Kishor T. Kapale

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Education

Ph.D./ Theoretical Quantum Optics December, 2002 (*Departmental Pre-Thesis Research Award*)	Texas A&M University (TAMU) 1997-2002 GPA: 4.0/4.0 *Advisor: Prof. M. O. Scully*
M.Sc./ Physics (1995-1997) (*Second Rank in Batch*)	Indian Institute of Technology, Bombay, India GPA: 8.5/10.0 (*Second Rank in the Entrance Exam*)
B.Sc./ Physics (1992-1995) (*First Rank in College, 19th Rank in University*)	University of Bombay, Bombay, India

Employment

9. Assistant Professor	Department of Physics, Western Illinois University (July 2007 - current)
8. Senior Postdoctoral Researcher	Funded by LSU and JPL Job located at Jet Propulsion Laboratory, Caltech (May 2006 - July 2007)
7. National Research Council Research Associate	Jet Propulsion Laboratory, California Inst. of Technology (April 2004 - April 2006)
6. Postdoctoral Research Associate	Princeton University, (Sept 2003-Dec 2003)
5. Postdoctoral Research Associate	Texas A&M University, (Dec 2002-April 2004)
4. Junior Researcher	Max-Planck Institute für Quantenoptik, Garching, Germany, (Summer months 1998-2001)
3. Graduate Assistant (Research)	Texas A&M University, (2000-2002)
2. Graduate Assistant (Teaching)	Texas A&M University, (1997-2000)
1. Summer Trainee	Physical Research Laboratory, Ahmedabad (Summer 1996)

Research Interests

- Quantum Optics, Atom Optics and Quantum Statistical Mechanics
- Quantum Information Science
- Molecular Physics and Quantum Chemistry

- Symbolic and Numerical Computation
- Material Simulations for Nonlinear Optical Properties

Research Skills and Accomplishments (general)

- Eight years of experience in the field of Theoretical Quantum Optics.
- First-hand research experience in the area of Bose-Einstein Condensation, Cavity QED, Atom Optics and Quantum Information Science
- Well conversant with the fields of Free Electron Lasers and Molecular Physics
- Well acquainted with the modern fields of Quantum Computing, Cryptography and Quantum Teleportation (A review article on Quantum Teleportation to credit).
- Excellent analytical, computational and communication skills.

Awards, Honors & Scholarships

1. **National Research Council Associateship Award** to work at Jet Propulsion Laboratory, Calfornia Institute of Technology, California. (Oct 2003)
2. **Pre-Thesis Award** from Department of Physics, TAMU for research accomplishments for academic year 2000-01 (April 2001).
3. **Travel Awards** from APS (American Physical Society) for oral presentation (March 2001, October 2001), and from Gordon Research Conference on Atomic Physics for poster presentation (June 2001).
4. Awarded membership of **The Honor Society of Phi Kappa Phi** 2001.
5. Winner of an **Honorable mention** award from APS for oral presentation (March 2000).
6. Winner of **J. N. Tata Endowment scholarship** for joining Texas A&M for higher studies (July 1997).
7. Placed **sixth** with the score of **99.61 percentile** in the All India Graduate Aptitude Test in Physics (February 1997).
8. Placed **second** in the All India Entrance Test for M.S. in Physics at Indian Institute of Technology (IIT), Bombay (June 1995).
9. Winner of **Gold Medal** in the National Graduate Physics Examination conducted by Indian Physics Teachers Association (April 1995).
10. Winner of **Silver Medal** in the Young Scientist Competition conducted by Greater Bombay Science Teachers Association in 1987.
11. **Scholarships :**
    - **J. N. Tata Endowment scholarship** to pursue higher studies in the USA (July 1997).

- *Government of India* **National Merit Scholarship** for my M.S. studies at IIT, Bombay (1995-1997).
- *Maharashtra State Government* **Open Merit Scholarship** (1990-1995).

Affiliations

- American Physical Society
- Optical Society of America

Other Activities

- Have taught all the physics laboratory sessions for freshman / sophomore science and engineering majors at Texas A&M University and served as a recitation instructor for all elementary physics courses.
- Served as a Judge at the Texas Junior Academy of Science, held at TAMU in April 2001.
- Served as a Judge at the Regional Science Fair at Navasota High School, Navasota, Texas in Spring 2000.
- Elected member of the Departmental Graduate Student Council for year 2000.
- One of the main organizers of the 30th Winter Colloquium on the Physics of Quantum Electronics, 9-12 Jan 2000, Snowbird, Utah.

Proposal and Grant Experience

Actively involved in proposal writing throughout the graduate and postdoc career to several governmental agencies such as Defense Advanced Research Projects Agency, Office of Naval Research, National Science Foundation, National Reconnainance Office-Director's Innovation Initiative and Army Research Office-Short Term Innovative Concept proposal.

Research Activities (Technical Description)

1. *Indian Institute of Technology, Bombay, India: (1995-1997)*
   Worked in the area of Numerical study of Free Electron Laser. An existing code "TDA" was modified to include the case of multiple undulator structures within a single cavity. As a result of this numerical study it was shown that the gain of an ordinary FEL is enhanced by increasing the undulator sections inside the resonator cavity. The enhancement in the gain was ascribed to the bunching of the electron achieved in the first undulator section. This work was done jointly with Prof. G. Mukhopadhyay, IITB and S. Krishnagopal, Center for Advanced Technology, Indore, India, during academic year 1996-1997
2. *Physical Research Laboratory, Ahmedabad, India: (1996)*
   The well known Fermi-Goldon Rule was extended to a more general case of multiple transitions using higher order perturbation theory, and was shown to be applicable to obtain

scattering cross-sections in various complicated atom-field systems, like Hyper Raman scattering. This work was done at Physical Research Laboratory, Ahmedabad with Prof. G. S. Agarwal.

3. *Texas A&M University, College Station, TX USA: (1997-2004)*
The work at Texas A&M University was done with various collaborators and partly at Max-Planck Institute fuer Quantenoptik, Garching Germany.

Bose–Einstein Condensation:

Problem of phase transitions in mesoscopic systems was studied in the backdrop of Bose-Einstein Condensation. An appropriate definition of critical temperature was obtained for such systems, based on laser phase transition analogy.

Also the condensate statistics was studied by various methods in the canonical settings, like steady state solution of a non-equilibrium master equation, conventional statistical mechanical techniques in the regime of Maxwell Daemon Ensemble approximation, and the canonical-ensemble quasiparticles. The main result obtained was the non-Gaussian nature of the condensate occupation statistics. The higher order moments were shown to be of appreciable magnitude and the results were compared with the exact numerical method in the parameter regime of validity of the above mentioned methods and the agreement was found to be excellent. The master equation approach was investigated further in order to explain the success of the approach, and the steady state solution of the same was shown to be in complete accord with the canonical ensemble distribution.

As a result of the study of the ideal Bose gas in the Maxwell-Daemon ensemble, it was shown that for higher statistical properties of the condensate occupation (e.g. all the moments greater than the first one) there is a strong dependence on the boundary conditions used to evaluate the energy spectrum in the case of a 3D Box-type confining potential.

Connection between the canonical and microcanonical ensembles was also investigated and a strategy was developed to convert the canonical results obtained earlier to the microcanonical ensemble that is more appropriate to the current experimental investigations.

Atomic Coherence effects:

Various problems were studied based on a common theme of quantum coherence and interference.

An experimentally achievable method for manipulation of spontaneous emission process from a three-level V-type atom was proposed. It was observed that through the interference of incoherent pump processes one obtains an easily controllable handle on spontaneous emission quenching. Near complete suppression of spontaneous emission from the doublet was obtained even in the absence of interference in the decay channels, which is considered an essential requirement traditionally.

Various atomic cooling schemes to achieve cooling in atomic system without the presence of spontaneous emission through quantum coherence were proposed. This also allows one to achieve cooling to an internal absolute zero of temperature in an atomic system in very small number of steps, thus contradicting an accepted opinion about the third law of thermodynamics.

An interesting regime of Lasing Without Inversion (LWI) was studied in which transient gain without inversion is possible in a three level lambda system. It was showed that in this regime coherent Raman amplification and absorption are canceled through a specific

preparation of the initial states and a pure form of lasing without inversion is achieved. The adverse effect of thermal radiation on the effect was also studied. Thus work is currently being finalized for submission to Physical Review Lettters.

Free Electron Lasers:

Numerical experiments with the Free Electron Lasers without Inversion (FELWI) were carried out. Modifications of the drift region between two undulators of a typical FEL setup were suggested and the FEL dynamics was studied by appropriately modifying the well-known TDA3D simulation code. This work essentially provides a proof-of-principle of the FELWI. The work is published in **Physical Review Letters** (2003).

Atom Optics:

The work in the field of Atom Optics concerns with the measurement of center-of-mass wave function of an atomic beam by passing it through a cavity and manipulating suitably the internal degrees of freedom of the atoms. Various conditional measurements on the position and momentum distribution of the atoms as they come out of the cavity give us information about both the amplitude and phase of the center-of-mass wavefunction.

Molecular Physics:

During the year spent at Texas A&M and at Princeton universities as a Postdoctoral Researcher after the completion of the Ph.D. work I had the opportunity of working in an entirely different area, namely molecular physics. A novel approach to molecular physics calculations through two-center orbital basis functions was developed and was found to be promising. Compared to existing approaches of expansions in terms of Gaussian and Slater type orbitals our approach gives a very compact and physically motivated wavefunction for the diatomics. The results are published in **Chemical Physics Letters** (2004). A comprehensive review article in this area of molecular physics and its relevance to the field of Quantum Optics is also published in the volume 51 of the **Advances in Atomic, Molecular and Optical Physics (2005).**

4. *Jet propulsion Laboratory, California Institute of Technology (May 2004-current)*

Coherent Atomic Ensemble and OAM light interaction:

Various problems in the area of quantum information science and quantum optics are currently being investigated. An interesting recent result includes deterministic generation of arbitrary coherent superposition of two counter-rotating vortex states in a trapped BEC cloud by coupling it with specially prepared orbital angular momentum (OAM) states of light. This research opens up great deal of possibilities on coherent manipulation of macroscopic states of BEC with light fields and never thought before manipulation techniques for the orbital angular momentum states of light. This work is published in **Physical Review Letters** (2005). Several further directions on the line of this work are currently under investigation.

Quantum Information Science:

A recent publication to **Physical Review A** discusses a novel method to employ cavity induced interaction between two atomic entities form a linear array of a number of them to achieve non-local quantum phase gate. This proposal allows direct implementation of the quantum logic circuits, as they are usually drawn with several non-neighbor quantum gates. This idea can also lead to efficient generation of cluster states.

Several proposals are also currently under investigation for the study of generation of entanglement of large ensembles of atoms via their collective interaction with cavity QED. Several directions under investigation include generation of Werner States, study of connection between entanglement and phase transitions in the atomic ensembles.

Several of my research efforts in the area of quantum optics, after arriving at JPL, have given rise to interesting results including:

(a) Sub-wavelength atom localization through the control of the EIT and Coherent Population Trapping (CPT) phenomena.

(b) Phase control of the group velocity to obtain wide-range of tunability from subluminal to superluminal pulse propagation in a single atomic medium.

(c) Phase control of the sub-wavelength atom localization itself to obtain even sharper and controllable localization. A new regime of sub-wavelength localization of atom was identified and named as "sub-half-wavelength" localization.

(d) Generation of multiparticle entangled states which are analogous to the well known entangled states such as Werner states, GHZ states and N00N states for atomic entities via their collective interaction with the cavity field.

(e) Heisenberg limited interferometry with neutral atoms for applications to the inertial sensing and highly sensitive magnetic field measurements.

(f) Practical schemes for generation of maximally path-entangled states of photons, the so-called "NOON" states.

Ongoing research activities:

(a) Photonic Crystal simulation via the Finite Difference Time Domain (FDTD) algorithm.

(b) Simulation of Nonlinear Optical (NLO) properties of nano-materials via development of new numerical algorithms.

(c) Further development of Heisenberg limited interferometry with atoms and photons in the context of schemes for generation of entangled states with large number of entities, adaptation of phase measurement for measurement of various other physical quantities and simplification of the final measurement to extract the phase.

(d) Connection between entanglement and phase transitions in externally driven atomic ensembles.

List of Publications of Dr. K. T. Kapale

Summary:

Total Written Works: 30
Reviews, Book Contributions: 2
Preprints: 6
Publications: 22

Conference Presentations, Posters and Invited Talks: 35

A Reviews, Book Contributions

2. "The two electron molecular bonds revisited: from Bohr orbits to two-center orbitals", G. Chen, S. A. Chin, Y. Dou, **K. T. Kapale**, M. Kim, A. A. Svidzinsky, K. Urtekin, H. Xiong, and M. O. Scully, **invited review article** for *Advances in Atomic, Molecular and Optical Physics*, Eds. P. R. Berman, C. C. Lin and H. Walther **Vol. 51** pg. 93–238 (2005); preprint available at physics/0508177.
1. "Quantum Teleportation", **K. T. Kapale** and M. S. Zubairy, in The Mathematics of Quantum Computation, edited by R. Brylinski and G. Chen (Chapman and Hall, Boca Raton, Florida 2002), Chapter 13, pp 323–355. **(comprehensive review article)**

B Preprints

5. "Generation of non-classical vortex states in Bose-Einstein Condensates"; preprint available upon request.
4. "Coherent Superposition of Quantized Vortices in Bose-Einstein Condensates through Optical Vortex Beams ", submitted to Phys. Rev. A; preprint available upon request.
3. "Multipartite Entanglement in Non-Equilibrium Quantum Phase Transition in a Collective Atomic System", with G. S. Agarwal; preprint available upon request.
2. "Lasing Without Inversion: Counter-intuitive population dynamics in the transient regime", S. Ya. Kilin, **K. T. Kapale**, and M. O. Scully, submitted to Phys. Rev. Lett.; preprint available upon request.
1. "Free-Electron Lasers Without Inversion: Design of a Two Magnet Drift Region", A. I. Artemyev, Yu. V. Rostovtsev, S. Trendafilov, **K. T. Kapale**, M. V. Fedorov, G. Kurizki, and M. O. Scully, Los Alamos archives, physics/0207032.

C Publications

23. "A Bootstrapping Approach for Generating Maximally Path-Entangled Photon States", **K. T. Kapale** and J. P. Dowling, *Phys. Rev. Lett.* **99**, 053602 (2005); preprint available at http://www.arxiv.org/abs/quant-ph/0612196.
22. "Polarization preserving quantum nondemolition photodetector", **K. T. Kapale**, *J. Mod. Opt.* **54**, 327–335 (2007), preprint quant-ph/0603279.
21. "Subwavelength atom localization via coherent population trapping", G. S. Agarwal and **K. T. Kapale**, *J. Phys. B: At. Mol. Opt. Phys.* **39**, 3437–3446 (2006); preprint quant-ph/0505014.
20. "Quantum Interferometric Sensors", **K. T. Kapale**, L. D. Didomenico, H. Lee, P. Kok, and J. P. Dowling, *Concepts of Physics*, vol. II no. 3-4 225 (2005), preprint quant-ph/0507150.
19. "Subwavelength atom localization via phase control of absorption spectrum-II", **K. T. Kapale** and M. S. Zubairy, *Phys. Rev. A* **73**, 023813 (2006), preprint quant-ph/0509068.
18. "Generation of Werner states via collective decay of coherently driven atoms", G. S. Agarwal and **K. T. Kapale**, *Phys. Rev. A* **73**, 022315 (2006), preprint quant-ph/0510092.
17. "Cavity-mediated long-range interaction for fast multiqubit quantum logic operations", **K. T. Kapale**, G. S. Agarwal, and M. O. Scully, *Phys. Rev. A* **72**, 052304 (2005), preprint quant-ph/0502130.
16. "Vortex Phase Qubit: Generating Arbitrary, Counterrotating, Coherent Superpositions in Bose-Einstein Condensates via Optical Angular Momentum Beams", **K. T. Kapale**, and J. P. Dowling, *Phys. Rev. Lett.* **95**, 173601 (2005), preprint quant-ph/0504130.
15. "Exploiting the quantum Zeno effect to beat photon loss in linear optical quantum information processors", F. M. Spedalieri, H. Lee, M. Florescu, **K. T. Kapale**, U. Yurtsever and J. P. Dowling, *Opt. Commun.* **254**, 374–379 (2005), preprint quant-ph/0408026.
14. "Subwavelength atom localization via phase control of absorption spectrum", M. Sahrai, H. Tajali, **K. T. Kapale**, and M. S. Zubairy, *Phys. Rev. A* **72** 013820 (2005), preprint quant-ph/0502158.
13. "Tunable phase control for subluminal to superluminal light propagation", M. Sahrai, H. Tajali, **K. T. Kapale**, and M. S. Zubairy, *Phys. Rev. A* **70**, 023813 (2004).
12. "Molecular Calculations with Two-Center Correlated Orbitals", M. O. Scully, R. E. Allen, Y. Dou, **K. T. Kapale**, M. Kim, G. Chen, and A. Svidzinsky, *Chem. Phys. Lett.* **389**, 385-392 (2004).
11. "Spectroscopic measurement of an Atomic Wave Function", **K. T. Kapale**, S. Qamar, and M. S. Zubairy, *Phys. Rev. A* **67**, 023805 (2003).
10. "Quenching of spontaneous emission through interference of incoherent pump processes", **K. T. Kapale**, M. O. Scully, S.-Y. Zhu, and M. S. Zubairy, *Phys. Rev. A* **67**, 023804 (2003).
9. "Numerical Experiments with Free-Electron Lasers Without Inversion", Yu. V. Rostovtsev, S. Trendafilov, A. I. Artemyev, **K. T. Kapale**, G. Kurizki, and M. O. Scully, *Phys. Rev. Lett.* **90**, 14802 (2003).

8. "Sharpening accepted thermodynamic wisdom via quantum control or cooling to an internal temperature of zero by external coherent control fields without spontaneous emission", M. O. Scully, Y. Aharonov, **K. T. Kapale**, D. J. Tannor, G. Sussmann, and H. Walther, *Journal of Modern Optics*, **49**, 2297-2307 (2002).
7. "Non-trivial effect of boundary conditions on statistical properties of ideal Bose–Einstein condensates", M. Holthaus, **K. T. Kapale**, V. V. Kocharovsky and M. O. Scully, *Phys. Rev. E* **65** 036129 (2002)
6. "Equivalence of the Master Equation Approach to the Canonical ensemble approach for an Ideal Bose Gas", **K. T. Kapale** and M. S. Zubairy, *Opt. Commun.* **191**, 299-304 (2001).
5. "Master equation vs. partition function: Canonical statistics of ideal Bose–Einstein condensates", M. Holthaus, **K. T. Kapale**, V. V. Kocharovsky and M. O. Scully, *Physica A* **300**, 433-467 (2001).
4. "Phase control of electromagnetically induced transparency and its application to tunable group velocity and atom localization", **K. T. Kapale**, M. Sahrai, H. Tajali, and M. S. Zubairy, in *Advanced Optical and Quantum Memories and Computing II*, Ed. Hans J. Coufal, Zameer U. Hasan and Alan E. Craig, Proc. of SPIE vol. **5735**, 69-79 (2005).
3. "Numerical Experiments on Free-Electron Lasers Without Inversion: small- and high-gain regimes", Y. Rostovtsev, S. Trendafilov, A. Artemyev, **K. T. Kapale**, G. Kurizki, and M. O. Scully, in *Fourth-Generation X-Ray Sources and Ulrafast X-Ray Detectors*, Ed. Roman O. Tatchyn *et al.*, Proc. of SPIE. **5194**, 11-19 (2004).
2. "Violation of the Third Law of Thermodynamics through an Atomic Cooling Scheme", **K. T. Kapale**, Proceedings of the First International Conference on the Quantum Limits to the Second Law, San Diego July 2002.
1. "Does the Critical Temperature Concept Make Sense for Bose Einstein Condensation in Mesoscopic Systems? or Is There an Easy Resolution to the Uhlenbeck Dilemma?" M. O. Scully and **K. T. Kapale**, in *Proceedings of the R. Arnowitt Fest: Relativity, Particle Physics and Cosmology*, edited by R. E. Allen (World Scientific, Singapore, 1999), pp. 181-189.

E Conference Presentations, Posters and Invited Talks

35. Talk: "A Bootstrapping Approach to Generation of Maximally Path-Entangled States of Light" at SQuINT 2007, California Institute of Technology, Pasadena, CA. Feb. 16-18 2007.
34. Invited Talk (Colloquium): "Superresolution: Quantum tricks to beat the diffraction limit" at Department of Physics, Western Illinois University, Macomb, IL, Feb. 6, 2007.
33. Talk: "Subwavelength Atom Localization via Coherent Population Trapping" at Frontiers in Optics 2006, Rochester, New York Oct. 8-12, 2006.
32. Invited Poster : "Polarization preserving quantum non-demolition photodetector for protection of quantum information in photonic quantum processors and communication networks" at International Workshop On Linear Optical Quantum Information Processing, held at Louisiana State University, Baton Rouge, Louisiana on April 9-12, 2006.

31. Talk: "Generation of Werner States via Collective Decay of Coherently Driven Atoms" at American Physical Society, March Meeting, Baltimore, Maryland, March 13-17, 2006.
30. Talk: "Generation of coherent superposition of vortex states in Bose-Einstein Condensates" at American Physical Society, March Meeting, Baltimore, Maryland, March 13-17, 2006.
29. Invited Talk (Colloquium): "Superresolution: Quantum tricks to beat the diffraction limit" at Department of Physics, Stevens Institute of Technology, Hoboken, New Jersey on March 1, 2006.
28. Talk: "The Vortex-Phase qubit: Generation of coherent superposition of vortex–antivortex pair in Bose-Einstein condensates" at Quantum Computing and Many Body Systems International Conference, Key West Florida Jan 30-Feb 3, 2006
27. Invited Talk (Colloquium): "Superresolution: Quantum tricks to beat the diffraction limit" at Department of Physics, University of Oregon, Eugene, Oregon on Nov 28, 2005.
26. Talk: "The Vortex-Phase qubit: Generation of coherent superposition of vortex–antivortex pair in Bose-Einstein condensates" at Frontiers in Optics 2005, Tucson, Arizona Oct. 16-20, 2005.
25. Talk: "Heisenberg Limited Interferometry with Neutral Atoms" at Frontiers in Optics 2005, Tucson, Arizona Oct. 16-20, 2005.
24. Poster: "The Vortex-Phase qubit: Generation of coherent superposition of vortex–antivortex pair in Bose-Einstein condensates" at Quantum Computing Program Review of ARO and ARDA, Tampa, Florida Aug. 22-26, 2005.
23. Invited Talk (Colloquium): "Superresolution: Quantum tricks to beat the diffraction limit" at Department of Physics, Oklahoma State University, Stillwater, Oklahoma on Sept. 1, 2005.
22. Poster: "The Vortex-Phase qubit: Generation of coherent superposition of vortex–antivortex pair in Bose-Einstein condensates" at Quantum Computing Program Review of ARO and ARDA, Tampa, Florida Aug. 22-26, 2005.
21. Poster: Cavity Assisted Non-Neighbor Interaction for Fast Multiqubit Quantum Logic Operations, at Seventh Annual SQUINT Meeting, Tucson, Arizona, Feb. 18-20, 2005.
20. Invited talk: "Bose-Einstein Condensates and Generalized Zeta Functions", Workshop on Semiclassical Approximation and Vacuum Energy" Jan 12-16, 2005 at Dept. of Mathematics, Texas A&M University, College Station, Texas.
19. Invited talk: "Phase control of group velocity: Tunable switch for subluminal to superluminal light propagation" at Department of Physics, Oklahoma State University, Stillwater, Oklahoma on Nov 17, 2004.
18. Talk: "N-qubit quantum memory through well-defined sequence of optical pulses", Frontiers in Optics, Annual meeting of OSA, October 10-14, 2004, Rochester, New York.
17. Invited Talk: "Cavity QED Implementation of Quantum Teleportation", SERC school on Quantum Information and Quantum Optics, Physical Research laboratory, Ahmedabad, India, Feb. 13, 2004.

16. Invited talk (Colloquium): "Novel approach to molecular physics through correlated two-center orbitals" at Tata Institute for Fundamental Research, Mumbai, India on Jan 30, 2003.
15. Invited talk: "Novel approach to molecular physics through correlated two-center orbitals" at Indian Institute of Technology, Mumbai, India on Jan 28, 2004.
14. Invited talk: "Novel approach to molecular physics through correlated two- center orbitals", PQE, January 4-8, 2004, Snowbird, Utah
13. Invited talk: "Quenching of spontaneous emission through interference of incoherent pump processes", PQE, January 5-9, 2003, Snowbird, Utah.
12. Invited talk: "A Novel approach to molecular physics: Two-center basis functions", TAMU-ONR workshop on Quantum Optics, July 2003
11. Poster: "Violation of the Third Law of Thermodynamics through an Atomic Cooling Scheme", First international conference on the quantum limits to the second law, San Diego, July 2002.
10. Talk (Travel Award): "Influence of Boundary Conditions on the statistical properties of ideal Bose-Einstein Condensates", **K. T. Kapale**, M. Holthaus and M. O. Scully, Texas Section APS Meeting, October 4-6, 2001 at Texas Christian University.
9. Poster: "Implementation of quantum teleportation protocol using cavity QED techniques", **K. T. Kapale**, M. O. Scully and M. S. Zubairy, TAMU-ONR workshop on quantum optics, Jackson-Hole, Wyoming, August 2001.
8. Poster: "Equivalence between conventional canonical distribution and the equilibrium solution of the master equation", **K. T. Kapale**, M. O. Scully and M. S. Zubairy, 8th Rochester meeting, June 2001.
7. Talk (Travel Award): "Non-trivial influence of boundary conditions on the higher statistics of the ideal Bose-Einstein condensates", **K. T. Kapale**, M. Holthaus and M. O. Scully, Gordon Research Conference on Atomic Physics, June 2001.
6. Talk (Travel Award): "Critical Temperature concept for Bose Einstein Condensation in Mesoscopic Systems", **K. T. Kapale**, and M. O. Scully, Texas Section APS meeting, March 1-3, 2001 at Sam Houston State University.
5. Talk (Travel Award): "Equivalence of Master Equation Approach to the Canonical Distribution for an Ideal Bose Gas", **K. T. Kapale**, M. O. Scully and M. S. Zubairy, Texas Section APS meeting, March 1-3, 2001 at Sam Houston State University.
4. Talk (Outstanding Presentation Award): "Nonequilibrium Master Equation Approach to the Condensate Statistics of an Ideal Bose Gas", **K. T. Kapale**, V. V. Kocharovsky, M. O. Scully and M. S. Zubairy, Texas Section APS meeting, March 10-12, 2000 at Texas A&M university.
3. Poster: "Condensate statistics of an ideal Bose gas through canonical ensemble quasiparticles", **K. T. Kapale** and M. O. Scully, Festive-Workshops on Quantum Optics, Teton Village, Wyoming, July 30 - August 4, 2000.
2. Poster: "Non-equilibrium Analysis of Bose Einstein Condensation and Laser Phase Transition Analogy", **K. T. Kapale**, V. V. Kocharovsky, M. O. Scully, S.-Y. Zhu, and M. S. Zubairy, TAMU-ONR workshop on Quantum Optics, Jackson Hole, Wyoming, July 26-30, 1999.

1. Poster: "Resolution of the Uhlenbeck Dilemma",
   K. T. Kapale and M. O. Scully, TAMU-ONR workshop on Quantum Optics, Jackson Hole, Wyoming, July 1998.

F Thesis and Project Reports:

3. Ph.D. Dissertation:"Topics in statistical mechanics and Quantum optics: Condensate statistics of ideal Bose gases and atomic coherence effects" at Texas A&M University, College Station, Texas, USA
2. M.S. Thesis: "Optoelectronic Studies of Free-Electron Lasers" at Indian Institute of technology, Bombay, India
1. Summer Research Project Report: "Higher order Fermi-Goldon Rule and its Applications" at Physical Research Laboratory,
   Ahmedabad, India