsyan
Nature Communications **5**, 3752 (2014)
Featured in Phys.Org as a Science News commentary

16. *Observation of transverse condensation via Hanbury Brown–Twiss correlations.*
Wu RuGway, A. G. Manning, S. S. Hodgman, R. G. Dall, A. G. Truscott, T. Lamberton, and K. V. Kheruntsyan,
Phys. Rev. Lett. **111**, 093601 (2013)
PRL Editors' Suggestion

17. *Sensitivity to thermal noise of atomic Einstein-Podolsky-Rosen entanglement.*
R. J. Lewis-Swan and K. V. Kheruntsyan,
Phys. Rev. A **87**, 063635 (2013)

18. *Ideal n-body correlations with massive particles.*
R. G. Dall, A. G. Manning, S. S. Hodgman, Wu RuGway, K. V. Kheruntsyan, and A. G. Truscott,
Nature Physics **9**, 341 (2013)

19. *Two-body momentum correlations in a weakly interacting one-dimensional Bose gas.*
I. Bouchoule, M. Arzamasovs, K. V. Kheruntsyan, and D. M. Gangardt,
Phys. Rev. A **86**, 033626 (2012)

20. *Two-body anticorrelation in a harmonically trapped ideal Bose gas.*
T. M. Wright, A. Perrin, A. Bray, J. Schmiedmayer, and K. V. Kheruntsyan,
Phys. Rev. A **86**, 023618 (2012)

21. *Violation of the Cauchy-Schwarz inequality with matter waves.*
K. V. Kheruntsyan, J.-C. Jaskula, P. Deuar, M. Bonneau, G. B. Partridge, J. Ruaudel, R. Lopes, D. Boiron, and C. I. Westbrook
Phys. Rev. Lett. **108**, 260401 (2012)
PRL Editors' Suggestion;
Featured in Physics for a Viewpoint Commentary

22. *Yang-Yang thermometry and momentum distribution of a trapped one-dimensional Bose gas.*
M. J. Davis, P. B. Blakie, A. H. van Amerongen, N. J. van Druten, K. V. Kheruntsyan,
Phys. Rev. A **85**, 031604(R) (2012)

23. *Resonant cascaded down-conversion.*
C. Weedbrook, B. Perrett, K. V. Kheruntsyan, P. D. Drummond, R. C. Pooser, and O. Pfister,
Phys. Rev. A **85**, 033821 (2012)

24. *Sub-Poissonian fluctuations in a 1D Bose gas: from the quantum quasicondensate to the strongly interacting regime.*
T. Jacqmin, J. Armijo, T. Berrada, K. V. Kheruntsyan, and I. Bouchoule,
Phys. Rev. Lett. **106**, 230405 (2011)

25. *Stochastic simulations of fermionic dynamics with phase-space representations.*
Magnus Ögren, K. V. Kheruntsyan, and J. F. Corney,
Comp. Phys. Comm. **182**, 1999 (2011)

26. *Mapping out the quasi-condensate transition through the dimensional crossover from one to three dimensions.*

J. Armijo, T. Jacqmin, K. V. Kheruntsyan, and I. Bouchoule,
Phys. Rev. A **83**, 021605(R) (2011)

27. *Probing three-body correlations in a quantum gas using the measurement of the third moment of density fluctuations.*
J. Armijo, T. Jacqmin, K. V. Kheruntsyan, and I. Bouchoule,
Phys. Rev. Lett. **105**, 230402 (2010)
Highly Cited Paper from 2011 to 2013 according to WoS

28. *First-principles quantum dynamics for fermions: application to molecular dissociation.*
Magnus Ögren, K. V. Kheruntsyan, and J. F. Corney,
Europhys. Lett. **92**, 36003 (2010)

29. *Sub-Poissonian number differences in four-wave mixing of matter waves.*
J.-C. Jaskula, M. Bonneau, G. B. Partridge, V. Krachmalnicoff, P. Deuar, K. V. Kheruntsyan, A. Aspect, D. Boiron, and C. I. Westbrook
Phys. Rev. Lett. **105**, 190402 (2010)

30. *Role of spatial inhomogeneity in dissociation of trapped molecular condensates.*
Magnus Ögren and K. V. Kheruntsyan,
Phys. Rev. A **82**, 013641 (2010)

31. *Spontaneous four-wave mixing of de Broglie waves: beyond optics.*
V. Krachmalnicoff, J.-C. Jaskula, M. Bonneau, V. Leung, G. B. Partridge, D. Boiron, C. I. Westbrook, P. Deuar, P. Zin, M. Trippenbach, and K.V. Kheruntsyan,
Phys. Rev. Lett. **104**, 150402 (2010)

32. *Comparative study of dynamical simulation methods for the dissociation of molecular Bose-Einstein condensates.*
S. L. W. Midgley, S. Wuester, M. K. Olsen, M. J. Davis, and K. V. Kheruntsyan,
Phys. Rev. A **79**, 053632 (2009)

33. *Directional spatial structure of dissociated elongated molecular condensates.*
Magnus Ogren, C. M. Savage, and K. V. Kheruntsyan,
Phys. Rev. A **79**, 043624 (2009)

34. *Non-local pair correlations in the 1D Bose gas at finite temperature.*
P. Deuar, A. G. Sykes, D. M. Gangardt, M. J. Davis, P. D. Drummond, and K. V. Kheruntsyan,
Phys. Rev. A **79**, 043619 (2009)

35. *Atom-atom correlations in colliding Bose-Einstein condensates.*
Magnus Ogren and K. V. Kheruntsyan,
Phys. Rev. A **79**, 021606(R) (2009)

36. *Atom-atom correlations and relative number squeezing in dissociation of spatially inhomogeneous molecular condensates.*
Magnus Ogren and K. V. Kheruntsyan,
Phys. Rev. A **78**, 011602(R) (2008)

37. *Atomic four-wave mixing via condensate collisions.*
A. Perrin, C. M. Savage, D. Boiron, V. Krachmalnicoff, C. I. Westbrook, and K. V. Kheruntsyan,
New J. Physics **10**, 045021 (2008)
Invited article to a Focus Issue on "Quantum Correlations in Tailored Matter"

38. *Spatial nonlocal pair correlations in a repulsive 1D Bose gas.*
A. G. Sykes, D. M. Gangardt, M. J. Davis, K. Viering, M. G. Raizen, and K. V. Kheruntsyan,
Phys. Rev. Lett. **100**, 160406 (2008)

39. *Yang-Yang thermodynamics on an atom chip.*
A. H. van Amerongen, J. J. P. van Es, P. Wicke, K. V. Kheruntsyan, and N. J. van Druten,
Phys. Rev. Lett. **100**, 090402 (2008)
PRL Editors' Suggestion

40. *Pairing mean-field theory for the dynamics of dissociation of molecular Bose-Einstein condensates.*
M. J. Davis, S. J. Thwaite, M. K. Olsen, and K. V. Kheruntsyan,
Phys. Rev. A **77**, 023617 (2008)

41. *Spatial pair correlations of atoms in molecular dissociation.*
C. M. Savage and K. V. Kheruntsyan,
Phys. Rev. Lett. **99**, 220404 (2007)

42. *Interaction-induced crossover versus finite-size condensation in a weakly interacting trapped 1D Bose gas.*
I. Bouchoule, K. V. Kheruntsyan, and G. V. Shlyapnikov,
Phys. Rev. A **75**, 031606 (2007)

43. *First-principles quantum simulations of dissociation of molecular condensates: Atom correlations in momentum space.*
C. M. Savage, P. E. Schwenn, and K. V. Kheruntsyan,
Phys. Rev. A **74**, 033620 (2006)

44. *Quantum atom optics with fermions from molecular dissociation.*
K. V. Kheruntsyan,
Phys. Rev. Lett. **96**, 110401 (2006)

45. *Einstein-Podolsky-Rosen correlations via dissociation of a molecular Bose-Einstein condensate.*
K. V. Kheruntsyan, M. K. Olsen, and P. D. Drummond,
Phys. Rev. Lett. **95**, 150405 (2005)

46. *Finite temperature correlations and density profiles of an inhomogeneous interacting 1D Bose gas.*
K. V. Kheruntsyan, D. M. Gangardt, P. D. Drummond, and G. V. Shlyapnikov,
Phys. Rev. A **71**, 053615 (2005)

47. *Matter-wave amplification and phase-conjugation via stimulated dissociation of a molecular Bose-Einstein condensate.*
K. V. Kheruntsyan,
Phys. Rev. A **71**, 053609 (2005)

48. *Reply to "Comment on 'Stimulated Raman adiabatic passage from an atomic to a molecular Bose-Einstein condensate'".*
P. D. Drummond, K. V. Kheruntsyan, D. J. Heinzen, and R. H. Wynar,
Phys. Rev. A **71**, 017602 (2005)

49. *Three-dimensional solitons in coupled atomic-molecular Bose-Einstein condensates.*
T. G. Vaughan, K. V. Kheruntsyan, and P. D. Drummond,
Phys. Rev. A **70**, 063611 (2004)

50. *Coherent molecular bound-states of bosons and fermions near a Feshbach resonance.*
P. D. Drummond and K. V. Kheruntsyan,
Phys. Rev. A **70**, 033609 (2004)

51. *Canonical Bose gas simulations with stochastic gauges.*
P. D. Drummond, P. Deuar, and K. V. Kheruntsyan,
Phys. Rev. Lett. **92**, 40405 (2004)

52. *Pair correlations in a finite-temperature 1D Bose gas.*
K. V. Kheruntsyan, D. M. Gangardt, P. D. Drummond, and G. V. Shlyapnikov,
Phys. Rev. Lett. **91**, 040403 (2003)

53. *Quantum correlated twin atomic beams via photo-dissociation of a molecular Bose-Einstein condensate.*
K. V. Kheruntsyan and P. D. Drummond,
Phys. Rev. A **66**, 031602(R) (2002)

54. *Stimulated Raman adiabatic passage from an atomic to a molecular Bose-Einstein condensate.*
P. D. Drummond, K. V. Kheruntsyan, D. J. Heinzen, and R. H. Wynar,
Phys. Rev. A **65**, 063619 (2002)

55. *Theory of a mode-locked atom laser with toroidal geometry.*
P. D. Drummond, A. Eleftheriou, K. Huang, and K. V. Kheruntsyan,
Phys. Rev. A **63**, 053602 (2001)

56. *Asymptotic solutions to the Gross-Pitaevskii gain equation: growth of a Bose-Einstein condensate.*
P. D. Drummond and K. V. Kheruntsyan,
Phys. Rev. A **63**, 013605 (2001)

57. *Exact steady-state Wigner function for a nondegenerate parametric oscillator.*
K. V. Kheruntsyan and K. G. Petrosyan,
Phys. Rev. A **62**, 105801 (2000)

58. *Superchemistry: dynamics of coupled atomic and molecular Bose-Einstein condensates.*
D. J. Heinzen, R. H. Wynar, P. D. Drummond, and K. V. Kheruntsyan,
Phys. Rev. Lett. **84**, 5029 (2000)

Highly Cited Paper in the 2000 decade according to WoS

59. *Multidimensional quantum solitons with nondegenerate parametric interactions: Photonic and Bose-Einstein condensate environments.*
K. V. Kheruntsyan and P. D. Drummond,
Phys. Rev. A **61**, 063816 (2000)

60. *Novel solitons in parametric amplifiers and atom lasers.*
P. D. Drummond, K. V. Kheruntsyan, and H. He,
J. Opt. B: Quantum Semiclass. *Optics* **1**, 387 (1999)

61. *Wigner function for a driven anharmonic oscillator.*
K. V. Kheruntsyan,
J. Opt. B: Quantum Semiclass. Optics **1**, 225 (1999)

62. *Coherent molecular solitons in Bose-Einstein Condensates.*
P. D. Drummond, K. V. Kheruntsyan, and H. He,
Phys. Rev. Lett. **81**, 3055 (1998)

63. *Multidimensional parametric quantum solitons.*
K. V. Kheruntsyan and P. D. Drummond,
Phys. Rev. A **58**, 2676(R) (1998)

64. *Three-dimensional quantum solitons with parametric coupling.*
K. V. Kheruntsyan and P. D. Drummond,
Phys. Rev. A **58**, 2488 (1998)

65. *Controlling instability and squeezing from a cascaded frequency doubler.*
K. V. Kheruntsyan, G. Yu. Kryuchkyan, N. T. Mouradyan, and K. G. Petrossian,
Phys. Rev. A **57**, 535 (1998)

66. *Wigner function for generalized model of parametric oscillator: phase-space tristability, competition and nonclassical effects.*
K. V. Kheruntsyan, D. S. Krahmer, G. Yu. Kryuchkyan, and K. G. Petrossian,
Optics Communications **139**, 157 (1997)

67. *Noise, instability and squeezing in third harmonic generation.*
S. T. Gevorkyan, G. Yu. Kryuchkyan, and K. V. Kheruntsyan,
Optics Communications **134**, 440 (1997)

68. *Critical phenomena and quantum statistics in four-wave mixing.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
Zh. Eksp. Teor. Fiz. **110**, 1589 (1996) [JETP **83**, 875 (1996)]

69. *Critical effects in photon correlation for parametric generation.*
G. Yu. Kryuchkyan, K. G. Petrossian, and K. V. Kheruntsyan,
Pis'ma v Zh. Eksp. Teor. Fiz. **63**, 502 (1996) [JETP Letters **63**, 526 (1996)]

70. *Exact quantum theory of parametrically driven dissipative anharmonic oscillator.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
Optics Communications **127**, 230 (1996)

71. *Parametric oscillation in four-wave mixing with nondegenerate pumping.*
G. Yu. Kryuchkyan, K. V. Kheruntsyan, and K. G. Petrossian,
Kvantovaya Elektronika **22**, 599 (1995) [Quantum Electronics **25**, 573 (1995)]

72. *Exact quantum treatment of the parametric chi(3)-interaction.*
G. Yu. Kryuchkyan, K. V. Kheruntsyan, V. O. Papanyan, and K. G. Petrossian,
Quantum Semiclass. Optics **7**, 965 (1995)

73. *Four-wave mixing with nondegenerate pumps: steady states and squeezing in the presence of phase modulation.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
Quantum Semiclass. Optics **7**, 529 (1995)

74. *Phase-dependent correlations and spectra of intense squeezed light in the above-threshold regime of four-wave-mixing.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
Zh. Eksp. Teor. Fiz. **104**, 1161 (1994) [JETP **78**, 623 (1994)]

75. *Nonlinear dynamics and generation of nonclassical light in two laser fields.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
Zh. Eksp. Teor. Fiz.**103**, 18 (1993) [JETP **76**, 9 (1993)]

76. *Squeezing of quantum fluctuations in nondegenerate two-photon absorption.*
K. V. Kheruntsyan,
Izvestiya Akademii Nauk Armenii, Fizika (Proceedings of National Academy of Sciences of Armenia, Physics) **28**, 131 (1993) [J. Contemporary Phys. **28**, 1 (1993)]

77. *Sub shot-noise fluctuations in the intensity sum of two coupled beams.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
Optics Communications **93**, 328 (1992)

78. *Squeezing in intracavity four-wave mixing with non-degenerate pumps.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
Quantum Optics **4**, 289 (1992)

79. *Squeezing spectrum for radiation of atoms in two laser fields.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
Optics Communications **87**, 181 (1992)

80. *Statistics of energy fluctuations and spatial distribution of intensities of Stokes pulses in steady-state stimulated Raman scattering.*
R. Kh. Drampyan, G. Yu. Kryuchkyan, and K. V. Kheruntsyan,
Optika i Spektroskopiya **73**, 713 (1992)

81. *Quantum effects of intensity interference in parametric amplification.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
Optika i Spektroskopiya **69**, 692 (1990)

c) Full-length articles in refereed Conference Proceedings

82. *Stochastic gauge: a new technique for quantum simulations.*
P. D. Drummond, P. Deuar, J. F. Corney, and K. V. Kheruntsyan,
Proceedings of the 16th International Conference on Laser Spectroscopy, 13–18 July 2003, Tropical North Queensland, Australia (Eds. P. Hannaford, A. Sidorov, H. Bachor, and K. Baldwin, World Scientific, Singapore, 2004, P. 161–170)

83. *Optical mesons in parametric waveguides.*
P. D. Drummond, H. He, and K. V. Kheruntsyan,
Frontiers of Quantum Optics and Laser Physics, Proceedings of ICQOLP, Hong-Kong, 1997 (Eds. S.Y. Zhu, M.S. Zubairy and M.O. Scully, Springer-Verlag, Berlin, 1997, P. 30–38)

84. *Spectral, noise and correlation properties of intense squeezed light generated by a coupling in two laser fields.*
G. Yu. Kryuchkyan and K. V. Kheruntsyan,
NASA CP-3270, Washington DC, 1994, PP. 51–64, Proceedings of the Third International Workshop on Squeezed States and Uncertainty Relations, Baltimore, Maryland, 1993.