Jawaharlal Nehru Centre for Advanced Scientific Research

Deemed to be University - 2002

Research Areas
Academic Activities
Research Facilities
Collaborations

Estd. 1989

International Centre for Materials Science

Objectives

- High quality in-house multi-disciplinary materials research
- Promote national and international research & education collaborations
- Conduct discussion meetings, schools & technical workshops

Resources

- Funding and Fellowship for students and young researchers
- Sophisticated Instrumentation facilities

Degree Programs, Student and Faculty Strength

DEGREE PROGRAMMES

- Ph. D
- M.S (Engg.)/MS
- Integrated Ph.D
- M.S-Ph.D (for POBE-POCE diploma holders)

Now open to foreign students!

As a Deemed University, the Centre has awarded 97 Ph.D, 28 MS and 22 MS (Int. Ph.D) degrees, 3 PG Diploma in Materials Science , 19 Diplomas in Chemistry (POCE) and 17 Diplomas in Biology (POBE) .

ELIGIBILITY

- **Ph. D**: M.Sc in Science, BE/BTech/MBBS in Engineering or Medicine
- **M.S(Engg. by research)/M.S(by research)**: M.Sc in Science, BE/BTech/MBBS in Engineering or Medicine
- **Integrated Ph.D Degree**: B.Sc in Science
- **M.S-Ph.D**: Graduate in Science with Diploma in Chemistry or Biology are eligible to apply.
- **Post Graduate Diploma** : Materials Science and Science Education

Present *GRADUATE* Students Strength ~ 330
Present Faculty Strength ~ 50

Research Areas: *UNITS*

- Chemistry & Physics of Materials
- New Chemistry
- Theoretical Sciences
- Engineering Mechanics
- Geodynamics
- Evolutionary & Organismal Biology
- Molecular Biology & Genetics
- Neuroscience
- Education Technology

MATERIALS:
Nanotechnology
Materials Simulations
Energy

ENVIRONMENT:
Atmosphere, Water
Earthquakes
Ecology & Evolution

Human Diseases:
Malaria, Epilepsy
HIV AIDS, Cancer,
Stem Cells & Vaccines

Science Outreach:
From Villages to Urban

Research Areas

CHEMICAL & PHYSICAL SCIENCES

Materials Science, Nanotechnology, Raman Spectroscopy, Organic-inorganic hybrid materials, biopolymers, Brillouin Spectroscopy, Computational studies, Graphene based devices, Supercritical carbon dioxide, Soft matter, Gas sensing and storage, Materials for energy, **hydrogen storage** Conducting Polymers and Molecular Electronics

Major Facilities

- Aberration Corrected UHR TEM
- Field Emission- SEM
- Pulsed Laser Deposition
- Molecular Beam Epitaxy
- X-ray Photoelectron Spectroscopy
- Mossbauer Spectrometer
- Confocal Microscope
- Optical Tweezers
- High Resolution TEM
- Nuclear Magnetic Resonance
- SQUID*

Research Activities

- Magnetism, superconductivity, colossal magnetoreisistance, electronic phase separation, metal insulator transitions & multiferroicity of Transition metal oxides
- Chemical synthesis and characterization of open framework and porous structures and nano-materials.
- Carbon nanotubes, graphene: Synthesis, characterization, structure, functionalization and their adsorption, magnetic, mechanical and electrochemical pr
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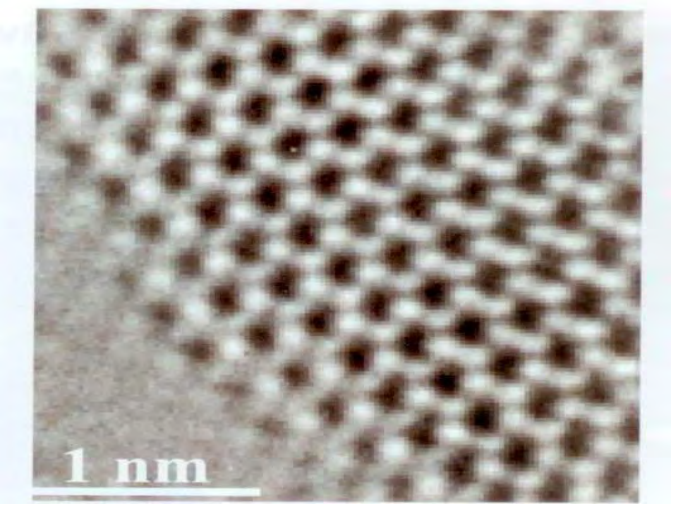
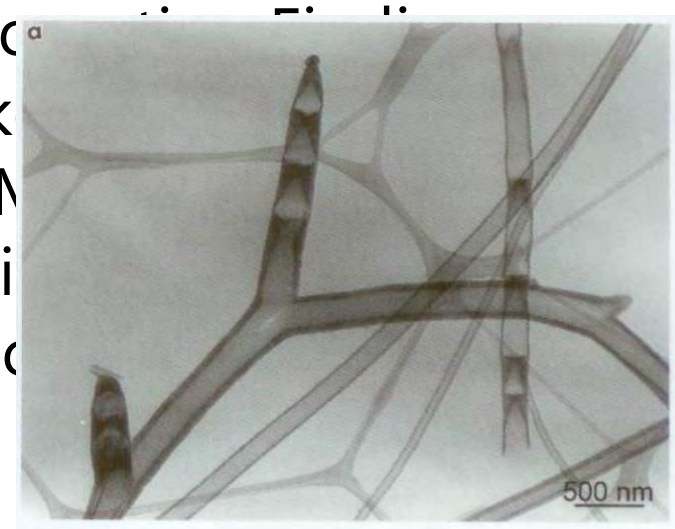




- Transport & magnetic properties of materials
- Open framework, porous structures, nanomaterials, carbon nanotubes, graphene & 2D analogues
- Growth of III-N semiconductors

Centre for Computational Materials Science (CCMS)

Mandates for the CCMS at JNCASR

- To support JNC's ongoing and future research on computational materials science
- To develop new computational methods and algorithms
- To build and strengthen the community of computational materials science researchers in the country
- To train young students and postdoctoral fellows in computational methods and in high performance computing through schools and workshops
- To provide a platform for collaborations and networking

Computing Facilities

- **130 TFLOPs (+500 TFLOPs coming up soon)**
- **3D Visualization Facility**
- **Instructional Classroom *****

New Chemistry Unit

RESEARCH FACILITIES

NMR, FT-IR, UV-Vis and Fluorescence Spectrometers

Gas and Liquid Chromatograph Spectrometers (GC/LC-MS)

X-ray Diffractometers

High Performance Liquid and Gel Permeation Chromatography

Parallel Peptide Synthesizer

Electron Microscopes

Various Material Characterization Facilities

Digital Polarimeter

High Performance Computers

RESEARCH ACTIVITIES

Carbon Nanomaterials

Solid State and Materials Chemistry

Functional Organic, Supramolecular and Macromolecular materials

Organic and Asymmetric Synthesis

Peptide and Protein Chemistry

Biomaterials

Antimicrobial Therapeutics and Medicinal Chemistry

Research Areas

Theoretical Sciences

Quantum Theory of Solids, Materials for Energy and Environment, Molecular Solids, Glasses, Water and Fluids, Atomistic Simulations, Multi-scale modeling, **proteins**, Nonequilibrium Physics

Theoretical Biology

Superconductors, Topology

Foundations of Quantum Mechanics

Research Areas

Engineering Mechanics

Earth Sciences, Bio-Fluid Dynamics, Atmospheric Sciences, Aerodynamics, Computational fluid mechanics, Biological flows, Microscale modeling, **flow of complex fluids**, complex interfacial flows

Research Areas

Geodynamics

Tectonics, Himalayan Geology

Hydrology

Underground water resources,

Earthquakes,

Implications to Environment

Uniqueness: Material Sciences at JNCASR

A strong interaction between *Theory and Experiments*

Interaction: researchers in *other Scientific Disciplines*

Strong Interaction with ***Industry, National Labs***

A deemed University: *Strong educational component* (a vibrant campus with 330 students! *S:T* ratio=*6:1*)

Significant Science Outreach Activity: a dedicated unit (ETU)

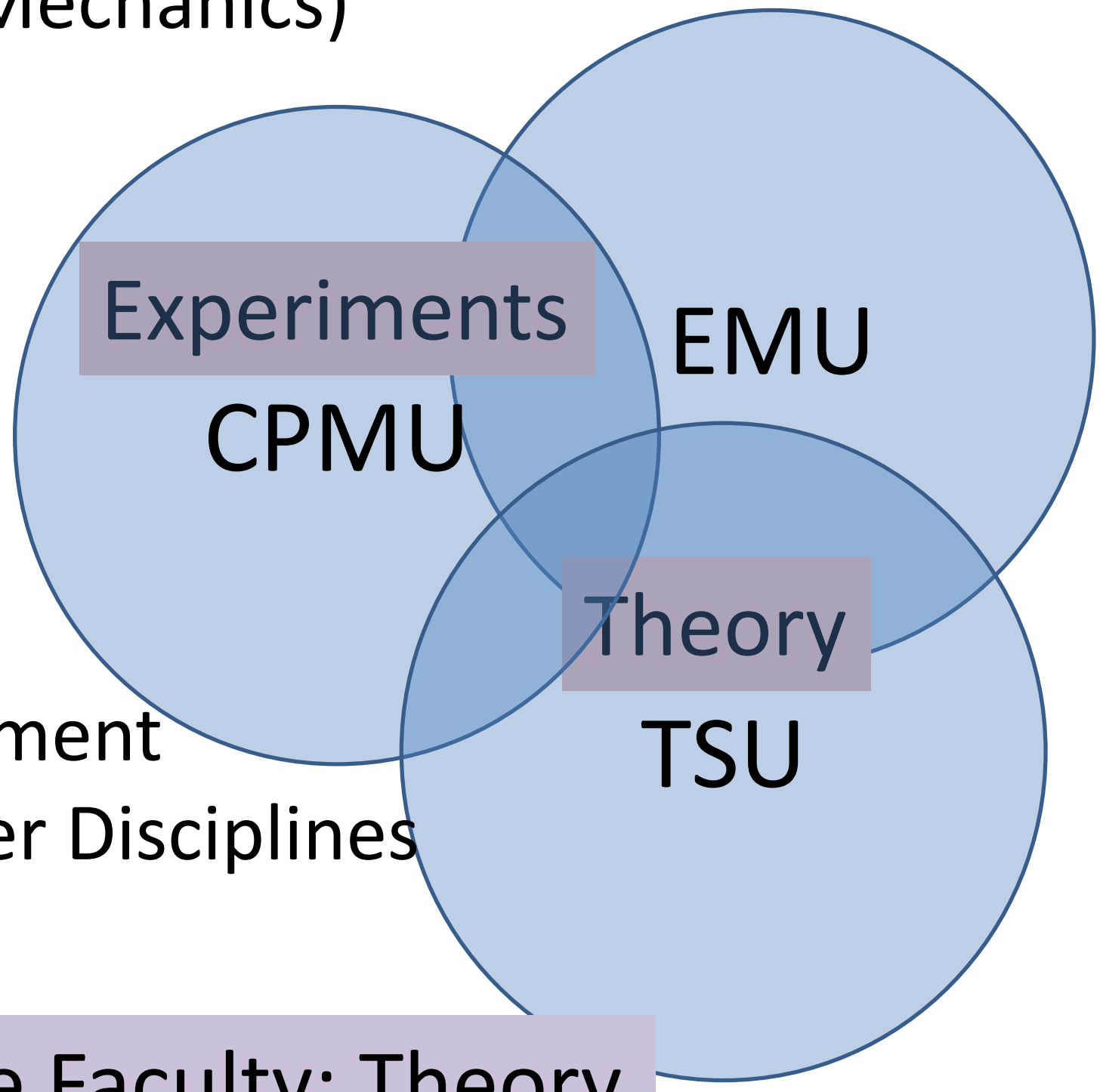
Ranked high in Materials Science & as a University

Material Sciences Research in Three Units:

CPMU (Chemistry & Physics of Materials)

TSU (Theoretical Sciences)

EMU (Engineering Mechanics)



Strong Interactions Between

(1)Theory & Experiment

(2)Physics and Other Disciplines

~ One Third of the Faculty: Theory

An orientation to Applications

Technology

Nano-materials

Health

Smart Functional

Techniques, e.g. Raman

Bio-molecules

Correlated

Hard

Energy

Glasses

Semiconductors

Granular

Polymers

Condensed Matter & Materials

Colloids

Electronics

Entropy

Soft

Fluids

Catalysts, Fuel Storage

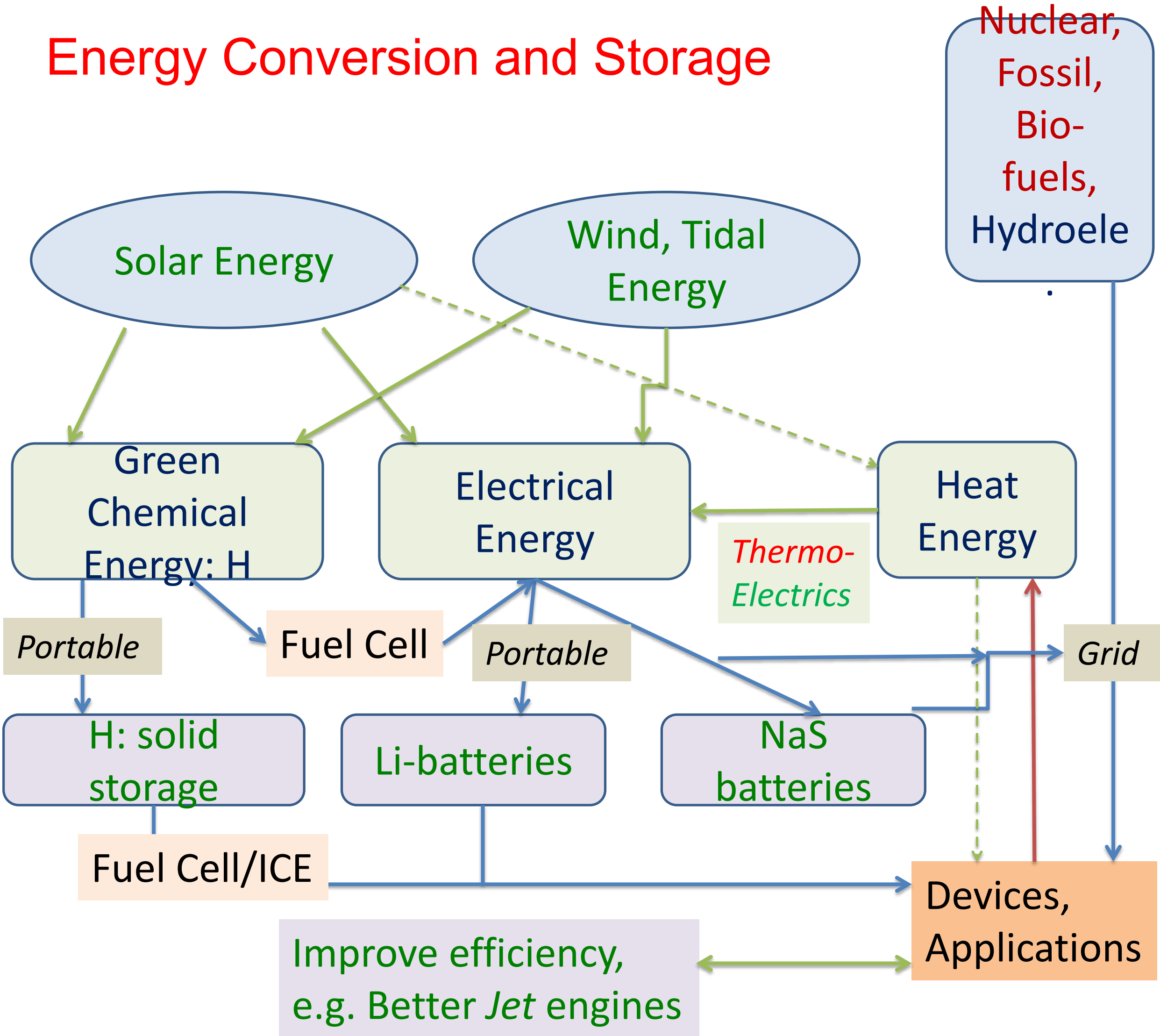
Energy

Atmosphere

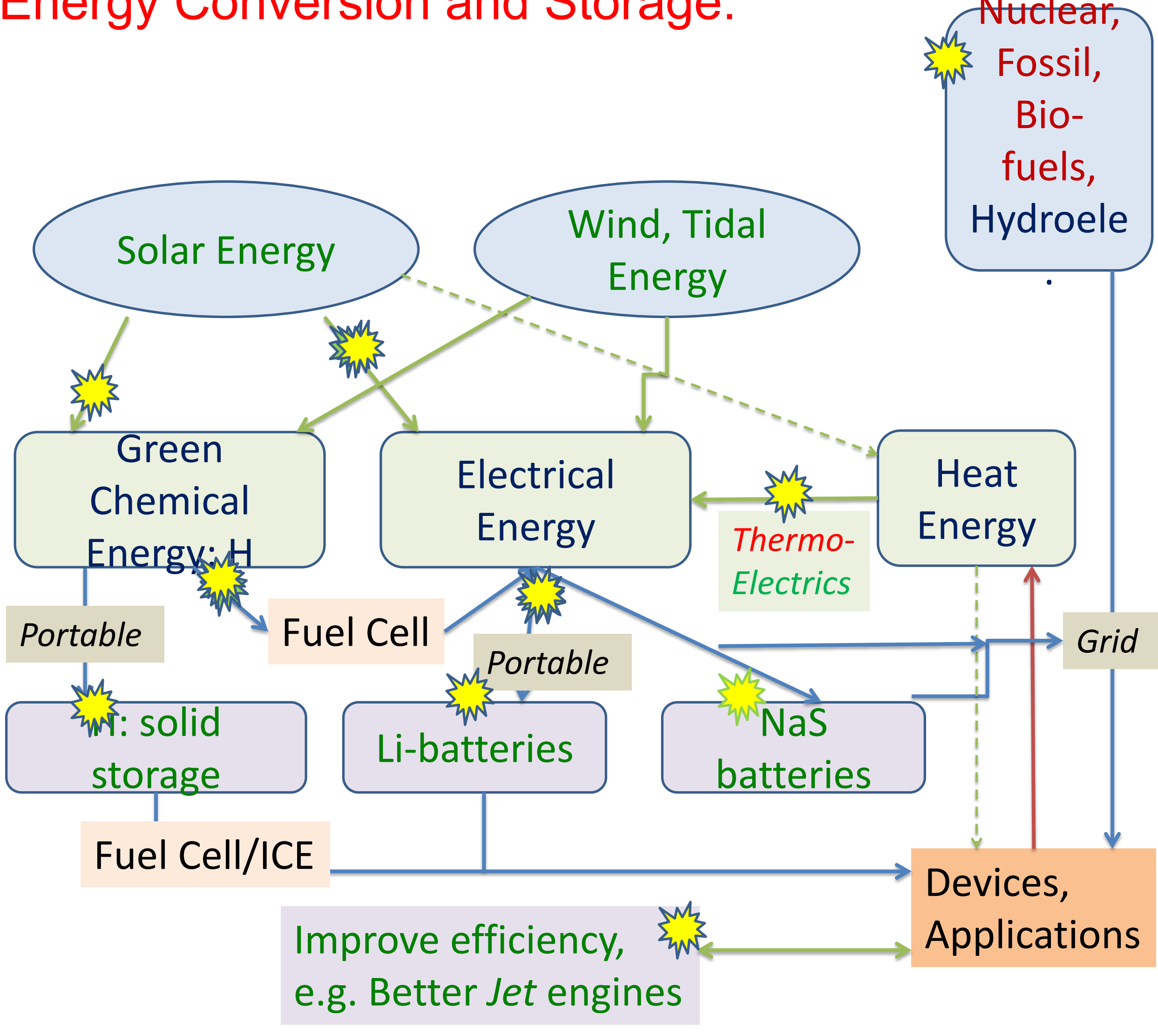
Chemistry

Environment

Energy Conversion and Storage



Energy Conversion and Storage:



Collaborations: *Academia & Industry*

Indian Research Collaborations

JNCASR: World-wide Research Collaborations

Providing a platform for national and international collaborations

PETRA III (DESY, Hamburg, Germany)

1. 3rd Generation Synchrotron - most modern facility open to all researchers
2. Training of manpower for future synchrotrons in India.
3. International collaboration between groups in India and Germany

Major DST Initiatives @ JNCASR

PHOTON FACTORY (KEK, Tsukuba, Japan)

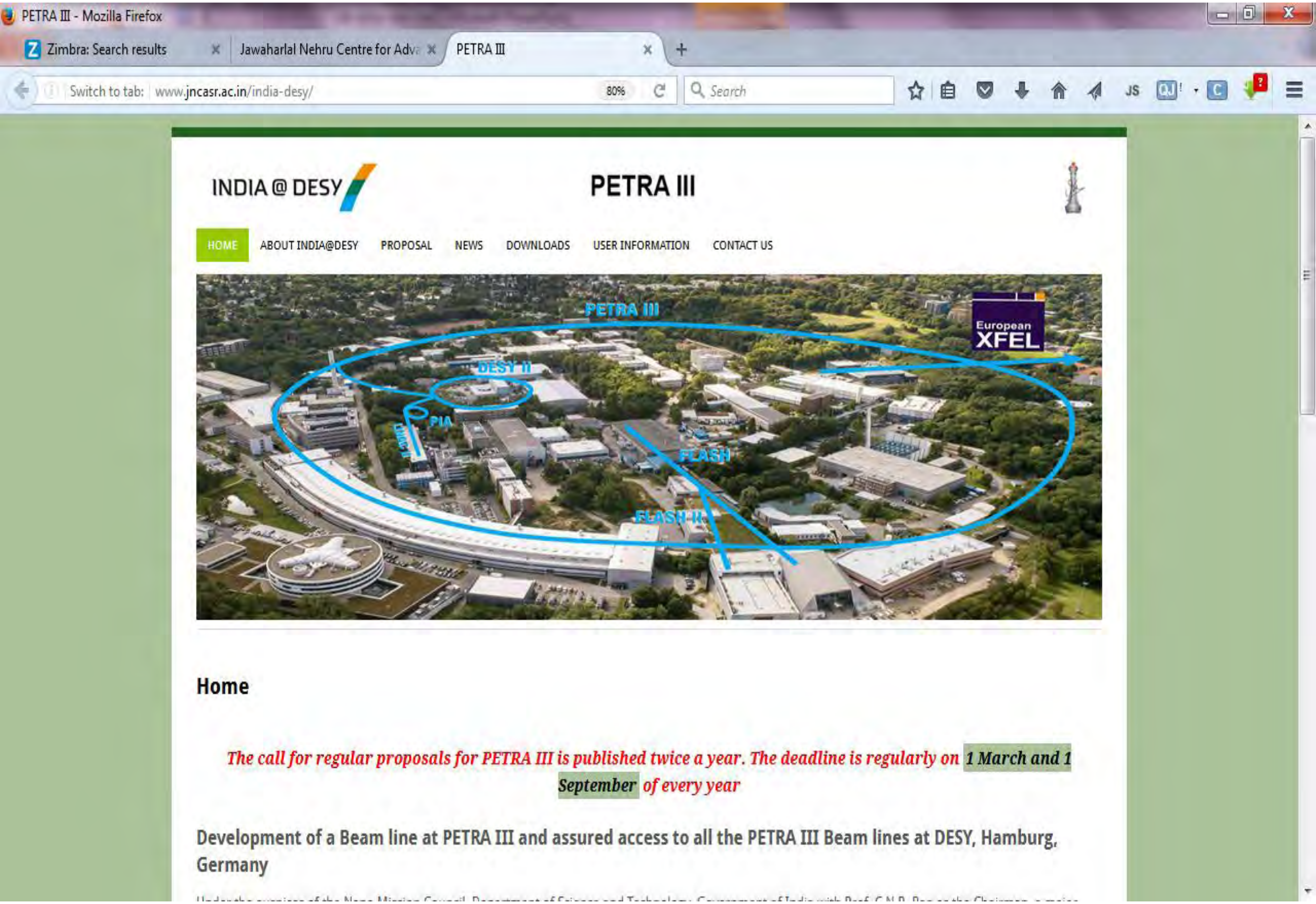
1. 2rd Generation Synchrotron, India has leased a Beamline (18B) for Strong Indo-Japan collaboration
2. Beamline manned by Indian Scientists/Post-doctoral fellows.
3. 5 experiments developed by India: Temperature dependent and High Pressure XRD, Reflectivity, Diffused scattering and SAXS/GIXS (including liquid interfaces)

ISIS (Rutherford Appleton Laboratory, UK)

1. World's leading Centre for research in physical and life sciences – open to all researchers from India
2. Array of Neutron and muon instruments to analyse at atomic scale.
3. Indo- UK Collaboration in the areas of Neutron and Muon experiments

Access to Synchrotron Facility

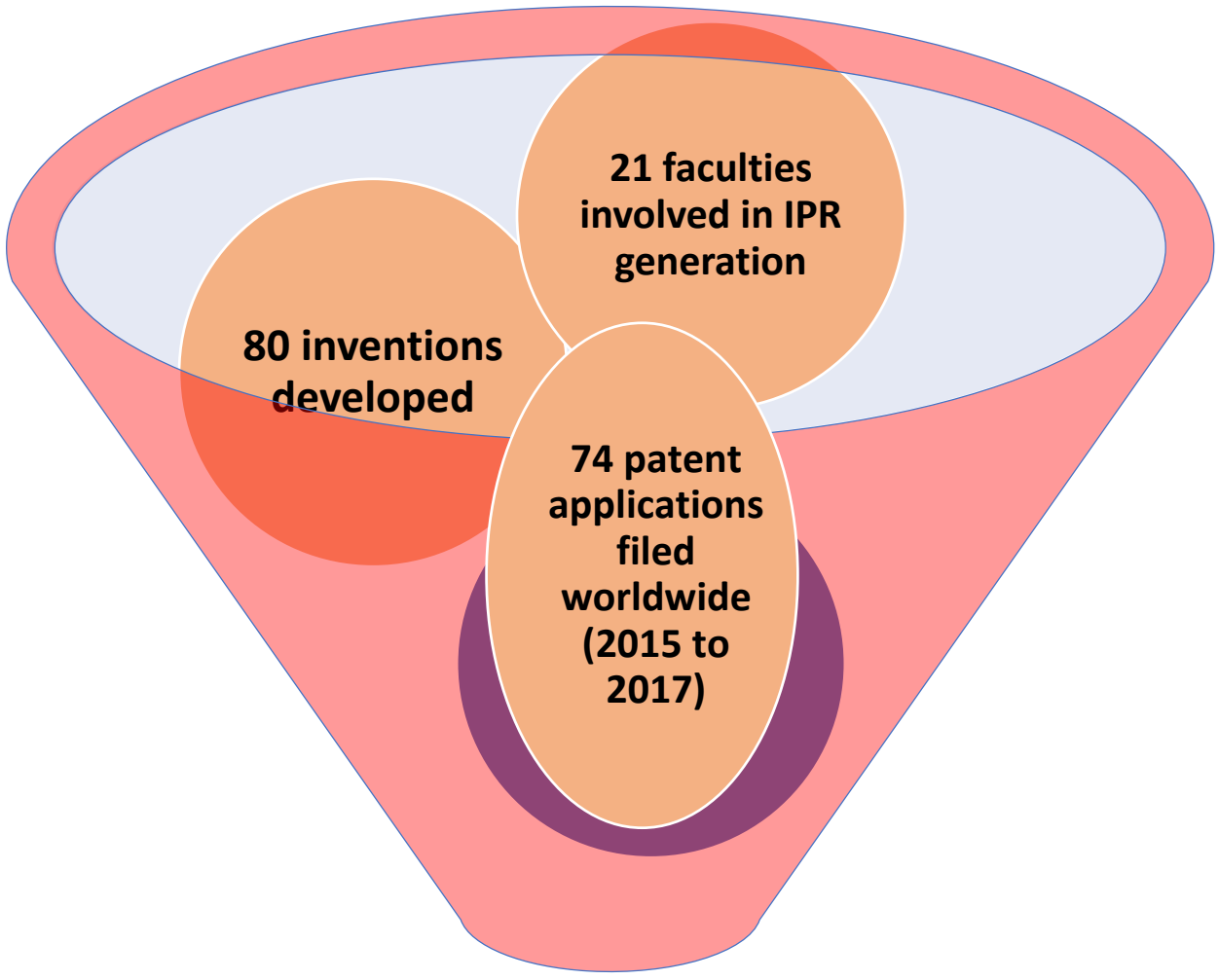
http://www.jncasr.ac.in/india-desy



- Also, Rutherford Neutron Facility, UK

INNOVATION to TRANSLATION

Efforts to escalate R&D valorization



Directed basic research

Start-ups incorporated for JNCASR's IP commercialization = 03

Start-ups currently under consideration = 01

Licensing and Industry Interactions – JNC: industry meets

Collaborations with Industry & Mission Labs (2007-2017)

- Tata Consultancy Services
- C-STEP
- GE
- IBM
- Motorola
- Shell
- Boing
- P&G (Duracel)

- ISRO
- DRDO (DMRL, DMSRDE)
- DAE (IGCAR, BARC, TIFR)