Promoting Research and Innovation in Higher Education Institutions

Somak Raychaudhury

Inter-University Centre for Astronomy and Astrophysics
Pune
An autonomous institution of the University Grants Commission

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Teaching and Research in HEIs

Scientific output from Indian HEIs is increasing in quantity, but not as much in quality (citation, impact)

- Pre-independence: pioneering work in Science was done in Colleges and Universities
- Post-independence: emphasis has shifted to research institutions; Universities have largely remained outside (contrary to most countries who do well in education)
- Within Universities: small research groups function better than large collaborations
Asutosh Mookherjee

1914: First Indian National Science Congress
In his Presidential Address, Asutosh Mookherjee made the case for research in Universities and its funding

“……But, looking to the future, … India’s landed classes should realise that science enables us to solve difficult agricultural problems and thereby to revolutionise agricultural methods”

e.g. Taraknath Palit, Rashbehari Ghosh: University Science College Rs 37.5 lakhs in 1914.
Small and large-scale Research in HEIs

- Research (mostly scientific) is of two kinds:
  - Small group based research
  - Large collaborative research
- HEIs in India need to get engaged in both
- This has required radical changes in
  - Pedagogic practices- skill-based teaching, problem solving, inquiry-based learning
  - Bureaucracy in individual institutions
  - Relation with the outside world, in particular industry
Jagadis Chandra Bose’s microwaves
In Presidency College, Calcutta

The “Collecting funnel” = Horn antenna

R, radiator; S, spectrometer-circle; M, plane mirror; C, cylindrical mirror; p, totally reflecting prism; P, semi-cylinders; K, crystal-holder; F, collecting funnel attached to the spiral spring receiver; t, tangent screw, by which the receiver is rotated; V, voltaic cell; r, circular rheostat; G, galvanometer.

Penzias & Wilson
Nobel 1978
The Synergy between Teaching and Research in HEIs

• In doing research, students gain and develop essential skills for gathering, synthesising and creating knowledge

• Teachers and Research Staff get fresher insight into research conventions and habits, and also learn how to teaching skills

It is necessary to
• Bring together specialised research for many institutions
• Harness skills necessary to enhance the employability of students both within and outside of academia
Key Challenges for HEIs

• Balance between teaching and research at Universities and Colleges
• Innovation in ways of linking research with teaching
• Delivering 21st century skills suited to individual student strengths (flexibility)
• Collaboration between HE institutions, HEIs and industry
• Outreach, dissemination of achievements, and protection of rights
Indian Institutes of Science Education and Research (IISERs)

Founded on the concept of Research Universities.

IISERs are designed to integrate undergraduate science teaching with high quality research.

Emphasis is on multidisciplinary learning and research

Have adopted open curriculum. Students choose their own basket-full of courses: all students gain sufficient breadth in both natural sciences and Humanities and Social Sciences and at the same time gain depth in a discipline of their choice.

We pursue inquiry-based and research-based under-graduate and graduate science education programs.

Courtesy: L Shashidhara, IISER Pune
The UGC Inter-University Centres in Physics

• Inter-University Accelerator Centre, Delhi
• Inter-University Centre for Astronomy and Astrophysics, Pune
• UGC-DAE Consortium for Scientific Research, Indore
“..IUCAA, Pune was set up in 1988 as an autonomous centre of excellence to help initiate and nurture, research and developmental activities in Astronomy and Astrophysics in the University sector. IUCAA was set up with the basic purpose of providing advanced centralized facilities for subjects not adequately covered in the university departments and colleges. “
Activities at the Inter-University Centres

Research & Development

Large International Collaborations

Public Outreach

University Programmes

Teaching/Learning Centre
Visiting Associates from Universities and Colleges

- IUCAA, Pune (200 HEIs)
- UGC-DAE CSR, Indore (350 HEIs)
LIGO-India:
a Mega-Science project on Indian soil to build the 3rd Gravitational wave detector after the first two won a Nobel prize

Indo-US collaboration

Funding agencies: NSF (USA) and jointly DAE (India) & DST (India)

Institutions: LIGO Lab., Caltech & MIT (USA), together with
1. Inter-University Centre for Astronomy & Astrophysics (IUCAA), Pune
2. Institute for Plasma Research (IPR), Gandhinagar
3. Raja Ramanna Centre for Advanced Technology (RRCAT), Indore
4. Directorate of Construction, Services and Estate Management (DCSEM), Mumbai

Last three affiliated to Dept of Atomic Energy, India
Nobel Prize 2017: IUCAA built the core group for GW research in India

It’s a big day for me; I’ve been working on this for 30 years’

Pune professor led team that aided the American scientists with detecting gravitational waves, which led to their Nobel

A. Nobel prize in Physics, shared by Barry Barish, Kip Thorne and Rainer Weiss of CalTech, US, was announced recently. Their work has come to define the era of gravitational wave detection.

IUCAA CONNECT TO 2017 NOBEL PRIZE FOR PHYSICS

IUCAA’s role in the discovery

IUCAA, India’s foremost astrophysics institute, has played a crucial role in the discovery of gravitational waves. The institute’s researchers have been working on the project for over three decades, and their efforts have finally paid off.

IUCAA, which was founded in 1980, has a long history of contributing to gravitational wave research. The institute’s work has been instrumental in the development of the Laser Interferometer Gravitational-Wave Observatory (LIGO), which was used to make the historic discovery.

IUCAA’s researchers have made significant contributions to the field, including the development of advanced detection techniques and the design of LIGO’s optical interferometer. The institute has also played a key role in training the next generation of gravitational wave scientists.

IUCAA’s director, Sanjeev Dharndhar, said: “We are thrilled to be part of this historic discovery. Our work has been critical in the development of LIGO, and we are proud to have contributed to this important new chapter in science.”

IUCAA’s contribution to the discovery

IUCAA’s role in the discovery of gravitational waves is significant, as the institute’s researchers have been working on the project for over three decades. The institute’s work has been instrumental in the development of the Laser Interferometer Gravitational-Wave Observatory (LIGO), which was used to make the historic discovery.

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IUCAA’s future plans

IUCAA has plans to continue its work in the field of gravitational wave research. The institute has already started work on a new detector, the Cosmic Explorer, which will be used to detect gravitational waves from the early universe.

IUCAA’s director, Sanjeev Dharndhar, said: “We are looking forward to the future of gravitational wave research. Our work has just begun, and we are excited to see what the future holds.”

IUCAA’s impact on India

IUCAA’s role in the discovery of gravitational waves has had a significant impact on India. The institute’s work has helped to establish India as a leader in the field of gravitational wave science.

IUCAA has already trained hundreds of students and researchers in the field of gravitational waves, and many of these individuals have gone on to make important contributions to the field. The institute’s work has also helped to establish India as a leader in the field of gravitational wave science.

IUCAA’s director, Sanjeev Dharndhar, said: “We are proud to have played a key role in the discovery of gravitational waves. Our work has helped to establish India as a leader in the field, and we are looking forward to continuing our work in the future.”
Series of meetings at IUCAA to build LI S&T community
Four meetings in 2017-18

International experts:
- Rana Adhikari (Caltech US)
- Giles Hammond (Glasgow UK)
- Kiwamu Izumi (LIGO-Hanford US)
- Brian Lantz (Stanford U, US)
- David McClelland (ANU, Aus.)
- Benno Willke (AEI-Hannover, Germany)
- Brett Shapiro (Stanford U., US)
- Andreas Friese (U. Birmingham, UK)

Indian Institutions: IUCAA, IPR, RRCAT, IIT Madras, IIT Delhi, IIT Kanpur, IISER Pune, IISER Tvm, IISER Kolkata, TIFR Mumbai, TIFR Hyderabad, ICTS-TIFR, Physical Research Lab., National Physical Laboratory, Univ. of Pune & Nanded, SINP Kolkata, ...
भारतीय खगोलविद्वान ने खोजा विशालकाय मंदाकिनी समूह

नई दिल्ली, आप्रवासन: भारतीय गणोन्नति संगठन (IUCAA) के द्वारा नवीनता और विशालकाय मंदाकिनी समूह का खोज कर लिया गया है। पुर्वी के काल वर्षों में अपने फोटोग्राफ के साथ नवीनता और विशालकाय मंदाकिनी समूह का खोज कर लिया गया है। 

10 हज़ार से अधिक मंदाकिनी समूह सामने आए हैं। 

बंगाल के इंदिल-पुंजाबीसी टैंटर पार्थ बाग्ची, रायचौड्हरी, दाहडे (IUCAA पुणे)। 

- बाग्ची, रायचौड्हरी, दाहडे (IUCAA पुणे)। 
- संक्ययान (IISER पुणे)। 
- सरकार (नई जमशेदपुर)। 
- जेकब (न्यूमैन कॉलेज, केरल)।

The Saraswati Supercluster

One of the largest superclusters of galaxies

The Saraswati Supercluster, a supercluster of galaxies

What are superclusters? 

Superclusters are large gatherings of galaxies. They can have billions of galaxies and can be as large as 50 to 100 million light years across. Superclusters are the largest known structures in the universe.

The Saraswati Supercluster is one of the largest superclusters of galaxies. It is located in the constellation of Pisces.

Why does the Saraswati Supercluster matter? 

The Saraswati Supercluster is important because it is one of the largest superclusters of galaxies. It is located in the constellation of Pisces.

What is known about the Saraswati Supercluster? 

The Saraswati Supercluster is one of the largest superclusters of galaxies. It is located in the constellation of Pisces.

The Saraswati Supercluster is located in the constellation of Pisces. It is one of the largest superclusters of galaxies and is known for its concentration of distant galaxies.
What was the name given to the supercluster of galaxies, discovered by a team of Indian astronomers in 2017?

A: Lakshmi  
B: Parvati  
C: Saraswati  
D: Durga
What use are the Golden Mountain or the Silver Mountain, if the trees there remain (ordinary) trees?

I really value the Malaya Mountain under whose care even minor vegetation acquires the fragrance of sandalwood.

Bhartruhari: Neetishatak
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