

**Quantum Research and Technologies**  
**Division of Physical and Mathematical Sciences**  
**Indian Institute of Science**



# Physical and Mathematical Sciences

One of the six Divisions at the Indian Institute of Science

Chair: Rahul Pandit (rahul@iisc.ac.in)

## Three Departments

- Physics [Chair: Prabal Maiti]
- Mathematics [Chair: S. Thangavelu]
- Instrumentation and Applied Physics (IAP) [Chair: S. Asokan]

## Two Centres

- Cryogenic Technology (CCT) [Chair: Prabal Maiti]
- High Energy Physics (CHEP) [Chair: Justin David]

# Physical and Mathematical Sciences

**Grants from major national and international agencies:**

- **Department of Science and Technology**
- **Council for Scientific and Industrial Research**
- **Department of Biotechnology**
- **Defence Research and Development Organization**
- **Indian Space Research Organization**
- **University Grants Commission**
- **CEFIPRA, Max Planck, IUSSTF, UKIERI, and AISRF**

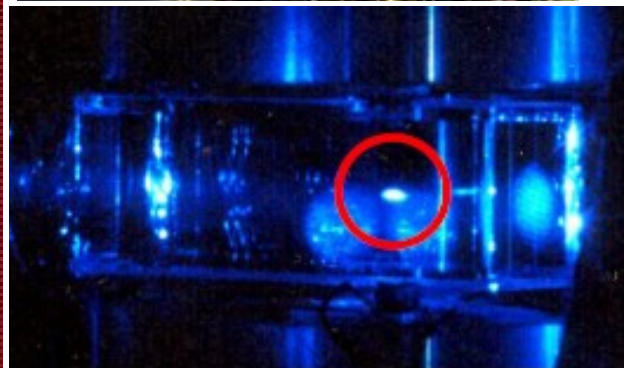
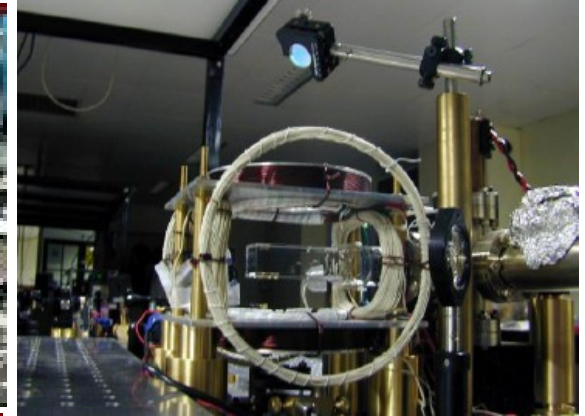
# Physics



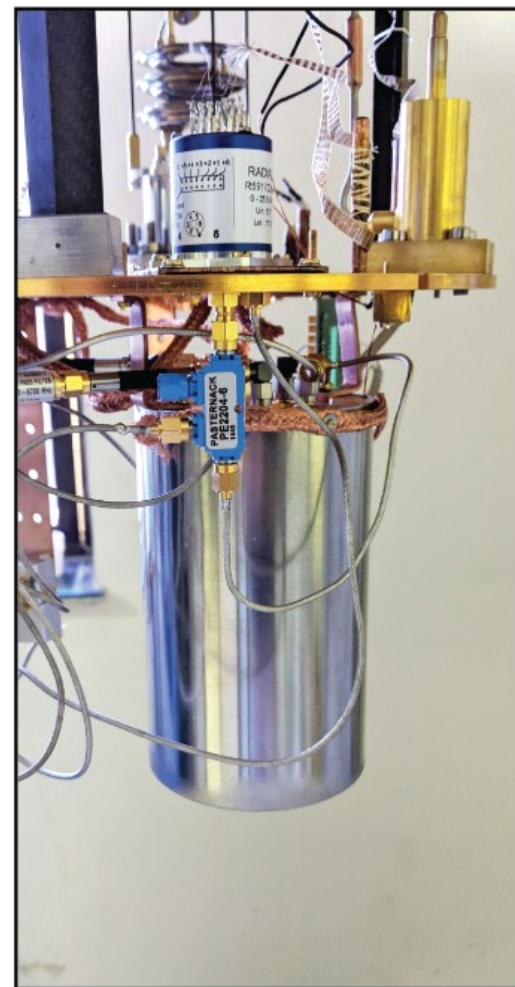
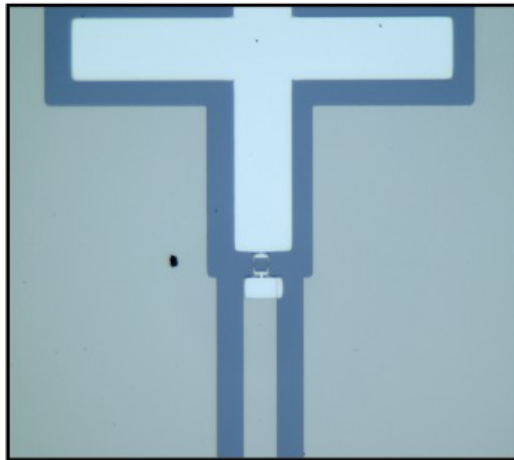
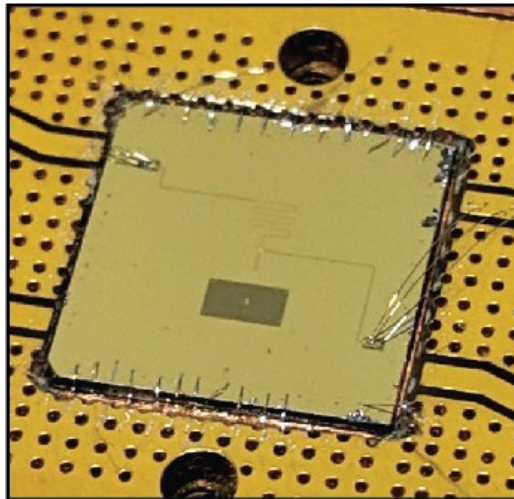
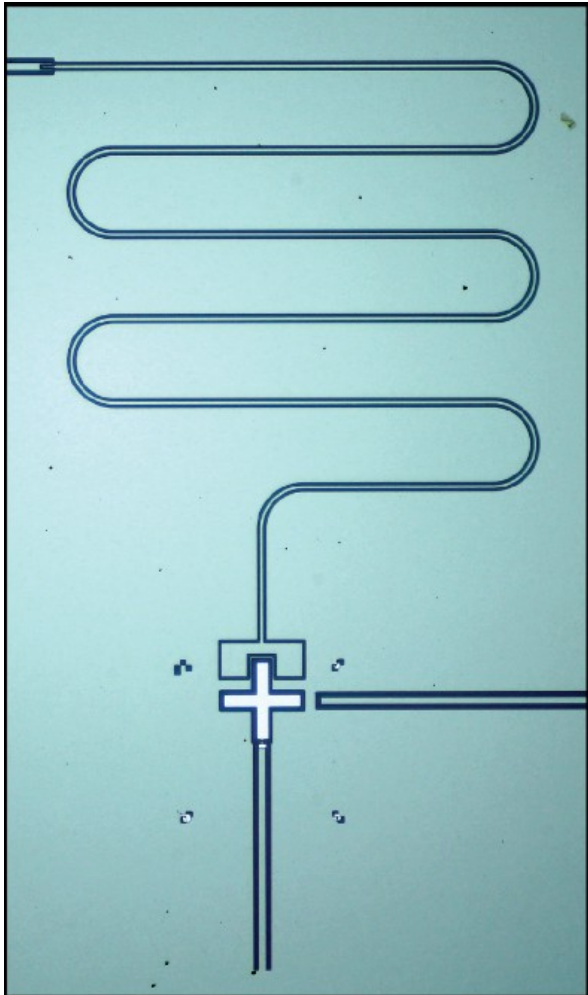
- **Founded in 1933 by Professor CV Raman.**
- **State of the art research programs in cutting edge areas**
- **Teaching Programmes**
  - **Post-M.Sc.**
  - **Integrated Ph.D. Programmes**
  - **Undergraduate Programme.**
- **Interactions with industry.**
- **UGC Centre for Advanced Study for more than two decades and National Resource Centre in Physics.**

# Research Areas

- Condensed Matter Physics
- Soft Matter, Complex Systems
- Biology Inspired Physics
- Quantum Computing, Quantum Matter, and Quantum Technologies
- Atomic and Optical Physics,
- Plasma Physics,
- Astronomy and Astrophysics.



# Superconducting Qubit Devices (Vibhor Singh, Physics)





## Faculty: Physics

Professors:	14
Associate Professors:	6
Assistant Professors:	10
Chief Research Scientists:	2
Principal Research Scientists:	3
Honorary Professors:	3
Distinguished Associate (CCMT)	1
<b>TOTAL</b>	<b>40</b>

## Other Faculty

Associate Faculty:	3
INSPIRE faculty:	5
<b>TOTAL</b>	<b>8</b>

# Students and Staff: Physics

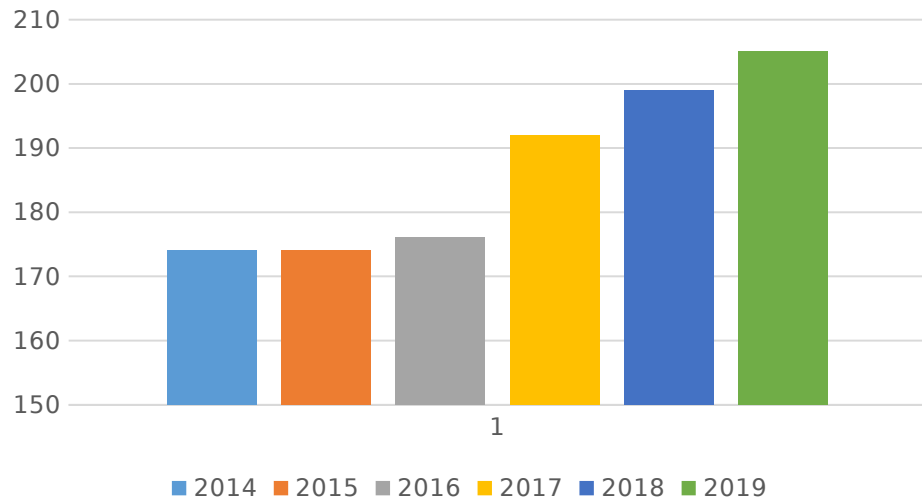
PhD Students:	234
Postdoctoral Fellows:	25
Project Assistants:	26
Supporting Staff:	4



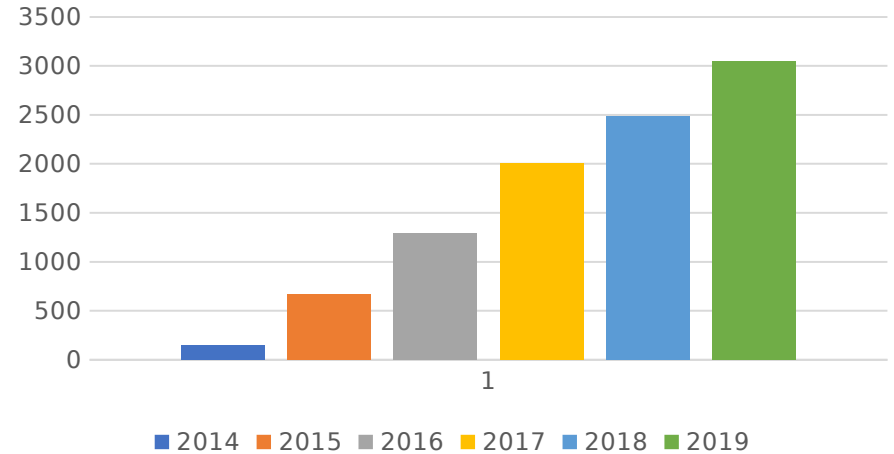


# Publications

1120 publications (2014-2019)



11,416 citations (2014-2019)



High Impact Journal	Number (2014-19)
PRL	31
PNAS	7
Nanoscale	21
Nature Comm	13
Nature Phys	4
Nature Nano	3
Nano Letter	10
ACS Nano	10
MNRS	60

# Mathematics



- Founded in 1956.
- Post-M.Sc. and Integrated Ph.D. Programmes.

UGC Centre for Advanced Study.(d)

Number of faculty: 29

post-docs : 30;

students: about 65 ( 35 Int Ph D+ 30 Ph D)

Number of publications in 2019: 76

# Mathematics

## Research:

1. Algebra/Representation theory/Algebraic Geometry

2. Complex/Functional/Harmonic Analysis

3. Low dimensional/algebraic/combinatorial topology

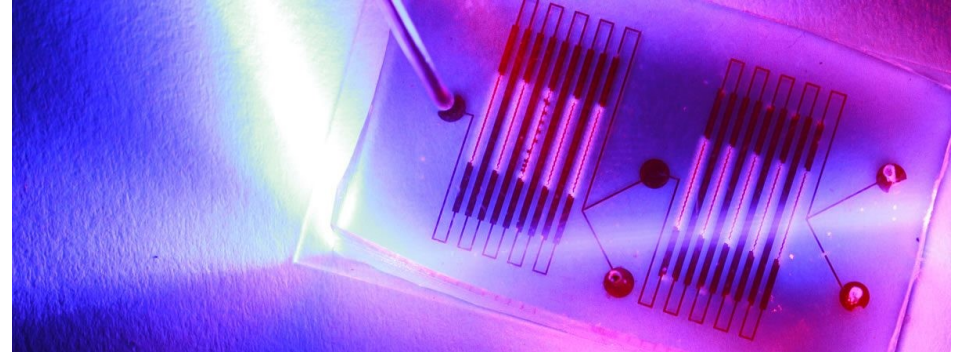
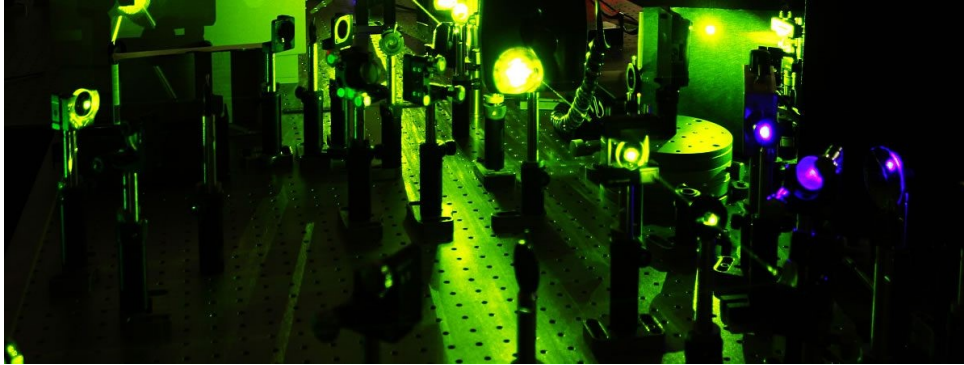
4. Differential geometry/Geometric Analysis

5. Probability/combinatorics/stochastic processes

6. Partial differential equations/Numerical analysis/ Dynamical systems

7. Analytic number theory and Arithmetic Geometry

# Instrumentation and Applied Physics



- Established in 1967 as **Central Instrumentation and Services Laboratory** which later became **Regional Instrumentation centre and Instrumentation and Services Unit**
- **Department of Instrumentation : Founded in 1996.**
- **Research: analytical, electronic, optical and laser, solar-energy and thermal, and vacuum and thin-film instrumentation.**
- **Teaching Programmes: M.Tech., and Post-M.Sc. PhD and Integrated PhD Programmes; Undergraduate Programme.**
- **Interactions with industry; several start-up companies.**

# Instrumentation and Applied Physics

**Research Areas |** Nanodevices, Single Molecule Physics, Optical Fiber Sensor, Point-of-Care Diagnostics, MEMS, Sensor Technology, Flexible Electronics, Optical Metrology, Electronic Circuits, Control Systems, Electron Transport, Quantum Information, Microfluidics, Microscopy & Imaging

Publications: 300 + (2012 - present)

Patents : 30+ (2012 - Present)

Books: 2 (2012 - Present)

Number of Research Projects: 65 +

Total Grants Received: 20+ Cr

Consultancy Income: 22.56+ Lacks

International Collaboration: 1.2 Cr

17 faculty members

# Societal Impact

Openwater.in

(Prof. Sanjiv Sambandan)

Spin-off from Flexible Electronics Lab, IAP.

High throughput water treatment and waste water management



Plasma Coaters Pvt. Ltd.

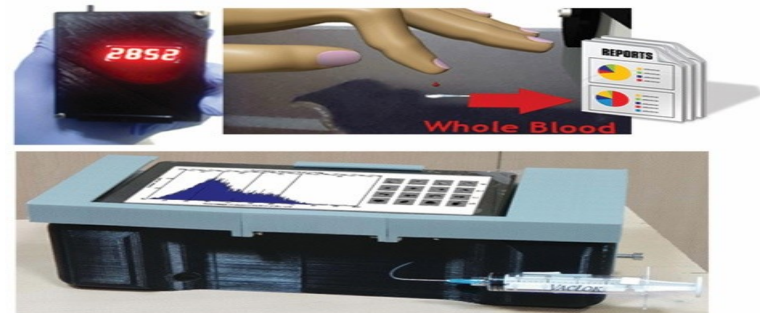
(Prof. G. Mohan Rao)

Development of high end industrial coatings using plasma process for industry and defence, and development of plasma-based systems for varied applications

ShanMukha Innovations Pvt. Ltd.

(Prof. Sai Siva Gorthi)

\_Open Platform Point-of-care diagnostic devices, capable of performing cyto, molecular, biochemical and immuno-diagnostics from a drop of blood, at affordable prices, to provide quality healthcare to urban and rural population





# High Energy Physics



- Founded in 2004. [Earlier the Centre for Theoretical Studies founded by Professor ECG Sudarshan.]
- Research: quantum field theory, physics at particle colliders, experiments at CERN, string theory, non-commutative geometry, quantum information and computing, and field theory in condensed-matter systems.
- New programme in Experimental High Energy Physics started in 2016. IISc has joined CMS at CERN, 2016
- Teaching Programmes: Post-M.Sc. and Integrated-Ph.D. Programmes; Undergraduate Programme.

# High Energy Physics

- 13 faculty members:

4 Assistant Professors

2 Associate Professors

6 Professors

1 Honorary Professor.

6 post-doctoral fellows,

35 Ph.D. students

6 Under Graduate students.

# Centre for Cryogenic Technology

- Founded in 1999 (grew out of an older facility).
- Produces 4,25,000 litres of liquid nitrogen and 35,000 litres of liquid helium per year principally for research programmes at the Institute.
- Major users of the facility are experimental groups in Physics, Chemistry, Biology, and the NMR Research Centre.
- Research: cryogenics-related research programmes; students taken through the Department of Physics or Instrumentation and Applied Physics.
- Interactions with industry.

# Overview

- About 100 Faculty members
- Several Visitors (e.g., Infosys and Satish Dhawan Chair Professors)
- 60 Fellows of Science Academies in India
- 8 Fellows of TWAS
- 3 FRSs
- 3 Padma Shri Awards
- 9 SS Bhatnagar Awards

# Welcome to Young Researchers

