About CAMOST

AMO (Atomic, Molecular, and Optical) sciences encompass significant areas of human activities directly impacting life through applications in health, communication, navigation, metrology, space, internet, and quantum technologies. Advances in the field of quantum computing would lead to exciting possibilities in solving problems related to weather modeling, the evolution of our Universe, secure communication, etc.

Tirupati is the only town in India that is home to both an Indian Institute of Technology (IIT) and an Indian Institute of Science Education and Research (IISER). These two institutes started together at Tirupati in 2015 and have leveraged each other’s unique strengths by sharing resources and have now come together to establish the Center for Atomic, Molecular, & Optical Sciences & Technologies (CAMOST) to address key challenges in frontier areas of AMO sciences and technologies. Researchers from institutions pan-India would collaborate with each other under the aegis of CAMOST.

CAMOST is India’s first such center in a university environment where some of the country’s best undergraduate and graduate students interact closely with post-doctoral researchers and distinguished faculty. Close cooperation between scientists and engineers from IIT Tirupati, IISER Tirupati, and also from several other premier institutes in India would come under CAMOST’s initiatives. This partnership is already nucleated and the formal inauguration of CAMOST takes place at the hands of Dr. Arabinda Mitra (Scientific Secretary, Office of the Principal Scientific Advisor, Government of India) on August 14th, 2020, on the eve of the 73rd anniversary of India’s INDEPENDENCE DAY.

Vision

Inspire tangible solutions to frontier problems in AMO Science and Technologies through innovative research initiatives in basic and applied science domains.

Mission

To advance the field of AMO Sciences and Technologies by:

- Developing innovative solutions to frontier problems of AMO Quantum Science and Technology
- Contributing to solving key problems in atmospheric, space, and biosciences
- Fostering human resources to meet 21st-century challenges in AMO quantum Sciences & Technologies

Thrust Areas

- Ultrafast physics: Quantum dynamics on attosecond time scale
- Quantum communication and Quantum technology applications
- Quantum photonics: Cold plasma applications
- Laboratory astrophysics, Astrochemistry, and Atmospheric Sciences
- Optical tweezers for biomedical applications
- Single-molecule magnetism for high-density data storage
- Quantum Chemistry and Statistical Mechanics
- High Technology Devices
Administrative Council

K N Satyanarayana
Director, IIT Tirupati

K N Ganesh
Director, IISER Tirupati

Mentor & Convener

P C Deshmukh
Adjunct Professor, IIT Tirupati

Scientific Advisory Council

Dilip Angom
PRL, Ahmedabad

E Krishnakumar
RRI, Bangalore

C P Safvan
IUAC, New Delhi
(President of ISAMP)

Dmitry Budker
JGU Mainz & UCB

John Costello
Dublin City University

Bhanu Pratap Das
Tokyo Institute of Technology

S T Manson
Georgia State University

G Ravindrakumar
TIFR, Mumbai

Roland Wester
University of Innsbruck

Jan Michael Rost
MPI for Complex Systems
Core Administrative Members

Arijit Sharma  
Coordinator, IIT Tirupati

S Sunil Kumar  
Coordinator, IISER Tirupati

Reetesh Gangwar  
HoD, Physics, IIT Tirupati

G Ambika  
Chair, Physics, IISER Tirupati

Principal Investigators

IIT Tirupati

Arijit Sharma  
Arun K Manna  
Debasish Mondal  
N N Murthy  
P C Deshmukh  
Rajib Biswas

Reetesh Gangwar  
Swapnil Bhuktare  
Vijaya K Gurugubelli  
Vinay P Majety  
Mamilla Ravi Sankar  
Aravinda S

IISER Tirupati

Patmabati Mondal  
Raghunath O R  
Soumit Mandal  
S Sunil Kumar  
Sudipta Datta

Tapan C Adhyapak  
Sasmita Mohakud  
Rakesh S Singh  
Ravi Kumar Pujala
Adjunct Members

Dhananjay Nandi
IISER Kolkata

G Aravind
IIT Madras

Koushik Saha
IIT Dharwad

R Hari Varma
IIT Mandi

Jobin Jose
IIT Patna

Rajesh K Kushawaha
PRL, Ahmedabad

S Sivakumar
KREA University

Sivarama Krishnan
IIT Madras

Ramachandra R Yalla
University of Hyderabad

Sankar De
SINP, Kolkata
Events hosted by CAMOST (August 2021 – June 2022)

A comprehensive overview of CAMOST and its activities is available on the twin websites:
https://iittp.ac.in/camost
http://www.iisertirupati.ac.in/camost.

In addition to building up several collaborations among its members, CAMOST has organized several events such as seminars and plans to organize some additional events to commemorate its second year of operation.

First Anniversary Colloquium Series:
To commemorate the nucleation of CAMOST, we conducted CAMOST ANNIVERSARY WEEK COLLOQUIUM SERIES (16-20 August 2021). Five eminent scientists working on Quantum Science and Technologies and Plasma Science delivered lectures at this event.

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Affiliation</th>
<th>Date</th>
<th>Title of the talk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. G. Ravindrakumar</td>
<td>TIFR Mumbai</td>
<td>16.08.2021</td>
<td>Physics of extreme states created by tabletop lasers</td>
</tr>
<tr>
<td>Prof. R. Vijayaraghavan</td>
<td>TIFR Mumbai</td>
<td>17.08.2021</td>
<td>How to build a quantum computer?</td>
</tr>
<tr>
<td>Prof. Urbasi Sinha</td>
<td>RRI Bangalore</td>
<td>18.08.2021</td>
<td>Photonic quantum science and technologies</td>
</tr>
<tr>
<td>Prof. Dmitry Budker</td>
<td>JGU Germany &amp; UC Berkeley</td>
<td>19.08.2021</td>
<td>The perfect defect: Physics and sensing applications of the NV centers in diamond</td>
</tr>
<tr>
<td>Prof. Peter Bruggeman</td>
<td>University of Minnesota</td>
<td>20.08.2021</td>
<td>Low-temperature plasma – A perspective</td>
</tr>
</tbody>
</table>

Talks organized:
CAMOST organized two online webinars in the last year (August 2021 – June 2022).

- Dr. Sudipta Dutta, IISER Tirupati delivered a talk on “Tunable magnetic states in two-dimensional materials”, 29 October 2021.
- Dr. Reetesh Kumar Gangwar, IIT Tirupati delivered a talk on “Spectroscopic diagnostic of argon rotating gliding discharges”, 17 November 2021.

Special Issue of AAMOS20 proceedings in Physica Scripta:
CAMOST, along with Dayanand Sagar University, Bengaluru, co-hosted the international web conference: ‘Advances in Atomic, Molecular, and Optical Sciences – 2020’ (AAMOS20) from 14th to 18th December 2020. The conference was convened by an international committee of distinguished scientists from Australia, Japan, India, Ireland, and the USA. 37 talks over five days were delivered at AAMOS20 by leading experts from many countries which include Australia, Japan, China, India, Switzerland, Germany, Ireland, the UK, Italy, and the USA. The proceedings of AAMOS20 are being published by the Institute of Physics (UK) Journal Physica Scripta as a special focus issue. The details are available at the linked text below:

Advances in Atomic, Molecular, and Optical Sciences (2020) - Physica Scripta - IOPscience

Publications of CAMOST Members

In the past year (August 2021 – June 2022), CAMOST members have published 25 peer-reviewed journal articles in renowned international journals and two chapters in books.
Journal Publications:


7. Subhasish Saha and Jobin Jose, *Sensitivity of correlation effects and Shannon entropy in Be@C60 to the nature of confinement potentials*, Phys. Scr. **96**, 094012 (2021)


**Book Chapter/ Monographs:**


**Invited lectures/talks/posters by CAMOST Members**

In the past year (August 2021 – June 2022), several CAMOST members have been invited for seminars, talks, and poster presentations at several national and international conferences and workshops. The details are listed below:

**Lectures/Talks:**

1. Debasish Mondal, Seminar: *National and International Research Fellowships and Employment opportunities* at Students’ Week Celebrations event at Ramakrishna Mission Sikhshanamandira, Kolkata, India on 5 January 2022.


3. Arijit Sharma, Seminar: Towards developing the next generation portable atomic sensors based on the two-photon transition in warm atomic vapors for quantum communication, sensing, and positioning applications, at Indo-Israel Joint Workshop on Quantum Technologies organized jointly by DIA-CoE DRDO and IIT Delhi from 5–6 April 2022 at IIT Delhi on 6 April 2022.

4. Arijit Sharma, Seminar: Towards developing the next generation portable atomic sensors based on the two-photon transition in warm atomic vapors for quantum communication, sensing, and positioning applications, at TAMIONS II Conference and Discussion Meeting organized by ICTS Bengaluru from 9-13 May 2022 at ICTS Bengaluru on 11 May 2022.

5. Soumit Sankar Mondal, Seminar: *Protein dynamics at bulk and single molecule level*, 1 June 2022 at Guwahati University.


Posters:
1. Salvi Mohandas, Franziska Dahlmann, Eric Endres, Sunil Kumar, and Roland Wester, Gas-phase spectroscopic study of \( \text{[dAMP-H]} \) in a cryogenic 16-pole wire trap, Early Career Conference in Trapped Ions (ECCTI) 2022, Date: 26 June 2022 to 1 July 2022, Location: CERN, Switzerland
2. Abhijit Kundu, Sumit Achar, Rashtrapriya Kumar Kapri and Dr. Arijit Sharma, Poster: Progress towards a cold atom-ion quantum network, at TAMIONS II Conference and Discussion Meeting organized by ICTS Bengaluru from 9-13 May 2022 at ICTS Bengaluru on 9-11 May 2022.
3. C. Rasadi Munasinghe, P. C. Deshmukh, S. T. Manson, Photoionization Branching Ratios of Spin-Orbit Doublets in Rn Far Above Thresholds, APS Division of Atomic, Molecular and Optical Physics (DAMOP), May 30 – June 3, 2022, Orlando, Florida, USA
4. Aarthi Ganesan, Sourav Banerjee, Ankur Mandal, P. C. Deshmukh, S. T. Manson, Photoionization time delay of Hg 6s subshell at higher energies: RMCTD calculations, APS Division of Atomic, Molecular and Optical Physics (DAMOP), May 30 – June 3, 2022, Orlando, Florida, USA
5. Rezvan Hussaini, P. C. Deshmukh, S. T. Manson, Angular Dependence of the Transition from Dipole to Quadrupole Photoionization Time Delay in Atoms, APS Division of Atomic, Molecular and Optical Physics (DAMOP), May 30 – June 3, 2022, Orlando, Florida, USA
6. Soumyashree Baral, Jobin Jose, P. C. Deshmukh, S. T. Manson, 6p Cooper minima in the photoionization in high-Z atoms, APS Division of Atomic, Molecular and Optical Physics (DAMOP), May 30 – June 3, 2022, Orlando, Florida, USA
8. Nishita M Hosea, Jobin Jose, Hari Varma, P. C. Deshmukh, S. T. Manson, Photoionization dynamics of Na 3s in the Cooper minimum region, APS Division of Atomic, Molecular and Optical Physics (DAMOP), May 30 – June 3, 2022, Orlando, Florida, USA
10. Jisrawi, Najeh; Valluri, S. R., P. C. Deshmukh, Shreyas Suresh, J. Jeysitharam, Metamaterials and the Lambert W function, Canadian Association of Physics (CAP) Congress, June 5-10, 2022, McMaster University, Hamilton, Canada

Sponsored research grants secured by CAMOST Members

In the past year (August 2021 – June 2022), CAMOST members have secured 2 sponsored research grants from external funding agencies.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Project Coordinators</th>
<th>Project Title</th>
<th>Funding agency</th>
<th>Project Period</th>
<th>Sanctioned fund (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arijit Sharma (PI)</td>
<td>Development of a deterministic single-photon source for quantum technology applications</td>
<td>I-HUB Quantum Technology Foundation, IISER Pune</td>
<td>01 Mar 2022 – 28 Feb 2024</td>
<td>25.20 lakhs</td>
</tr>
<tr>
<td>2</td>
<td>S. Sunil Kumar (PI, IISER-T), Arijit Sharma (Co-PI,)</td>
<td>Towards the development of fluorophores of</td>
<td>DST-SERB</td>
<td>22 Mar 2022 –</td>
<td>76.09 lakhs (out of which)</td>
</tr>
</tbody>
</table>
Research infrastructure supported by CAMOST

In the past year (August 2021 – June 2022), CAMOST has supported the procurement of the following equipment under research infrastructure support extended to CAMOST projects:

At IIT Tirupati:

(i) DSO 4-Channel, 100MHz with sample rate 2 GS/s
(ii) Arbitrary wave function generator Dual-channel, 25 MHz with sampling rate 125 MS/s
(iii) 375 laser system for Ca ionization
(iv) 422 laser system for Ca ionization
(v) 850 laser system for Ca ion laser repumping
(vi) 854 laser system for Ca ion laser repumping
(vii) 866 laser system for Ca ion laser repumping
(viii) 854 laser system for Ca ion laser repumping
(ix) 866 laser system for Ca ion laser repumping
(x) 854 laser system for Ca ion laser repumping
(xi) 866 laser system for Ca ion laser repumping
(xii) 397 laser system for Ca ion laser cooling
(xiii) 780 laser system for Rb atom cooling
(xiv) 780 laser system for Rb atom cooling
(xv) Analog electronics module for reference cavity
(xvi) Kimball Physics two 16 port vacuum chambers made of SS 316L (non-magnetic steel) for Rb atom trap and Ca ion trap experiment
(xvii) Laser wavelength meter with 10 MHz accuracy
(xviii) RF Spectrum Analyzer 10kHz-9GHz
(xix) Vacuum components (CF blanks, CF and KF bellows, CF conical nipples, CF I-piece, CF T-piece, CF 4-way cross) for the Rb atom experiment and the Ca ion trap experiment
(xx) Active Vibration Isolation Optical tables (10 feet X 4 feet) 2 nos.
(xvii) Oscilloscopes 70 MHz 4 channel - 2 Nos
(xviii) Arbitrary wave function generators - 2 Channel - DC - 20 MHz - 3 nos
(xix) Low ripple and low distortion programmable bipolar DC power supplies (0-30V, 0-5A) - 3 numbers
(xx) Data acquisition systems - 200 MHz DSO (Digital Storage Oscilloscope)

At IISER Tirupati:

(i) Fast low noise high voltage switch Type – HS200 Dual