Ish Dhand

Curriculum Vitae

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Personal details

Office Address	Institute for Theoretical Physics, University of Ulm, Albert-Einstein-Allee 11, D - 89069 Ulm, Germany
Email, webpage	ishdhand@gmail.com, http://ishdhand.me/
Date of Birth	04 February 1990
Citizenship	Indian
Gender	Male

Research Experience and Education

Feb. 2019 – May 2020	Postdoctoral Research Associate Institute: University of Ulm, Germany Host: Martin B. Plenio
Feb. 2017 – Jan. 2019	Alexander von Humboldt Postdoctoral Fellow Institute: University of Ulm, Germany Host: Martin B. Plenio
Apr. 2016 – Jan. 2017	Postdoctoral Research Associate Institute: University of Ulm, Germany Host: Martin B. Plenio
Sep. 2013 – Feb. 2016	Ph.D., Physics University of Calgary, Canada Supervisor: Prof. Dr. Barry C. Sanders Thesis: Multi-Photon Multi-Channel Interferometry for Quantum Information Processing. arXiv:1603.07476 Grade point average: 4.0/4.0
Sep. 2012 – Aug. 2013	M.Sc., Physics (switched to Ph.D.) University of Calgary, Canada Supervisor: Prof. Dr. Barry C. Sanders Grade point average: 4.0/4.0
Jul. 2008 – Jun. 2012	B.Tech., Computer Science Institute: Indian Institute of Technology Kanpur, India

Peer-reviewed publications

2018 I. Schwartz, J. Scheuer, B. Tratzmiller, S. Müller, Q. Chen, I. Dhand, Z. Wang, C. Müller, B. Naydenov, F. Jelezko, and M. B. Plenio. Robust optical polarization of nuclear spin baths using Hamiltonian engineering of nitrogen-vacancy center quantum dynamics. *Science Advances*, 4(8):eaat8978. arXiv:1710.01508

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn, and M. B. Plenio. Proposal for quantum simulation via all-optically-generated tensor network states. *Physical Review Letters*, 120:130501. arXiv:1710.06103

2017 B. P. Lanyon, C. Maier, M. Holzapfel, T. Baumgratz, C. Hempel, P. Jurcevic, I. Dhand, A. S. Buyskikh, A. J. Daley, M. Cramer, M. B. Plenio, R. Blatt, and C. F. Roos. Efficient tomography of a quantum many-body system. *Nature Physics*, 13(12):1158. arXiv:1612.08000

2017 J. Scheuer, I. Schwartz, S. Müller, Q. Chen, I. Dhand, M. B. Plenio, B. Naydenov, and F. Jelezko. Robust techniques for polarization and detection of nuclear spin ensembles. *Physical Review B*, 96:174436. arXiv:1706.01315

2016 I. Dhand, A. Khalid, H. Lu, and B. C Sanders. Accurate and precise characterization of linear optical interferometers. *Journal of Optics*, 18(3):035204. arXiv:1508.00283

2016 H. de Guise, D. Spivak, J. Kulp, and I. Dhand. $\mathcal{D}$-functions and immanants of unitary matrices and submatrices. *Journal of Physics A: Mathematical and Theoretical*, 49(9):09LT01. **(selected as letter — outstanding short paper)** arXiv:1511.01851

2015 I. Dhand, B. C. Sanders, and H. de Guise. Algorithms for SU(n) boson realizations and $\mathcal{D}$-functions. *Journal of Mathematics and Physics*, 56:111705. **(featured article)** arXiv:1507.06274

2015 I. Dhand and S. K. Goyal. Realization of arbitrary discrete unitary transformations using spatial and internal modes of light. *Physical Review A*, 92:043813. arXiv:1508.06259

2014 I. Dhand and B. C. Sanders. Stability of the Trotter-Suzuki decomposition. *Journal of Physics A: Mathematical and Theoretical*, 47:265206. **(featured article)** arXiv:1403.3469

Book

2018 I. Dhand, A. D'Souza, V. Narasimhachar, N. Sinclair, S. Wein, P. Zarkeshian, A. Poostindouz, and C. Simon. Understanding quantum physics through simple experiments: from wave-particle duality to Bell's theorem. arXiv:1806.09958 (This is a 30,000-word open-access preprint for a proposed undergraduate-level textbook that is currently under review.

Competitive awards and achievements

2017 Team leader of best team at Quantum Ideas Factory boot camp 11–13 September, 2017 organized by Physics Institute, Heidelberg University.

2016 Awarded two-year EUR 82,800 Humboldt Research Fellowship for Postdoctoral Research by Alexander von Humboldt Foundation.

2015 DAMOPC Best Student Oral Presentation Award (Second Prize) by Division of Atomic, Molecular and Optical Physics, Canadian Association of Physicists.

2015 Awarded CAD 2275 Departmental Graduate Student Excellence Award by Department of Physics and Astronomy, University of Calgary.

2014 Awarded CAD 2300 Departmental Graduate Student Excellence Award by Department of Physics and Astronomy, University of Calgary.

2013 Awarded CAD 3600 Queen Elizabeth II Fellowship, 2013 by University of Calgary.

2012 Awarded CAD 7200 Departmental Fellowship, 2012-2013 by the Department of Physics and Astronomy, University of Calgary.

2010 Academic Excellence Award at Indian Institute of Technology Kanpur. 7% of the students with the highest GPA across all departments in the institute are awarded

2009 Awarded INR 260,000 Aditya Birla Scholarship by Aditya Birla Group. 10 out of 10,000 incoming students to the Indian Institutes of Technology receive the Aditya Birla Scholarship.

2008 Stood 22nd all over India out of the 322,000 candidates in the Joint Entrance Examination conducted by the Indian Institutes of Technology.

2008 Awarded the Indian Physics Association prize for the Best Solution to a Challenging Theoretical Problem by Indian Physics Association. Awarded to 1 out of the 35 gold medalists in the Indian National Physics Olympiad.

2008 Awarded Gold Medal in Indian National Physics Olympiad. Awarded to 35 out of 30,000 participants in the Indian National Physics Olympiad.

2007 Represented India at the 8th Asian Physics Olympiad at Shanghai. 2 students were chosen to participated in the olympiad out of 30,000 participants in the Indian National Physics Olympiad.

2006 Awarded the National Child Award by the Prime Minister of India on behalf of Ministry of Human Resource Development, Government of India. One high-school student is nominated for this award from each state of India.

2004 Awarded National Bal Shree for creative scientific innovation by the President of India on behalf of Ministry of Human Resource Development, Government of India. Awarded to 20 out of 20,000 participants nationally.

Talks and conference participation

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, University of Toronto, Toronto, Canada *(Invited seminar)*, 18 October 2018.

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, University of Waterloo, Waterloo, Canada *(Invited seminar)*, 10 October 2018.

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, University of Calgary, Calgary, Canada *(Invited seminar)*, 03 October 2018.

2018 I. Dhand, Tensor network states for fun and profit, Tata Institute of Fundamental Research, Mumbai, India *(Invited seminar)*, 24 September 2018.

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, Indian Institute of Science Education and Research Mohali, Mohali, India *(Invited seminar)*, 17 September 2018.

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, Tata Institute of Fundamental Research, Mumbai, India *(Invited seminar)*, 14 September 2018.

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, Indian Institute of Technology Bombay, Mumbai, India *(Invited seminar)*, 13 September 2018.

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, Indian Institute of Science Education and Research Pune, Pune, India *(Invited seminar)*, 11 September 2018.

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, Harish-Chandra Research Institute, Allahabad, India *(Invited seminar)*, 06 September 2018.

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, Indian Institute of Technology Kanpur, Kanpur, India *(Invited seminar)*, 04 September 2018.

2018 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, Proposal for Quantum Simulation via All-Optically Generated Tensor Network States, Institute of Mathematical Sciences Workshop on Quantum Metrology and Open Quantum Systems *(Contributed seminar)*, 27 August 2018.

2017 I. Dhand, M. Engelkemeier, L. Sansoni, S. Barkhofen, C. Silberhorn and M. B. Plenio, All-optical generation of entangled multi-qubit states *(Contributed seminar)*, International Conference on Integrated Quantum Photonics, Rome, Italy. 28 September 2017.

2015 I. Dhand, A. Khalid, H. Lu, and B. C. Sanders, Accurate and Precise Characterization of Linear Optical Interferometers *(Contributed seminar)*, Canadian Association of Physics (CAP) Congress, Edmonton, Canada. 18 June 2015.

2015 I. Dhand, B. C. Sanders, and H. de Guise, Group-Theoretic Methods in Multi-Photon Interferometry. *(Contributed poster)*, Canadian Association of Physics (CAP) Congress, Edmonton, Canada. 18 June 2015.

2015 I. Dhand, H. de Guise and B. C. Sanders, Algorithms for Boson Realizations of SU(n) *(Contributed seminar)*, Theory Canada 10, Calgary, Canada. 12 June 2015.

2015 I. Dhand, H. de Guise, A. Khalid, He Lu and B. C. Sanders, Design, Characterization and Simulation of Linear Optical Devices *(Invited Seminar)*, Workshop on Multi-Photon Interferometry, Shanghai, China. 8 May 2015.

2014 I. Dhand and J. Ghosh, Quantum Simulation and Implementations *(Invited poster)*, Alberta Quantum-Nano Workshop, Red Deer, Canada. 14 July 2014.

2013 I. Dhand and B. C. Sanders, Finite precision in Trotter-Suzuki decomposition *(Contributed seminar)*, Canadian Quantum Information Students' conference, Calgary, Canada. 25 Jun 2013.

2013 I. Dhand and B. C. Sanders, Finite precision in Trotter-Suzuki decomposition *(Invited seminar)*, Institute for Quantum Computing, University of Waterloo, Waterloo, Canada. 6 Jun 2013.

2013 I. Dhand and B. C. Sanders, Finite precision in Trotter-Suzuki decomposition *(Contributed seminar)*, CAP Congress 2013, Montreal, Canada. 28 May 2013.

Note: Only those seminars or posters that I have presented are listed.

Supervision

2018 Co-supervising PhD thesis of Alexander Nüßeler on *Tensor network methods for simulating fermionic open quantum systems* (Apr. 2018 –).

2018 Co-supervising Masters thesis of Fabian Höb on *Optimal tensor-network methods for simulating open quantum systems* (Jun. 2018 –).

2018 Co-supervised Bachelors thesis of Daniel Dulog on *Towards time evolution of fermionic open quantum systems* (Dec. 2017 –Jun. 2018).

2017 Co-supervised Bachelors thesis of Moritz Lange on *Efficient simulation of quantum many body systems via TEDOPA* (Jun. 2017 –Mar. 2018).

Teaching

2015 Instructor, one day course on *A first encounter with quantum mysteries* at University of Calgary Continuing Education.

2015 Teaching assistant, *Quantum mysteries and paradoxes*. Designed and delivered two lectures. Assisted with designing and grading assignments and examinations.

2015 Teaching assistant, *Electromagnetic theory I*. Designed and delivered two review lectures. Assisted with designing and grading examinations and laboratory sessions.

2013 Teaching assistant, *Senior physics laboratory*.

2012 Teaching assistant, *Freshman mechanics*.

Service

20** Referee for New Journal of Physics, Physical Review A, Physical Review Letters, Physical Review X, Quantum Information Processing, Quantum Science and Technology, Science, and Scientific Reports.

2015 Organizer of Workshop on Multi-Photon Interferometry at Shanghai, China during 7-11 May 2015.

2013 Organizer of CQISC, Canadian Quantum Information Students' Conference held in June 2013 at University of Calgary.

2012 Organizer of PHAS Lunches, fortnightly lunch talks in the physics department at University of Calgary.

2010 Organizer and chair of ICARUS-2010, undergraduate research conference organized at IIT Kanpur.

Referees

- **Martin B. Plenio**
  Alexander von Humboldt Professor, Universität Ulm
  Director, Institute of Theoretical Physics, Universität Ulm
  Director, Center for Quantum Bio-Sciences, Universität Ulm
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  Email: martin.plenio@uni-ulm.de

- **Christine Silberhorn**
  Lehrstuhlinhaberin, Integrated Quantum Optics, Universität Paderborn
  Professor, DFG Graduiertenkolleg Micro- and Nanostructures in Optoelectronics and Photonics, Universität Paderborn
  Office Address: Integrated Quantum Optics, Universität Paderborn, Warburger Str. 100, 33098 Paderborn, Germany
  Email: christine.silberhorn@uni-paderborn.de

- **Barry C. Sanders**
  Director, Institute for Quantum Science & Technology, University of Calgary
  Thousand Talents Chair at the University of Science and Technology China
  Vajra Visiting Faculty member, Raman Research Institute, India
  Office Address: Institute for Quantum Science and Technology, University of Calgary, 2500 University Dr. NW, Calgary, AB, Canada, T2N 1N4
  Email: sandersb@ucalgary.ca

- **Hubert de Guise**
  Professor, Department of Physics, Lakehead University, Canada
  Office Address: CB 4033, Lakehead University, 955 Oliver Road, Thunder Bay, ON, Canada, P7B 5E1
  Email: hubert.deguise@lakeheadu.ca