

Subhadeep De

Office:

Room - 217,
Inter-University Centre for Astronomy and Astrophysics,
S. P. Pune University Campus, Ganeshkhind,
Pune – 411007, India.

Phone - +91-20-25604217 (Off.);

Email – subhadeep@iucaa.in

Skype – sde.subhadeep

Web - www.iucaa.in

Residence:

27, Akashganga, IUCAA Housing Complex,
S. P. Pune University Campus,
Ganeshkhind,
Pune – 411007, India.

+91-8860179175 (mob.)

+91-20-2560 427 (Home)

sde.subhadeep@gmail.com

Research Interest: Experimental expertise in laser cooling and trapping of atoms, degenerate quantum gasses and time & frequency metrology.

Present interests are within the following areas

- (1) Precision measurements for probing fundamental science.
- (2) Optical atomic clock for probing fundamental science and technological applications.
- (3) Developing quantum enhanced technologies and quantum metrology.

Externally Funded Projects:

1. PI of “Optical clock based accurate time stamping in quantum communication” under the mission mode project “Quantum Enabled Science and Technology (QuEST)” of DST (2020-23).
Budget – 970 lakhs.
2. PI of “Photoionization and high-resolution imaging system” funded by CSIR-NPL (2018-19).
Budget – 23 lakhs.
3. PI of “Transfer Cavity Locking of Repump Lasers Incorporated with FPGA Based Advanced Locking Electronics” funded by DAE-BRNS, India (2014-17).
Budget – 29 lakhs.
4. PI of “Design, Fabrication and Characterization of an Ion Trap for Trapping *Single* Ytterbium Ion – Building *the First* Optical Frequency Standard in India” funded by SERB-DST, India (2014-17).
Budget-57 lakhs.
5. PI of “All-in-one digital module consisting frequency generator, lock-in amplifier and PID controller” CSIR funded project awarded from young scientist award in Physical science 2015 (2016-19).
Budget- 25 lakhs.
6. Co-PI of “Single Trapped Ion Optical Frequency Standards” funded by CSIR-NPL, India (2012-17).
Budget-850 lakhs.
7. Team member of “Setting up backup timescale and dissemination of IST” funded by CSIR-NPL, India (2016-19).
Budget-2000 lakhs.

Consultancy projects:

1. Team member of “Consultancy for establishment of facilities for Dissemination of IST under Legal Metrology Act 2009” funded by Dept. of Legal Metrology, MoCA (2018-20).
Budget - 91 lakhs.
2. Team member of “Development of Timing laboratories of legal metrology traceable to National Time Scale generating IST at five locations and creation of one disaster recovery center” funded by Dept. of Legal Metrology, MoCA (2019-21).
Budget – 10000 lakhs.

Ph. D Thesis Supervised:

(A.) Enrolled at CSIR-NPL, New Delhi

1. N. Batra – “Computations, Design and Instrumentation for Precision Ion Trap Experiment”, graduated in 2018.
2. A. Roy – “Developing experimental setup for trapped ion based optical atomic clock”, graduated in 2019.
3. L. Sharma – “Development of the laser optical set-ups for Ytterbium ion optical frequency standards” 4th year.
4. H. Rathor – 2nd year.
5. N. Yadav – 2nd year.
6. R. Bindal – 1st year.
7. S. Utreja – 1st year.

M. Tech Thesis Supervised:

1. “Field Programmable Gate Array Based Laser Frequency Stabilization: A Low Cost and Portable System” – Anindya Rastogi, CSIR-NPL (2014).
2. “Computer Controlled DC Power Supply: Digital Voltage Stabilizer” – Ekta Malik, IP University (2014).
3. “Interfacing Field Programmable Gate Array (FPGA) based Locking Electronics with Optical Experiment” – Anjali Yadav, Amity University (2014).
4. “Implementation Of Certain Quantum Gate Operations Using Ultra Cold Atoms In Optical Lattices And Super Lattices” – Poonam Pathak and Deepa Bhatt, IIT Delhi (2015). Jointly supervised with Dr. Sankalpa Ghosh at IIT Delhi.

Employment:

Dec 2019 – present Associate Professor	Inter-University Centre for Astronomy and Astrophysics, Pune Setting up precision quantum measurement lab for (i) quantum metrology on ultra-stable optical reference that has applications in fundamental sciences and high-end technologies e.g. quantum communication; (ii) precision measurements for probing temporal constancy of dimensionless fundamental constants.
Nov 2016 – Dec 2019 Senior Scientist	CSIR – National Physical Laboratory, New Delhi, India Project I – ‘Single Trapped Ion for Optical Standards (STIOS)’. Project II - ‘Setting up back up time scale for Indian Standard Time’
Nov 2012 – Nov 2016 Scientist	CSIR – National Physical Laboratory, New Delhi, India Project I – ‘Single Trapped Ion for Optical Standards (STIOS)’.
Dec 2008 - Oct 2012 Research associate	Joint Quantum Institute, National Institute of Standard and Technology, Gaithersburg and University of Maryland, USA. Project – ‘Creating experimental facility to produce mixture of rubidium (^{87}Rb) BEC and lithium (^6Li) DFG and studying underlying physics’. Advisor – Dr. Ian B. Spielman.

Education:

July 2004 – Sep 2008 Ph. D student	University of Groningen, Netherlands. Thesis title - “Laser cooling and trapping of Barium”. Advisor – Prof. Klaus P. Jungmann and Prof. Lorenz Willmann.
July 2001 – June 2003 M. Sc. in Physics	Indian Institute of Technology, Kharagpur, India. Thesis title – ‘Second harmonic generation of nonlinear mirror mode locked laser using BBO crystal’. Thesis advisor – Dr. P. K. Datta.
August 1998 – June 2001 B. Sc. in Physics (Hons.)	Vivekananda Mahavidyalaya, Burdwan University, India. Subjects: physics (Hons.), mathematics and chemistry (minors).

Research experience:

1. Scientist & Senior scientist (Nov 2012 – Dec 2019)

We are developing the first optical frequency standard in India based on the ultra-narrow transition of a single trapped Ytterbium ion confined in a Paul trap. At present we are engaged in developing subsystem of the experiment such as the ion trap, setting up the lasers systems and other instrumentations. On the other hand, as per mandate of the division (Time and Frequency Div.), I am working in the team for generation, maintenance and dissemination of the Indian Standard Time to the stakeholders in the pan India. Apart from experiment, I am involved in theoretical study of the dynamics associated to degenerate gasses and trapped ion systems.

2. Post doctoral research (Dec 2008 – Oct 2012)

I was engaged in building an experiment to produce degenerate mixtures of Bose and Fermi gasses. I developed the laser systems for Rubidium and Lithium, ultra high vacuum (UHV) chamber, source to produce dual species atomic beam, Zeeman slower, electromagnet for both Helmholtz and anti-Helmholtz configuration, optical dipole trap, imaging system, data acquisition, electronic subsystems, streamline flow of chilled water through current carrying coils, dust free clean room working environment for optics. At the end of four years we accomplished BEC in the setup and pursued a spinor BEC experiment.

3. Doctoral thesis work (July 2004 – Sep 2008)

We produced magneto optically trapped Barium, which require simultaneous use of seven lasers for cycling the atoms in a closed transition. We were the first to trap atoms with such a complicated energy level scheme. I worked with dye, Ti:Sapphire, Nd:YAG Verdi, diode and fiber laser systems. I made several external cavity diode lasers at visible and infrared wavelengths. Frequency stabilization of these lasers was done either with a reference Fabry-Perot cavity or spectroscopy with iodine and tellurium molecules. I was designing the vacuum chamber for the experiment including the oven for barium atomic beam.

Teaching experience:

- (1) Teaching a four credit course on “Quantum optics and advanced solid-state optical devices” to the PhD and M Tech students.
- (2) Teaching part of the very specialized training on Time and Frequency Metrology to its users.
- (3) Conducting laboratory experiments associated to that course.
- (4) Scrutinizing thesis for “self-study” which is a part of the PhD course work at AcSIR

Technology development and in the process of licensing:

- (1) “Calibrated photodetector and its monitoring unit”, N. Batra, S. De et. al., TRL-7.
- (2) “Temperature and humidity monitoring system” S. Majhi, S. De. et. al., TRL-7, Copyright filed in 2017
- (3) “All-in-one digital electronic module for frequency synthesizer, lock-in-amplifier and PID servo” A. Roy., S. De et. al., TRL-7.

Publications in SCI journals:

(Names with * indicate corresponding authors)

- (25) “Optical atomic clocks for Redefining SI units of Time and Frequency” Lakhi Sharma, H. Rathore, S. Utreja, Neelam, A. Roy, S. De and S. Panja, MAPAN-J. Metrol. Soc. India, In-print (2020)
- (24) “Atomic flux distribution from a low-divergent dark wall oven” Lakhi Sharma, A. Roy, S. Panja, and **S. De***, Rev. Sci. Instrum. **90**, 053202 (2019).
- (23) “An FPGA based all-in-one function generator, lock-in amplifier and auto-relockable PID system”, A. Roy, Lakhi Sharma, I. Chakraborty, V. N. Ojha, and **S. De***, JINST **14**, P05012 (2019).
- (22) “Estimation of the ion-trap assisted electrical loads and resulting BBR shift” Lakhi Sharma, A. Roy, S. Panja, V. N. Ojha and **S. De***, Scientific Reports, **8** 16884 (2018).
- (21) “Necessity of “Two Time Zones: IST-I (UTC+5:30 h) and IST-II (UTC+6:30 h)” in India and its implementation” Lakhi Sharma, S. De, P. Kandpal, M.P. Olaniya, S. Yadav, T. Bhardwaj, P. Thorat, S. Panja, P. Arora, N. Sharma, A. Agarwal, T.D. Senguttuvan, V.N. Ojha and D.K. Aswal, Current Science **115**, 1252 (2018).
- (20) “Accurate determination of BBR shift, magic and tuneout wavelengths for the $1S_{1/2}$ - $5D_{3/2}$ clock transition in Yb^{+} ” A. Roy, S. De, B. Arora, and B. K. Sahoo, J. Phys. B:At. Mol. Opt. Phys. **50** 205201 (2017).
- (19) “Design of a stable DC voltage source and computer controlling of it using an indigenously developed all-digital addressing-cum-control hardware” A. Roy, N. Batra, S. Majhi, S. Panja, A. Sengupta, and **S. De***, Mapan-J. Metrol. Soc. India, **33**, 139 (2017).
- (18) “Design and construction of a helical resonator for delivering radio frequency to an ion trap” - N. Batra, S. Panja*, S. De, A. Roy, S. Majhi, S. Yadav and A. Sen Gupta, MAPAN-J. Metrol. Soc. India **32**, 193 (2017).
- (17) “An optimized ion trap geometry to measure quadrupole shift of $^{171}Yb^{+}$ clocks” – N. Batra, B. K. Sahoo and **S. De***, Chin. Phys. B **25**, 113703 (2016).
- (16) “Automation of an optical frequency standard experiment” – N. Batra, A. Roy, C. Samal, S. Majhi, S. Panja and **S. De***, IEEE Conf. Proc of 2nd International conference on control, instrumentation, energy and communication, Kolkata. DOI 10.1109/CIEC.2016.7513823 (2016).
- (15) “Design of the Ion Trap and Vacuum System for ^{171}Yb -ion Optical Frequency Standard”- A. Rastogi, N. Batra, A. Roy, J. Thangjam, V. P. S. Kalsi, S. Panja and **S. De***, MAPAN-J. Metrol. Soc. India **30**, 169 (2015).
- (14) ‘Measuring capacitance and inductance of a helical resonator and improving its quality factor by mutual inductance alteration’ – S. Panja*, **S. De**, S. Yadav, Sen Gupta. Rev. Sci. Instrum. **86**, 056104 (2015).
- (13) ‘Systematic Shifts for Ytterbium-ion Optical Frequency Standards’ – N. Batra, Sukhjit Singh, **S. De***, Amisha Arora, Bindiya Arora, A. Sen Gupta. Manuscript is communicated, arXiv:1405.5399 (2015).
- (12) ‘Frequency measurement using Rayleigh scattering from a BEC’ – A. B. Bhattarjee, and **S. De***, Int. J. Mod. Phys. B **29**, 1550051 (2015).
- (11) ‘Lifetime determination of the $5d_{2} 3F_{2}$ state in barium using trapped atoms’ - **S. De***, U. Dammalapati, and L. Willmann, Phys. Rev. A **91** 032517 (2015).
- (10) ‘A universal driver for vibration free operation of mechanical shutters’ – A. Acharya, S. De*, P. Arora, and A. Sen Gupta, Measurements **61** 16 (2015).
- (9) ‘Design of an ion trap for trapping single $^{171}Yb^{+}$ ’ – **S. De***, N. Batra, S. Chakraborty, S. Panja, and A. Sen Gupta, Current Science **106** 1348 (2014).

- (8) ‘Quenched Binary Bose-Einstein Condensates: spin domain formation and coarsening’ – **S. De***, D. L. Campbell, R. M. Price, A. Putra, B. M. Anderson, and I. B. Spielman, *Phys. Rev. A* **89** 033631 (2014).
- (7) ‘Optimal Focusing in Absorption Imaging of Ultra-cold atoms’ - A. Putra*, D. L. Campbell, R. M. Price, **S. De**, and I. B. Spielman. *Rev. Sci. Instrum.* **85** 013110 (2014).
- (6) ‘Fermion- mediated long-range interactions between bosons stored in an optical lattice’ – **S. De*** and I. B. Spielman, *Appl. Phys. B: lasers and optics* **114** 527 (2014).
- (5) ‘Magneto optical trapping of barium’ - **S. De***, U. Dammalapati, K. Jungmann, L. Willmann, *Phys. Rev. A* **79** 041402(R) (2009).
- (4) ‘Isotope shifts of 6s5d ³D-states in neutral Barium’ - U. Dammalapati, **S. De**, K. Jungmann, L. Willmann*, *Eur. Phys. J D* **53**, 1 (2009).
- (3) ‘Production and trapping of radioactive atoms at the TRImuP facility’ - E. Traykov*, U. Dammalapati, **S. De**, O.C. Dermois, L. Huisman, K. Jungmann, W. Kruithof, A.J. Mol, C.J.G. Onderwater, A. Rogachevskiy, M. da Silva e Silva, M. Sohani, O. Versolato, L. Willmann, H.W. Wilschut, *Nucl. Instrum. Meth. B* **266** 4532 (2008).
- (2) ‘Development of a thermal ionizer as ion catcher’ - E. Traykov*, U. Dammalapati, **S. De**, O.C. Dermois, L. Huisman, K. Jungmann, W. Kruithof, A.J. Mol, C.J.G. Onderwater, A. Rogachevskiy, M. da Silva e Silva, M. Sohani, O. Versolato, L. Willmann, H.W. Wilschut, *Nucl. Instrum. Meth. B* **266** 4578 (2008).
- (1) ‘Status of the TRImP project – Results of the commissioning experiments’ - H.W. Wilschut*, U. Dammalapati, **S. De**, P. Dendooven, O. Dermois, K. Jungmann, A. J. Mol, C.J.G. Onderwater, A. Rogachevskiy, M. da Silva, M. Sohani, E. Traykov and L. Willmann, *Hyperfine Interact.* **174** 97 (2007).

Publications in non-SCI journals:

*Names with * indicate corresponding authors*

- (1) “Indian Standard Time”, P. Arora, M. P. Olaniya, P. Kandpal, S. Yadav, V. Bharat, T. Bharadwaj, P. Thorat, S. De, S. Panja, N. Sharma, A. Agarwal, V. N. Ojha and D. K. Aswal, *Geography and You*, October (2018).
- (2) “Singly charged ions for optical clocks” - N. Batra, A. Roy, S. Majhi, S. Panja, and S. De*, *Asian J. of Phys.* **25**, 1069 (2017).
- (3) “Trapped ytterbium ion for optical frequency standards in India” - S.De*, A.Rastogi, N. Batra, S.Panja and A. Sen Gupta, *Kiran* **25**, 13 (2014).
- (4) ‘Coherent Dark Resonances in Atomic Barium’ - U. Dammalapati, **S. De**, K. Jungmann, L. Willmann*, arXiv:0708.0332 (2007).
- (5) ‘Aspects of cooling at the TRImP facility’ - L. Willmann*, G.P. Berg, U. Dammalapati, **S. De**, P. Dendooven, O. Dermois, K. Jungmann, A. Mol, C.J.G. Onderwater, A. Rogachevskiy, M. Sohani, E. Traykov and H.W. Wilschut; Conference proceeding of COOL05 Workshop, Galena, IL, USA, September 18-23, 2005, arXiv:physics/0602022 (2006).

Publications in Conference Proceedings:

*Names with * are presenting authors*

Name of the authors	Title of the paper	Name of conference / journal
H Rathore, A. Roy, S. De and S. Panja	A Compact Device for Precise Distribution of Time and Frequency	URSI Regional Conference on Radio Science, 12-14 Feb 2020, Varanasi, India.
Neelam, M. P. Olaniya, S. De, S. Panja	Effect of temperature variation on the stability of an optical fibre based time transfer link	ITSF-2020 Dusseldorf, Germany, 02-05 Nov 2020.
Neelam, M. P. Olaniya, S. De, S. Panja	Clock Comparison with an ultra-stable optical fibre link utilizing White Rabbit Network	URSI GASS 2020, 29 Aug-5 Sep 2020 Rome, Italy.
Neelam, M. P. Olaniya, H. Rathore, L. Sharma, A. Roy, S. De, S. Panja	Precise Time Transfer Through Optical Fibre Utilizing White Rabbit Network	URSI Regional Conference on Radio Science, 12-14 Feb 2020, Varanasi, India. Published at - IEEE Xplore (2020).
A Roy, L Sharma, H Rathore, J Saroha, Neelam, K Kumari, S. De and S. Panja	Single Trapped 171Yb+ for Optical Frequency Standards	URSI AP-RASC 2019, 09-15 March 2019, New Delhi.
A. Priyam, S. De, A. Agarwal, S. Panja and A. Sen Gupta	Time Transfer based on the satellite digital TV broadcasting system	URSI AP-RASC 2019, 09-15 March 2019, New Delhi.

A Priyam, S. De , A. Agarwal, S. Panja* and A. Sen Gupta	Precise Time Transfer utilizing geostationary satellite based TV signals	AdMET 2019, 20-22 February 2019, CSIR-NPL, New Delhi.
S. De* , A. Roy, L. Sharma, H. Rathor, Neelam, K. Kumari and S. Panja	Progress on Ytterbium-ion optical atomic clock	AdMET 2019, 20-22 February 2019, CSIR-NPL, New Delhi.
A. Roy*, Lakhi Sharma, V. N. Ojha, S. Panja and S. De	Demonstration of self-locking on laser frequency stabilization	AdMET 2019, 20-22 February 2019, CSIR-NPL, New Delhi.
Lakhi Sharma*, A. Roy, S. Panja and S. De	Design and construction of a simple dark wall atomic oven	AdMET 2019, 20-22 February 2019, CSIR-NPL, New Delhi.
S Yadav*, M P Olaniya, P Kandpal, V Bharath, M Das, S De , T Bhardwaj, P Thorat, S Panja, P Arora, N Sharma, A Agarwal, A Gupta, V N Ojha and D K Aswal	Strengthening of primary timescale generating UTC(NPLI) and IST	AdMET 2019, 20-22 February 2019, CSIR-NPL, New Delhi.
S. De*	Single trapped ion optical atomic clock	QIPA 2018, 2-8 December 2018, HRI, Allahabad.
L. Sharma, A. Roy, S. Panja, V. N. Ojha, and S. De	Black body radiation shift induced by resistive heating of an ion trap.	AISAMP 2018, 2-8 December 2018, IIT Bombay.
S. De* , N. Batra, V. N. Ojha, and D. K. Aswal	Calibrated Photodetector and Monitoring System	NCEEM, 2018, 19-20 September 2018, CSIR-NPL, New Delhi.
A. Roy, N. Batra, S. Panja, and S. De	Computer Controlled, Low Noise and Ultra-stable DC Voltage Source	NCEEM, 2018, 19-20 September 2018, CSIR-NPL, New Delhi.
A.Roy, L. Sharma, I. Chakraborty, S. Panja, V. N. Ojha and S. De*	FPGA based lock-in amplifier and PID controller	META 2018, 14-15 September 2018, NCRA Pune.
S. De* , L. Sharma, N. Batra, A. Roy, K. Sharma, S. Panja and V. N. Ojha	Electrical Equivalent Loads of an End-cap Ion-trap	CPEM 2018, 8-13 July 2018, Paris, France.
S. De*	Development of the optical clock in India and its applications	Marie Curie Sesquicentennial Conference-2017, JNU, New Delhi, India. November 2017.
S. De*	Atomic clocks for space applications and fundamental physics	New Initiatives in fundamental science experiments, Udaipur, India. September 2017.
A. Roy*, S. De , B. Arora, B. K. Sahoo	Polarizability and magic wavelength of Yb ⁺ clock transition $^2S_{1/2} - ^2D_{3/2}$	EFTF-IFCS 2017 conference, Besancon, France, July 2017.
S. De* , N. Batra, A. Roy, S. Majhi, L. Sharma and S. Panja	Status of the Optical Frequency Standard Experiment at CSIR-NPL	Admet-2017 conference proceeding, North Cap University, Gurgaon, Haryana, March 2017.
S. Panja*, S. De , N. Batra, A.Roy, S. Majhi, U. Mishra, L. Sharma, S. Yadav and A. Sen Gupta	Development of an Optical Frequency Standard based on a single trapped Ytterbium ion	Admet-2017 conference proceeding, North Cap University, Gurgaon, Haryana, March 2017.

L. Sharma, N. Batra, A. Roy, S. Majhi, S. Panja, V.N. Ojha and S. De*	An Optimized Imaging System for Fluorescence Detection of a Single Ytterbium-ion.	Admet-2017 conference proceeding, North Cap University, Gurgaon, Haryana, March 2017.
S. Panja*, S. De , N. Batra, A.Roy, S. Majhi, U. Mishra, L. Sharma, S. Yadav and A. Sen Gupta	Single trapped ion based frequency standard in the optical region.	URSI-RCRS-2017, Tirupati, AP, March 2017.
N. Batra, A. Roy, S. Majhi, L. Sharma, U. Mishra, S. Panja, and S. De*	Status of the Optical Frequency Standard in India	NCAMP 2017, PRL, Ahmedabad, Jan 2017.
S. De*	Applications of laser cooling and trapping in atomic clocks	Recent trends in cold atoms workshop, IISER Pune, May 2016.
S. De*	Optical Atomic Clocks to reach 1s accuracy over the age of the universe	SPS March meeting, JNU, New Delhi, March 2016.
N. Batra, A. Roy, C. Samal, S. Majhi, S. Panja and S. De*	Automation of an optical frequency standard experiment	CIEC 2016, Kolkata University, Kolkata, India, January 2016. IEEE Conference proceeding.
S. De* , N. Batra, A. Roy, C. Samal, S. Mjhi, and S. Panja	Ytterbium-ion trap: aiming for optical frequency standard and precision measurements	Charged particle collisions and electronic processes in atoms, molecules and materials (q-PaCE 2016), ISM Dhanbad, January 2016.
S. De* , N. Batra, A. Roy, N. Varshney, C. Samal, and S. Panja	Developing Ytterbium-ion Optical Frequency Standards in India	Cold atom GDR, Paris, France, November 2015.
S. Panja*, S. De , N. Batra, A. Rastogi, A. Roy, N. Varsney, C. Samol and A. Sen Gupta	Development of an optical frequency standard at CSIR-NPL	URSI-RCRS-2015, JNU New Delhi, November 2015.
N. Batra, A. Roy, S. Panja, and S. De*	Developing the first optical atomic clock in India	India International Science Festival (IISF 2015), IIT Delhi, December 2015.
S. De* , N. Batra, A. Rastogi, A. Roy, J. Thangjam, S. Yadav, S. Panja, and A. Sen Gupta	Ytterbium ion optical frequency standard	Current Developments in Atomic Molecular and Optical Physics (CDAMOP), Delhi Univ., March 2015
N.Batra*, A.Rastogi, S.De , S.Panja and A.Sen Gupta,	Development of Optical Clock with Single Trapped Ytterbium Ion	Current Developments in Atomic Molecular and Optical Physics (CDAMOP), Delhi Univ., March 2015
A.Rastogi*, N.Batra, S.De , S.Panja and A.Sen Gupta	All Digital Implementation of a Laser Frequency Stabilization Module	Current Developments in Atomic Molecular and Optical Physics (CDAMOP), Delhi Univ., March 2015
S.De* , A.Rastogi, N. Batra, S.Panja and A. Sen Gupta	Trapped ytterbium ion for optical frequency standards in India	National Laser Symposium 23, Tirupati.
A.Rastogi*, N. Batra, S.De , S.Panja and A. Sen Gupta	All Digital Implementation of a Laser Frequency Stabilization Module	Conference proceeding Mapiki-2014, NPL, Delhi, 2014.
N. Batra*, A. Rastogi, S. De , S.Panja and A.Sen Gupta	Development of single trapped ytterbium-ion optical clock	Conference proceeding Mapiki-2014, NPL, Delhi, 2014.
S.De* , A.Rastogi, N. Batra, S.Panja and A. Sen Gupta	Trapped Ytterbium Ion for Optical Frequency Standards in India	NLS 23 conference proceeding, SVU, Tirupati, 2014, 13.
A.Rastogi*, N. Batra, S.De , S.Panja and A. Sen Gupta	Field Programmable Gate Array based Digital Module for Laser Frequency Stabilization	NLS 23 conference proceeding, SVU, Tirupati, 2014, 204.
S. Panja*, S. De , N. Batra, A. Rastogi, and A. Sen Gupta.	Development of Optical Frequency Standards at CSIR NPL	ASUD 2014 conference proceeding, IACS, Kolkata, 2014.
N. Batra*, A. Rastogi, S. De , S. Panja and A. Sen Gupta	Atomic Clock Using Forbidden Transition of Ytterbium-ion	Conference proceeding of 20 th NCAMP, Thiruvanthapuram, 2014.

A. Sen Gupta*, A. Chatterjee, A. K. Suri, A. Agarwal, S. Panja, P. Arora, P. Thorat, S. De , S. Yadav, P. Kandpal, M. P. Olaniya.	Status Report on Time and Frequency Activities at NPL India.	Conference proceeding APMP-TCTF 2012, Wellington, 2012.
A.Sen Gupta*, P. Arora, S. De , A. Acharya, N. Batra, S. Yadav, S. Panja and A. Agarwal	Development of Atomic Frequency Standards at CSIR-NPL, India	URSI-2014 general assembly, Beijing, 2014.
S. De *, N. Batra, A. Rastogi, S. Chakraborty, S. Panja, and A. Sen Gupta	Optical Frequency Metrology at CSIR-NPL, India	Admet-2014 conference proceeding, Thapar University, Patiala, 2014, 83.
S. Panja*, N. Batra, H. Kohli, D. K. Daniel, A. Rastogi, S. De , S. Chakraborty and A. Sen Gupta	Delivering Narrow Bandwidth Radio Frequency to a Paul Trap for Trapping Single Ion	Admet-2014 conference proceeding, Thapar University, Patiala, 2014, 84.
S. De *, S. Chakraborty, N. Batra, H. Kohli, D. K. Daniel, A. Rastogi, S. Panja, and A. Sen Gupta	Single Trapped Ytterbium-ion for Optical Standards	RCRS-2014 conference proceeding, 2014.
S. Chakraborty, N. Batra, H. Kohli, D. K. Daniel, A. Rastogi, S. De , S. Panja*, and A. Sen Gupta.	Delivering narrow bandwidth radio frequency to a Paul trap for trapping single ion	RCRS-2014 conference proceeding, 2014.
S. De *, N. Batra, S. Chakraborty, H. Kohli, A. Rastogi, S. Panja, and A. Sen Gupta	Optical frequency standards at 688 THz with single trapped $^{171}\text{Yb}^+$	NLS 22 conference proceeding, Pune, 2014.
S. De *, D. L. Campbell, R. M. Price, A. Putra, B. M. Anderson, and I. B. Spielman	Dynamics of Spin Domains in a “Quasi-1D” Binary Spinor Bose Einstein Condensates	Admet-2013 conference proceeding, New Delhi, 2013.
S. De *, D. L. Campbell, R. M. Price, A. Putra, B. M. Anderson, and I. B. Spielman	Domain Coarsening and Coalescence in Quenched Binary BECs	ISAMP-2012 conference proceeding, IISER Kolkata, 2012.
S. De *, D. L. Campbell, A. R. Perry, R. Price, and I. B. Spielman.	Supersolid and Quantum magnetic Phases with Mixtures of Bose Condensed Rubidium and Degenerate Fermionic Lithium	ICAP-2012 conference proceeding, Paris, France, 2012.
S. De *, D. L. Campbell, A. Perry, and I. B. Spielman.	Progress towards a dual species degenerate quantum gases	National Science Foundation - US meeting, USA, 2010.
S. De *, D. L. Campbell, A. R. Perry, R. Price, and I. B. Spielman.	New Facility to Probe Physics with Degenerate Bose and Fermi gases	Conference proceeding of APS March Meeting, Dallas, USA, 2011.
S. De *, J. van den Berg, A. Mol, K. Jungmann, and L. Willmann	Laser Cooling and Trapping of a Leaky System: Barium	Conference proceeding of Deutsche Physikalische Gesellschaft, Darmstadt, Germany, 2008.
S. De *, A. Mol, K. Jungmann, and L. Willmann	Cooling of Heavy Alkaline-earth Elements	Physics @ FOM Veldhoven, Netherlands, 2008.
L. Willmann*, S. De , A. Mol, and K. Jungmann.	Laser cooling and trapping of barium	ICAP-2008 conference proceeding, Storrs, USA, 2008.
S. De *, U. Dammalapati, K. Jungmann, A. Mol, and L. Willmann	Towards searches electric dipole moment of radium	APS conference proceeding for DAMOP / DAMPΦ - 07, Calgary, Canada, 2007.
S. De *, K. Jungmann, A. Mol, and L. Willmann	Laser cooling of barium	Conference proceeding of Deutsche Physikalische Gesellschaft, Dusseldorf, Germany, 2007.
S. De *, A. Rogachevskiy, E. Traykov, M. Sohani, O. C. Dermois, L. Huisman, K. Jungmann, L. Willmann and H. W. Wilschut.	Trapping of radioactive Na atoms	FOM meeting-2007, Veldhoven, The Netherlands. 2007.
L. Willmann*, G.P. Berg, U. Dammalapati, S. De , P. Dendooven, O. Dermois, K. Jungmann, A. Mol, C.J.G. Onderwater, A. Rogachevskiy, M. Sohani, E. Traykov and H.W. Wilschut.	Aspects of cooling at the TRIMP facility	Conference proceeding of COOL-05 Workshop, Galena, IL, USA, 2005.
S. De *, U. Dammalapati, K. Jungmann,	Laser cooling of barium	Dutch Physical Society AMO meeting,

and L. Willmann		Lunteren, The Netherlands, 2005.
S. De* , G.P.A. Berg, U. Dammalapati, P. Dendooven, O. Dermois, R. Hoekstra, K. Jungmann, C.J.G. Onderwater, A. Rogachevskiy, M. Sohani, R.G.E. Timmermans, E. Traykov, L. Willmann and H.W. Wilschut.	Trapped radioactive isotopes for testing fundamental symmetries	Deutsche Physikalische Gesellschaft, Berlin, Germany, 2005.
S. De* , G.P.A. Berg, U. Dammalapati, P. Dendooven, O. Dermois, G. Ebberink, M.N. Harakeh, R. Hoekstra, L. Huisman, K. Jungmann, H. Kiewiet, R. Morgenstern, J. Mulder, G. Onderwater, A. Rogachevskiy, M. Sohani, M. Stokroos, R. Timmermans, E. Traykov, L. Willmann and H.W. Wilschut	First commissioning of TRIMP separator	Dutch Physical Society AMO meeting, Lunteren, The Netherlands, 2004.

Invited lectures:

1. "Precision measurement using trapped ion optical clock" 8th Topical conference on Atomic and Molecular Collisions for Plasma Applications, 03-05 March 2020, IIT Roorkee.
2. "Precision measurement using trapped ion optical clock", 21 December 2019, IUAC, New Delhi, India.
3. "Development of the optical atomic clock at CSIR-NPL" 11 June 2018, IIT Roorkee, India.
4. "Need of an atomic clock and its present development in India" 13 April 2018, SINP, Kolkata, India.
5. "Need of an atomic clock and its present development in India" 04 April 2018, Burdwan University, India.
6. "Development of the single trapped ytterbium-ion optical frequency standards" 26 February 2018, IUCAA, Pune, India.
7. "Progress in Trapped ion optical frequency standard in India" 26 September 2017, PIIM, Marseille, France.
8. "Time keeping using atomic clocks: overview and applications" 19 August 2017, Bennett University, Greater Noida, UP, India.
9. "Precise time keeping using atoms and lasers" 05 June 2017, IACS, Kolkata, India.
10. "Ytterbium ion optical frequency standard to reach 1 s inaccuracy over the age of the universe" November 23, 2016, RRCAT, Indore, India.
11. "Towards Developing the Optical Frequency Standard in India" November 8, 2015, SYRTE Paris, France.
12. "Ytterbium-ion optical frequency standard in India" September 08, 2015, Space Application Centre, Ahmedabad, India.
13. "Developing of an optical clock using trapped Ytterbium-ion" September 10, 2015, Physical Research Laboratory, Ahmedabad, India.
14. 'Towards Developing an Ytterbium-ion optical frequency standard' June 18, 2015, Technical University Kaiserslauten, Germany.
15. 'Optical Clock Using Trapped Ytterbium-Ion' – June 05, 2015, Van der Waals-Zeeman Institute, Amsterdam, Netherlands.
16. 'Optical Clock Using Trapped Ytterbium-Ion' – June 01, 2015, Van Swinderen Institute, Groningen, Netherlands.
17. 'Ytterbium-Ion Optical Frequency Standards' – May 11, 2015, Vrije University Amsterdam, Netherlands.
18. 'Atomic Clocks' – December 11, 2014, Frontiers in Light- Matter Interactions, IACS Kolkata, India.
19. 'Trapped Ytterbium Ion for Optical Frequency Standards in India: Single Trapped Ion Optical Standard (STIOS)' – December 04, 2014, DAE-BRNS National Laser Symposium – 23, Tirupati, India.
20. 'Atomic Clocks – From Indian Perspective' – February 15, 2014, Workshop on Physics of Cold Atoms, HRI Allahabad, India.
21. "Atomic Clocks – Time and frequency standards in India" January 06, 2014, IISER Pune, India.
22. "Experiments with Mixtures of Bose Condensate Rubidium and Degenerate Fermionic Lithium" March 26, 2013, Raman Research Institute, Bangalore, India.
23. "Ultra-cold Degenerate Bosons and Fermions" March 25, 2013, Indian institute of Astrophysics, Bangalore, India.
24. "Mixture of Bose Condensed Rubidium and Degenerate Fermionic Lithium" March 21, 2012, Raman Research Institute, Bangalore, India.
25. "Mixture of Rubidium - Lithium degenerate Bose - Fermi gases" March 13, 2012, IISER Mohali, India.
26. "Mixture of Rubidium and Lithium degenerate Bose and Fermi gases" February 20, 2012, NRC-CNRC, Ottawa, Canada.
27. "Mixture of Rubidium and Lithium degenerate Bose and Fermi gases" January 31, 2012, Arhus University, Arhus, Denmark.
28. "Physics of degenerate Bose and Fermi gases" – a series of talks at the following places
 - (a) June 15, 2011, Indian Association for Cultivation of Science, India.
 - (b) June 16, 2011, Saha Institute of Nuclear Physics, Kolkata, India.

- (c) June 22, 2011, IISER Kolkata, India.
 - (d) June 27, 2011, Physical Research Laboratory, Ahmedabad, India.
 - (e) July 5, 2011, National Physical Laboratory, Delhi, India.
 - (f) August 9, 2011, IIT Ropar, Rupnagar, India.
 - (g) August 11, 2011, IIT Roorkee, Roorkee, India.
29. “Ultracold and degenerate gases” July 29, 2011, Indian Institute of Technology, Bhubaneswar, India.
 30. “Laser cooling and trapping of barium” September 2, 2008, KVI, Groningen, Netherlands.
 31. “Barium: MOT of a leaky system” December 13, 2007, NIST, Gaithersburg, USA.
 32. Laser cooling and trapping for testing fundamental symmetries” November 12, 2007, TIFR, Mumbai, India.
 33. “Laser cooling and trapping for testing fundamental symmetries” October 11, 2007, SINP, Calcutta, India.
 34. “Laser cooling and trapping for testing fundamental symmetries” October 10, 2007, IACS, Calcutta, India.
 35. “Laser cooling and trapping for testing fundamental symmetries” October 09, 2007, SINP, Calcutta, India.
 36. “Towards testing of fundamental symmetries” June 13, 2007, ISAC seminar, TRIUMF, Vancouver, Canada

Colloquium & lectures:

1. “Accurate Measurement of Time for Synchronizing the Detectors” – GW@ Home by LIGO-India Education & Public Outreach at IUCAA, 20 July 2020.
Online - <https://www.youtube.com/watch?v=B-1dJ1Iltzo>
2. “Probing fundamental science using optical atomic clock” – Colloquium at IUCAA, 02 July 2020.
Online - <https://www.youtube.com/watch?v=3WIJKPwbEA8&t=88s>
3. “Atomic clocks and fundamental physics” – two lectures, IUCAA summer school & refresher course, 04-05 June 2020.
Online - <https://www.youtube.com/watch?v=JtRp82zGPCg>; <https://www.youtube.com/watch?v=u8xO0MmZGz8>
4. “Atomic clock and their applications”, 18 May 2020, webinar, GNDU, Amritsar.
Online - <https://youtu.be/rZymeJbLRN0>.
5. “Optical atomic clock and its applications” – 02 November 2019, Meerut Institute of Engineering and Technology, Meerut.
6. “Atomic clock technologies for precise determination of time” – 19 May 2016, IUCAA Pune, India.
7. “Atomic clocks from an Indian perspective” – 20 December 2015, Dwarka collective, New Delhi, India.
8. “An overview of atomic clock” – 12 October 2015, UGC refresher course, JNU, New Delhi, India.
9. “Atomic clocks – the time and frequency standards in India” – 17 December 2013, ISI Chennai, India.
10. “Atomic clocks: R&D on frequency standards at CSIR-NPL, India” – 12 November 2013, IIT Delhi, India.
11. “Physics with mixture of degenerate Bose and Fermi gases” – June 29, 2011, Bhaba Atomic Research Centre, Mumbai, India.

Poster presentation:

1. “Developing optical frequency standard in India”, The quantum revolution of metrology, 28-29 September 2017, BIPM, Paris, France.
2. “Suitable Ion Trap with Reduced Systematics for Ytterbium-ion”, AdMET 2016, February 24-26, 2016, CSIR-NPL, New Delhi, India.
3. “Optical frequency standards at 688 THz with single trapped $^{171}\text{Yb}^{+}$ ”, NLS 22, January 20, 2014, Mangalore, India.
4. “Supersolid and Quantum magnetic Phases with Mixtures of Bose Condensed Rubidium and Degenerate Fermionic Lithium”, ICAP 2012, July 23-27, 2012, Paris, France.
5. “Mixture of Rubidium and Lithium degenerate Bose and Fermi gases” February 22, 2012, Sigma-Xi poster presentation, NIST Gaithersburg, MD, USA.
6. “Progress towards a dual species degenerate quantum gases” National Science Foundation - US meeting, October, 2010, USA.
7. “Mixture of bosonic rubidium and fermionic lithium” International Conference of Cold Ions and Atoms 2010, January 18-22, 2010, Calcutta, India.
8. “New facility for producing degenerate mixtures of bosonic rubidium and fermionic lithium” Physics Frontier Center meeting, November 2009, College Park, MD, USA.
9. “Laser cooling and trapping of barium” ICAP-2008, July 27 – August 1, 2008, Storrs, USA.
10. “Trapping of radioactive Na atoms” FOM meeting-2007, January 23 – 24, 2007, Veldhoven, The Netherlands.
11. “Laser cooling of barium” September 2006, KVI poster sessions, Groningen, The Netherlands.
12. “Laser cooling of barium” Dutch Physical Society AMO meeting, November 2005, Lunteren, The Netherlands.
13. “Trapped radioactive isotopes for testing fundamental symmetries” March 5, 2005, Deutsche Physikalische Gesellschaft, Berlin, Germany.
14. “First commissioning of TRImP separator” Dutch Physical Society AMO meeting, November 2004, Lunteren, The Netherlands.

Media outreach: (1) Invited speaker in EUREKA, RSTV, December 17, 2015
<http://scm.niscair.res.in/videos/366/dr.-subhadeep-de,-scientist,-csir-npl>.
(2) Invited by SynTalk for the talk show on “The Workings Of Clocks”, February 03, 2018
<https://soundcloud.com/syntalk/twoc-the-workings-of-clocks-syntalk>

Reviewer: (1) International Journal for Theoretical Physics, Springer
(2) MAPAN-J. Metrol. Soc. India, Springer
(3) Asian Journal of Physics.

Affiliations & Training: (1) American Physical Society (**APS**).
(2) Indian Laser Association (**ILA**).
(3) Indian Society of Atomic and Molecular Physics (**ISAMP**).
(4) Metrology Society of India (**MSI**).
(5) IndIGO Consortium
(6) Certified training on radiation and laser safety (U. Groningen, Netherlands).
(7) Certified training on machine shop – level 1 (UMD, USA).
(8) NABL accredited accessor for **ISO 17025** quality system.

Awards, fellowships and recognitions:

2020	Joint Run Planning Committee (JRPC) representative from LIGO-India
2018	Best paper award, NCEEM 2018, NPL New Delhi.
2018	PTB Travel support award for attending CPEM 2018 in Paris.
2018	Member of European Cooperation in S&T (eCOST) on Trapped Ions.
2017	CSIR-NPL’s best performing group (recognition of the time & frequency group)
2016	Best paper award in CIEC 2016, Kolkata, India.
2015	CSIR-Young scientist award in Physical science.
2015	NWO visiting scientist fellowship, Govt. of Netherlands.
2015	Young researcher award in AdMET-2015.
2004	Ubbo Emmaus junior research fellowship, Govt. of Netherlands.
2003	MHRD junior research fellowship, Govt. of India.
2001	National scholarship, Govt. of India.
1998	National merit scholarship, State Govt. of West Bengal, India.

Personal details:

Date of Birth:	October 17, 1979.
Gender:	Male
Nationality:	Indian
Marital status:	Married
Language known:	English, Hindi, Bengali and Dutch (1 st level).