QuantumPhase Technology Pvt.Ltd.

Umakant D. Rapol, Ph.D.

Professor, Department of Physics
Indian Institute of Science Education and Research – Pune 411008 (INDIA)
Co-founder/Director: QuantumPhase Technology Pvt. Ltd.
Email: udrapol@gmail.com • umakant.rapol@iiserpune.ac.in • umakant.rapol@quantumphase.in
URL: https://sites.iiserpune.ac.in/~umakant.rapol/

PROFESSIONAL SUMMARY / EXPERTISE

Distinguished Experimental Physicist with deep expertise in Atomic Physics, Quantum Optics, and Classical Optics. Currently serving as Professor in the Department of Physics at the Indian Institute of Science Education and Research (IISER) Pune, I lead cutting-edge research focused on the development of scalable quantum computing and simulation platforms, as well as next-generation quantum sensors based on ultracold atoms and ions.

My research portfolio encompasses the design and development of advanced optical devices and high-precision metrology systems, including atom interferometry, using ultracold atomic and ionic ensembles. With a proven track record of successfully leading multidisciplinary research teams in both industrial R&D and academic environments, I combine strong technical leadership with strategic vision.

I bring ~16 years of teaching experience at undergraduate and postgraduate levels, complemented by 4 years of hands-on industrial research and development in a global multinational company. At IISER Pune, I have established a state-of-the-art experimental facility for the production of Bose-Einstein condensates and ultracold quantum matter using neutral atoms and an ion trap quantum computer work is in progress with ~20 Ca+ ion qubits already trapped and stabilised in the group — the only facility of its kind in the country. I have also developed a dedicated platform for optical-atomic frequency standards. This unique infrastructure supports a wide range of experiments in quantum networking, quantum simulations, and precision measurements using ultracold quantum gases. In addition, we have indigenously designed and built an atom interferometer-based precision absolute gravimeter, advancing quantum sensing capabilities within India.

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ACADEMIC AND PROFESSIONAL CAREER

Degree/Position held	Year(s)	University/Institution
Professor	June 2022 – present	Indian Institute of Science Education and Research, Pune – India
Associate Professor	July 2017 – June 2022	Indian Institute of Science Education and Research, Pune – India
Assistant Professor	2009 – 2017	Indian Institute of Science Education and Research, Pune – India
Lead Scientist	2005 – 2009	Micro and Nano Structures Technology Division, General Electric Global Research, JFWTC Bangalore – India
Post-Doctoral research associate	2004 – 2005	University of Innsbruck, Innsbruck – Austria (With Prof. Rainer Blatt)
Post-Doctoral research associate	2003 – 2004	Ecole Normale Superieure, Paris – France (with Prof. Claude Cohen Tannoudji, Nobel Laureate, Physics)

Ph. D.	2003	Indian Institute of Science, Bangalore – India (with late Prof. Vasant Natarajan)
M.Sc.	1996	University of Pune, Pune – India
B.Sc.	1994	DBF Dayanand College of Arts and Science, Solapur – India

AWARDS / PRIZES

- Prof. Anil Kumar memorial award for "The Best Ph. D. thesis" of the Department of Physics, Indian Institute of Science, Bangalore, India.
- UGC fellowship for carrying out Masters Program in Physics at the University of Pune, India.

RESEARCH SUPERVISION

- No. of PhD Students Graduated: 9
- No. of Current PhD students: 6
- No. of M. S. theses: 10 (1 co-supervised)

TEACHING EXPERIENCE

I have taught over the last 16 years at undergraduate and postgraduate level. The courses included Atomic Molecular and optical physics, Electronics, Introduction to computation, setting up undergraduate laboratories and in conducting undergraduate laboratory courses at various levels. Mentored numerous students for semester projects.

PROFESSIONAL RESPONSIBILITIES

I have been on various institute building and operations committees since I joined IISER Pune in 2009. Served as a member of purchase committee, Academic committee, Admissions committee, Experimental laboratories design committee, Space and infrastructure committee, Engineering Maintenance services committee, Master projects management committee and National Joint Entrance Screening Test (JEST) committee etc.

Served as a founding PI of Technology Innovation Hub for Quantum Technologies at IISER pune: under the DST's National Mission on Cyber Physical systems. Led a group of over 12 Co-PIs as a project director from IISER Pune and over 20 PIs from leading institutes from the country. I was instrumental in setting up the national quantum technologies incubator. This role was from end of 2019 until June 2023.

Editorial boards: Currently serving as an editorial board member of EPJ Quantum Technology Journal.

Contribution towards National Quantum Mission: I have been part of the drafting committee of the initial Detailed Project Report (DPR) for the National Quantum Mission. Towards this task, I conducted a national consultative meeting in coordination with the Department of Science and Technology and got the inputs from the Indian scientific community on Quantum Sensing and Metrology.

CONTRIBUTION TOWARDS COVID-19 PANDEMIC WORK

During the Covid-19 pandemic, I have extensively worked towards addressing the issue of local development of full ICU ventilators and in developing emergency oxygen-producing systems based upon chemical reactions.

The work done towards the development of ventilators has been extensively covered in media:

- Hindustan Times
- Indian Express (design)

- Nature India
- Indian Express (manufacturing)

The development of emergency oxygen producing devices has led to one granted and one filed patent (details below). The development has also been covered in media:

- Indian Express

LIST OF ONGOING AND CONCLUDED PROJECTS

Sl. No.	Title	Cost in Lakhs INR	Duration	Role (PI/Co-PI)	Funding agency
1.	Ion trap based 50+ qubits Quantum Computer development	2,200	2024 - 2030	PI	DST-NQM
2.	Establishment of Technology Innovation Hub at IISER Pune for Quantum Technologies (Ongoing)	17,000.00	2020-2023	PI & Founding Project Director	DST - NMICPS
3.	A novel Atom–Plasmon based platform for distributed and scalable Quantum Computer (Ongoing)	2,818.00	2020 - 2023	PI	DST
4.	Magneto-Optic trapping of Strontium atoms for experiments towards distributed quantum information processing (Concluded)	54.70	-	PI	DST
5.	IISER-CGPA joint Training and R and D project (Concluded)	202.00	2018-2021	Co-PI	LIGO India through DST
6.	NEWTON-BHABHA funds from British council - United Kingdom	350	2017 - 2020	Co-PI	British Council

PATENTS

1. **Rapol Umakant Damodar**, Patel Kushal, Biswas Korak, Maurya S. Sagar, Dutta Pranab. Oven for generation and collimation of an atomic beam, Indian Patent No. 577302, Application No: 202421000590
2. Sonde R. R., Bhatia D., Roy Shantanu, Pant Kamal Kishor, Hotha Srinivas, **Rapol Umakant**, Nair Sunil, Mhatra Dwiraj, Singh Kuldeep, Parmar Kaushal, Singh Shreya, Patel Kushal, Dutta Pranab, Maurya Shivsagar, Biswas Korak, Das Pratim Kumar. Hybrid Oxygen system using passive and active systems, provisional Patent applications IPO P IN101328 (2021) (IIT-Delhi IISER Collaboration During COVID-19 Pandemic)
3. **Rapol Umakant**, Hotha Srinivas, Nair Sunil, Patel Kushal, Dutta Pranab, Maurya Shivsagar, Biswas korak, Das Pratim Kumar. Chemical Oxygen Generator, Indian Patent NO: 202121020842 (Part of Covid-19 Pandemic Related work)
4. S. Maity, S. Vartak, and **U. Rapol**. Fringe locking subsystem and methods of making and using the same (2013). US Patent 8,363,224 B2
5. S. Maity, **U. Rapol**, S. Vartak, R. Langoju, A. Patil, A. Rammohan, et al. Systems and methods for detection and imaging of two-dimensional sample arrays (2012). WO Patent 2,012,057,681. and A. Patil, S. Maity, V. Langoju, A. Rammohan, S. Vartak, and U. Rapol.

Systems and methods for detection and imaging of two-dimensional sample arrays (2012). US Patent 2012/0,105,852.

6. E. Calla, S. Maity, **U. Rapol**, and A. Silvia. Welding control system (2009). US Patent App. 12/491,158. and E. Calla, S. Maity, U. Rapol, and A. Silvia. Schweißsteuerungssystem (2010). DE Patent App. (German Patent) 102,010,017,316.
7. A. Banerjee, S. Maity, M. Pietzykowski, and **U. Rapol**. Method and apparatus for detection of analytes (2008). US Patent App. 12/331,713.
8. R. Rao, U. Rapol, T. Asokan, and S. Ungarala. Arc detector (2008). EP Patent 1,993,181. and R. Rao, **U. Rapol**, T. Asokan, and S. Ungarala. Arc detector (2007). US Patent App. 11/747,970.
9. S. Maity, S. Vartak, V. Rao, M. Yamada, S. Chandrasekaran, A. Patil, A. Banerjee, and **U. Rapol**. Optical detection systems and methods of making and using the same (2010). US Patent App. 12/751,457.
10. K. Tandon, **U. Rapol**, U. Barik, and R. Vetrivel. Composite membrane for separation of carbon dioxide (2010). US Patent 7,811,359.

PUBLICATIONS

Total: 53 papers (15 published as independent researcher from IISER Pune). Total citations (as of 19 April 2026): 17,047; H-index: 37 (Google Scholar: https://scholar.google.com/citations?user=VaQjNL8AAAAJ&hl=en).

1. S. Sagar Maurya, Joel M. Sunil, Monu Bhartiya, Pranab Dutta, Jay Mangaonkar, Rahul Sawant, and **Umakant D. Rapol**, "Evaporative cooling by pulse width modulation (PWM) of optical dipole traps", Phys. Rev. Res 7 043050 (2025)
2. S. Sagar Maurya, J. Bharathi Kannan, Kushal Patel, Pranab Dutta, Korak Biswas, M. S. Santhanam, **Umakant D. Rapol**, "Asymmetric dynamical localization and precision measurement of the micromotion of a Bose-Einstein condensate", Phys. Rev. A 110 053307, 2024
3. Kushal Patel, Palki Gakkhar, Biswas Korak, Shiv Sagar Maurya, Dutta Pranab, Vishal Lal, Brajesh Mani and **Umakant D. Rapol**, "Spectroscopy of the 5s5p 3P0 →5s5d 3D1 transition of strontium using laser cooled atoms", J. Phys. B: At. Mol. and Opt. Phys. 57 105501(2024)
4. Pranab Dutta, S. Sagar Maurya, Korak Biswas, Kushal H. Patel and **Umakant D. Rapol**, "Comparative analysis of phase noise for different configurations of Bragg lattice for an atomic gravimeter with Bose–Einstein condensate", AIP Advances, 14, 015252 (2024)
5. S. Sagar Maurya, J. Bharathi Kannan, Kushal Patel, Pranab Dutta, Korak Biswas, Jay Mangaonkar, M. S. Santhanam and **Umakant D. Rapol**, "Interplay between quantum diffusion and localization in the atom-optics kicked rotor", Phys. Rev. E, 106, 034207 (2022)
6. Pranab Dutta, S. Sagar Maurya, Kushal Patel, Korak Biswas, Jay mangaonkar Sumit Sarkar and **Umakant D. Rapol** "A decade of advancement of quantum sensing and metrology in India using cold atoms and ions", J. Ind. Inst. Sci. 2022, https://doi.org/10.1007/s41745-022-00335-8
7. Jay Mangaonkar, Chetan Vishwakarma, S Sagar Maurya, Sumit Sarkar, Jamie L MacLennan, Pranab Dutt and **Umakant D. Rapol**, "Effects of finite momentum width on the reversal dynamics in a BEC based atom optics δ-kicked rotor", J. Phys. B, 53, 235502 (2020)
8. Sanku Paul, Sumit Sarkar, Chetan Vishwakarma, Jay Mangaonkar, M S Santhanam and **Umakant D. Rapol**, "Non-monotonic diffusion rates in atom-optics Lévy kicked rotor", Phys. Rev. E, 100, 060201(R) (2019)

9. Chetan Vishwakarma, Jay Mangaonkar, Kushal Patel, Gunjan Verma, Sumit Sarkar, and **Umakant D. Rapol**,"A simple atomic beam oven with a thermal break" Rev. Sci. Instrum.90, 053106 (2019)
10. Sumit Sarkar, Jay Mangaonkar, Chetan Vishwakarma, and **Umakant D. Rapol**, "Diffraction of atom laser in the Raman-Nath Regime" Phys. Rev. A, 98, 043625 (2018)
11. Y. K. Jawale, **U. Rapol** and C. A. Athale. "Open Source 3D-printed focussing mechanism for cellphone-based cellular microscopy" J. Microscopy 273, 105(2018)
12. Sumit Sarkar, Sanku Paul, Gunjan verma, Sunil Kumar, Chetankumar Vishwakarma, M. Sainath, **Umakant D. Rapol** and M. S. Santhanam, "Non exponential decoherence in an atom-optics kicked rotor" Phys. Rev. Lett. 118, 174101 (2017)
13. Gunjan Verma, Umakant D. Rapol and Rejish Nath, "Generation of dark solitons and their instability dynamics in two-dimensional condensates" , Phys. Rev. A 95, 043618 (2017)
14. Gunjan Verma, Chetankumar Vishwakarma, C. V. Dharmadhikari and **Umakant D. Rapol**,"A compact atomic beam based system for Doppler-free laser spectroscopy of strontium atoms" Rev. Sci. Instrum. 88, 033103 (2017).
15. Sunil Kumar, Sumit Sarkar, Gunjan Verma, Chetan Vishwakarma, Md Noaman and **Umakant Rapol** , "Bose-Einstein condensation in an electro-pneumatically transformed quadrupole-Ioffe magnetic trap", N. J. Phys., 17, 023062 (2015)
16. R. Abott et al., "Gravitational-wave constraints on the equatorial ellipticity of millisecond pulsars", ApJ Lett., 902, L21 (2020)
17. R. Abbott et al. "Constraints on dark photon dark matter using data from LIGO's and Virgo's third observing run", Phys. Rev. D. 105(6) 63030 (2022)
18. R. Abbott et al. "Searches for continuous gravitational waves from young supernova remnants in the early third observing run of Advanced LIGO and Virgo", Astr. Phys. J 921(1), 80 (2021)
19. R. Abbott et al. "Search for continuous gravitational waves from 20 accreting millisecond X-ray pulsars in O3 LIGO data", Phys. Rev. D 105(2) 22002 (2022)
20. R. Abbott et al. "Constraints from LIGO O3 Data on Gravitational-wave Emission Due to R-modes in the Glitching Pulsar PSR J0537–6910", Astr. Phys. J. 922(1) 71 (2021)
21. R. Abbott et al. "Search for lensing signatures in the gravitational-wave observations from the first half of ligo–virgo's third observing run", Astr. Phys. J. 923(1) 14, 2021
22. R. Abbott et al. "GWTC-2: compact binary coalescences observed by LIGO and Virgo during the first half of the third observing run", Phys. Rev. X 11(2) 021053 (2021)
23. R. Abbott et al. "All-sky search for short gravitational-wave bursts in the third Advanced LIGO and Advanced Virgo run", Phys. Rev. D. 104(12) 122004 (2021)
24. R. Abbott et al. "Search for Gravitational Waves Associated with Gamma-Ray Bursts Detected by Fermi and Swift during the LIGO–Virgo Run O3a", Phys. Rev. D. 915(2), 86 (2021)
25. R. Abbott et al. "Search for anisotropic gravitational-wave backgrounds using data from Advanced LIGO and Advanced Virgo's first three observing runs", Phys. Rev. D, 104(2) 02205 (2021)
26. R. Abbott et al. "All-sky search for continuous gravitational waves from isolated neutron stars in the early O3 LIGO data", Phys Rev. D. 104(8) 82004 (2021)
27. R. Abbott et al. "Upper limits on the isotropic gravitational-wave background from Advanced LIGO and Advanced Virgo's third observing run", Phys . Rev. D, 104(2) 022004, (2021)
28. R. Abbott et al. "Observation of gravitational waves from two neutron star-black hole coalescences", ApJ Lett., 915, L5 (2021)

29. R. Abbott et al. “Constraints on cosmic strings using data from the third Advanced LIGO-Virgo observing run”, Phys. Rev. Lett., 126(24), 241102 (2021)
30. R. Abbott et al. “Tests of general relativity with binary black holes from the second LIGO-Virgo gravitational-wave transient catalog”, Phys. Rev. D, 103(12), 122002 (2021)
31. R. Abbott et al. “Gwtc-2: Compact binary coalescences observed by ligo and virgo during the first half of the third observing run”, Phys. Rev. X, 11(1), 021053 (2021)
32. R. Abbott et al. “Population properties of compact objects from the second LIGO-Virgo Gravitational-Wave Transient Catalog”, ApJ Lett., 913(1), L7 (2021)
33. R. Abbott et al. “Diving below the spin-down limit: Constraints on gravitational waves from the energetic young pulsar PSR J0537-6910”, ApJ Lett., 913(2), L27 (2021)
34. R. Abbott et al. “All-sky search in early O3 LIGO data for continuous gravitational wave signals from unknown neutron stars in binary systems”, Phys. Rev. D, 103(6), 064017 (2021)
35. R. Abbott et al. “Gravitational-wave constraints on the equatorial ellipticity of millisecond pulsars”, ApJ Lett., 902, L21 (2020)
36. L. Tsakalakos, J. Balch, J. Fronheiser, M. Shih, S. LeBoeuf, M. Pietrzykowski, P. Codella, B. Korevaar, O. Sulima, J. Rand, Anilkumar Davuluru and **Umakant Rapol**, “Strong broadband optical absorption in silicon nanowire films”, J. Nanophotonics 1(1), 013552 (2007)
37. J. Benhelm, G. Kirchmair, **U. Rapol**, T. Körber, C. Roos, and R. Blatt, “Measurement of the hyperfine structure of the S1/2 −D5/2 transition in 43Ca+”, Phys. Rev. A 75(3), 032506 (2007)
38. J. Benhelm, G. Kirchmair, **U. Rapol**, T. Körber, C. Roos, and R. Blatt, “Erratum: Measurement of the hyperfine structure of the S1/2 −D5/2 transition in 43Ca+ [Phys. Rev. A 75, 032506 (2007)]”, Phys. Rev. A 75(049901), 049901 (2007)
39. S. Moal, M. Portier, J. Kim, J. Dugué, **U. Rapol**, M. Leduc, and C. Cohen-Tannoudji, “Accurate determination of the scattering length of metastable helium atoms using dark resonances between atoms and exotic molecules”, Phy. Rev. lett. 96(2), 23203 (2006)
40. H. Häffner, W. Hänsel, C. Roos, J. Benhelm, et al., “Scalable multiparticle entanglement of trapped ions”, Nature 438(7068), 643 (2005)
41. H. Häffner, F. Schmidt-Kaler, W. Hänsel, C. Roos, T. Körber, M. Chwalla, M. Riebe, J. Benhelm, **U. Rapol,** C. Becher, et al., “Robust entanglement”, App. Phys. B 81(2), 151 (2005)
42. J. Kim, **U. Rapol**, S. Moal, J. Léonard, M. Walhout, and M. Leduc, “Photoassociation experiments with ultracold metastable helium”, Euro. Phys. J. D 31(2), 227 (2004)
43. **U. Rapol**, A. Krishna, A. Wasan, and V. Natarajan, “Laser cooling and trapping of Yb from a thermal source”, Euro. Phys. J. D 29(3), 409 (2004)
44. A. Banerjee, D. Das, **U. Rapol**, and V. Natarajan, “Frequency locking of tunable diode lasers to a rubidium-stabilized ring-cavity resonator”, App. Opt. 43(12), 2528 (2004)
45. **U. Rapol** and V. Natarajan, “Doppler-free spectroscopy in driven three-level systems”, Eur. Phys. J. D 28(3), 317 (2004)
46. **U. Rapol**, A. Wasan, and V. Natarajan, “Subnatural linewidth in room-temperature rb vapor using a control laser”, Phys. Rev. A 67(5), 053802 (2003)
47. **U. Rapol**, A. Krishna, and V. Natarajan, “Precise measurement of hyperfine structure in the 5P3/2 state of Rb”, Euro. Phys. J. D 23(2), 185 (2003)
48. A. Banerjee, **U. Rapol**, D. Das, A. Krishna, and V. Natarajan, “Precise measurements of UV atomic lines: Hyperfine structure and isotope shifts in the 398.8 nm line of Yb”, Euro. Phys. Lett. 63, 340 (2003)

49. **U. Rapol**, A. Wasan, and V. Natarajan, "Observation of sub-natural linewidths for cold Rb atoms in a magneto-optic trap", Euro. Phys. Lett. 61, 53 (2003)
50. **U. Rapol** and V. Natarajan, "Precise measurement of hyperfine intervals using avoided crossing of dressed states", Euro. Phys. Lett. 60, 195 (2002)
51. A. Banerjee, **U. Rapol**, and V. Natarajan, "Direct measurement of the fine-structure interval in alkali atoms using diode lasers", App. Phys. lett. 80, 3688 (2002)
52. A. Banerjee, **U. Rapol**, A. Wasan, and V. Natarajan, "High-accuracy wavemeter based on a stabilized diode laser", App. Phys. Lett. 79, 2139 (2001)
53. **U. D. Rapol**, A. Wasan, and V. Natarajan, "Loading of a Rb magneto-optic trap from a getter source", Phys. Rev. A 64, 023402 (2001)

MANUSCRIPTS UNDER PROCESS

1. Sunil Kumar, Manav Shah, Ajith P. Ravishankar, Chetan Vishwakarma, Arindam Das, Jay Mangaonkar, Venu Gopal Achanta, and **Umakant D. Rapol**, "Design Fabrication and Characterisation of nanoplasmonic lattice for trapping of ultracold atoms", arXiv:1810.10385
2. Chetan Vishwakarma, Kushal Patel, Jay Mangaonkar, and **Umakant D. Rapol**, "Measurement of Sr-N2 elastic collision cross section in Magneto-Optical Trap", arXiv:1905.03202
3. Joel M. Sunil, J. Bharathi Kannan, Monu Bhartiya, Rayees A S, Shuvarati Roy, G. J. Sreejith, M. S. Santhanam, **Umakant Rapol**,"Localization with Hopping Disorder in Quasi-periodic Synthetic Momentum Lattice", arXiv:2604.11855

CONFERENCE PROCEEDINGS

1. C. Becher, H. Barros, J. Benhelm, D. Chek-al Kar, M. Chwalla, H. Häffner, W. Hänsel, T. Körber, T. Monz, E. Phillips, **U. Rapol**, M. Riebe, C. Roos, C. Russo, P. Schmidt, O. Gühne, W. Dür, and R. Blatt. Entanglement of trapped ions. In Conference on Lasers and Electro-Optics and 2006 Quantum Electronics and Laser Science Conference, CLEO/QELS 2006, p. 4629048 (2006).
2. **Rapol, U.D.** and Häffner, H. and Riebe, M. and Roos, C. and Hänsel, W. and Chwalla, M. and Benhelm, J. and Körber, T. and Lancaster, G. and James, D.F.V. and Schmidt-Kaler, F. and Blatt, R. Application of process tomography to quantum teleportation. In Quantum Electronics Conference, 2005. EQEC'05. European, p. 309 (IEEE, 2005).
3. T. Körber, C. Roos, W. Hänsel, **U. Rapol**, M. Chwalla, J. Benhelm, D. Chek-al kar, M. Riebe, H. Häffner, F. Schmidt-Kaler, and R. Blatt. Observation of very long-lived entanglement. vol. 2005, p. 314 (2005). In Quantum Electronics Conference, 2005. EQEC'05. European, p. 314 (IEEE, 2005).
4. **U. Rapol**, A. Wasan, and V. Natarajan, "Laser cooling and tapping of Rubidium and Ytterbium atoms", Physics with cold atoms p. 17 (2001).

GENERAL ARTICLES

1. V. Natarajan, A. Banerjee, and **U. Rapol**, "Experiments with a laser-cooled cloud of atoms", Current Science 76, 216 (1999).
2. Chetan Vishwakarma, Subhadeep De and **Umakant D. Rapol**, "A brief introduction to optical atomic clocks", Physics news 50, 32 (2020).