Poornaprajna Institute of Scientific Research

PROMOTED AND MANAGED BY ADMAR MUTT EDUCATION FOUNDATION (AMEF)
Recognized by Department of Scientific & Industrial Research (DSIR) and MAHE, Manipal

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City Campus : # 4, 16th Cross, Sadashivanagar, Bengaluru - 560 080

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About Us

H.H. Sri Eeshapriya Theertha Swamiji
Chairman

H. H. Sri Vibudhesha Theertha Swamiji
Founder, (1928 - 2009)

H.H. Sri Vishwapriya Theertha Swamiji

Knowledge is Power! Providing facilities to conduct research in basic sciences has become very necessary. Our brilliant youth go outside the country to do research and settle there. Until we check this trend, India cannot make real progress in any field. Hence, an attempt is made to establish the Poornaprajna Institute of Scientific Research (PPISR) under the guidance of many eminent scientists of this country. More the investment by the nation in science and technology, the stronger the country will evolve. All well-wishers are hereby approached to assist in this grand endeavor to make a self-sufficient Bharat equipped with skill and technology to lead and serve the world. I pray for divine guidance. May the Lord grant the necessary strength to develop this Institute for the benefit of the nation and the world alike.

H. H. Shri Vibudhesha Theertha Swamiji
Founder, PPISR

PPISR has excelled as a center of excellence in Materials Science and Catalysis, Biological Sciences and Theoretical Science research within a span of 13 yrs since the start of experimental research. Our faculties have got recognition in India and abroad. PPISR faculties have been invited to deliver talks in national and international conferences in India and abroad. PPISR faculty have also been honoured as visiting faculty by other reputed institutes like Albert Einstein College of Medicine, New York, USA; National Centre for Theoretical Science (NCTS, Taiwan); Karlshrue Institute of Technology, Germany; Raman Research Institute (RRI), Bengaluru etc. And it is also worth to mention our faculty has co-authored publications from PPISR with Prof. James Allison, Nobel Laureate in Physiology and Medicine 2018. Our faculty have received Award for Research Publications (ARP) for past 4 years by VGST, Dept. of IT, BT and S&T, Govt of Karnataka for their excellent contribution to research and also, they have received the Young Scientist project grants from VGST, GOK and DST, GOI.

Vision

To promote and nurture excellence in the fundamental and applied sciences for the advancement of scientific knowledge and the benefit of mankind.

Departments At The Institute

There are three main divisions i.e. Materials science, catalysis, biological sciences, physical sciences which are working on the cutting edge research related to basic as well as applied sciences headed by Dr. A. B. Halgeri, director of the institute.

Materials Science and Catalysis division works on the frontier areas such as novel catalysts for green chemical processes, functional energy nanomaterials and novel material design. It has the state-of-the-art research facility and high caliber scientists working not only on novel materials synthesis but also on their applications in the area of catalysis, adsorption, sensors, photoluminescence, solar energy conversion etc. Apart from academic research, the faculty have also taken up industry sponsored projects to develop catalyst and processes for various transformations.

Biological Sciences division is working on understand nature's ingenuity in creation, starting from simple atoms to the generation of molecules, assemblies and their controlled interaction culminating at continuously evolving creatures appears to be a never ending endeavor. We at the Biological Sciences division are striving to play our part towards this journey and the scientists conducting research in the frontier areas such as mycology, protein chemistry, and structural biology.

Theoretical Sciences division works in the broad fields of many-body and mesoscopic physics, nanoscience, quantum information theory, quantum communication, quantum cryptography, the foundations of quantum mechanics and astrophysics.

Materials Science and Catalysis Division

Materials science division works in the frontier areas such as novel catalysts for green chemical processes, functional energy nanomaterials and novel material design



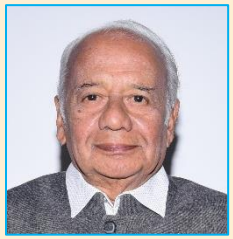

Broad areas of research

- Heterogeneous Catalysis
- Multi functional catalysis for green chemical processes
- Functional nanomaterials
- Catalytic biomass transformations
- C_1 activation
- CO_2 activation reactions

- Water splitting to generate H_2
- Gas sensors
- Photoluminescent Materials
- Photocatalysis
- Metal organic framework
- Mesoporous polymers
- Gas adsorption

Materials Science and Catalysis Division

Faculty



Dr. A. B. Halgeri

Dr. G. V. Shanbhag

Dr. S. P. Maradur

Dr. Naresh Nalajala

Dr. R. Vetrivel

Dr. Nagasuresh Enjamuri

Research Scholars/ Project engineers

Major Research Facilities

Catalytic reactors

High pressure catalyst testing unit

Flow reactors

Glass batch reactors

High Pressure stirring reactors

Photocatalytic reactor

Major Instruments

Potentiometer (Autotitrator)

Gas sensing analyzer

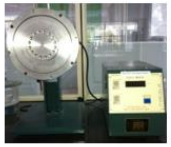
Spin Coater

Probe Sonicator

Rotary Evaporator

NH-2L Kneader

F-26 Extruder



DGM-II Abrasion Tester

ZQJ-II Grain Crushing Strength Tester

Major Research Highlights

- More than 175 research publications since 2011 in high impact journals including Applied Materials & Interfaces (ACS), Chemical Communications (RSC), Chemical Engineering Journal (Elsevier), Chemistry: A European Journal (Wiley), Catalysis Science & Technology (RSC), Journal of CO_2 Utilization (Elsevier), Dalton Transactions (RSC), PCCP (RSC), Crystal Growth & design (ACS), Inorganic Chemistry (ACS), ChemCatChem (Wiley), New Journal of Chemistry (RSC), Applied Catalysis A (Elsevier), Catalysis Today (Elsevier), RSC Advances, Chemical Engineering Science (Elsevier)
- The Average impact factor (from JCR) of these journals is ~5.0
- **2 world (PCT) filed and 2 US patents were granted in a collaborative project** and 5 book chapters have been published.
- 22 Best presentation awards were received by students in national and international conferences till end of 2022.
- **21 industry sponsored projects and 10 from Govt. agencies have been executed.**
- **A technology was successfully developed for the synthesis of aromatics by novel catalyst in an industry sponsored project.**
- **Received plaques from GTC Technology Inc, USA in appreciation of contribution in developing 1st and 2nd generation catalysts for toluene methylation process which was announced as technology world wide by GTC.**
- Three faculty have received "Award for research Publications" from Vision Group on Science and Technology (VGST), Govt of Karnataka.

Industry-Academia Partnership

Partnership between industry and academics is the key step towards innovation and sustainable growth and also ensures industrial relevance in academic research. Over the last 12 years, scientists of PPISR executed several industry projects successfully namely GTC Technology Inc (USA), GTC Vorro Environmental Services, USA, PW Technology Inc. USA, Hindustan Petroleum Corporation Ltd., Shell Technology Centre, Deepak Novochem Technologies Ltd., Deepak Nitrite Ltd and Thermax Industries, Pune, Sravathi Advanced Process technologies, Bengaluru and Bristol Myers Squibb, USA.

Overall, **21** projects sponsored by industries are executed at PPISR in all the three divisions till September 2023. Currently, there are 5 industry sponsored projects under progress at PPISR. PPISR received plaques in appreciation by GTC Technology Inc in 2012, 2014 and 2015 for successfully completing projects as PI and developing 1st and 2nd generation catalysts for toluene methylation process. The project sponsored by HP Green R & D Centre, HPCL completed successfully with 2 US patents and 2 Indian patents granted where PPISR Scientists are co-inventors. The successful completion of the industry projects increased the reputation of PPISR as one of the very few research institutes which are truly having partnerships with industries on a continuous basis. At the same time, it is producing quality PhDs with high impact publications in academic research. The success in industry projects also built trust on PPISR because of which industries are approaching PPISR on regular basis with intent to give projects. PPISR is regularly conducting project review meetings, proposal meetings with its industry partners and new industries to review the progress and also to understand the industry requirements.

Plaque award by GTC Technology USA in 2014

HPCL team visit for review meeting

Our Success Stories….

Toluene methylation Project Achievements

❖ The 10 years project was successfully completed in 2019 with a development of 1st and 2nd generation catalysts for selective toluene methylation.

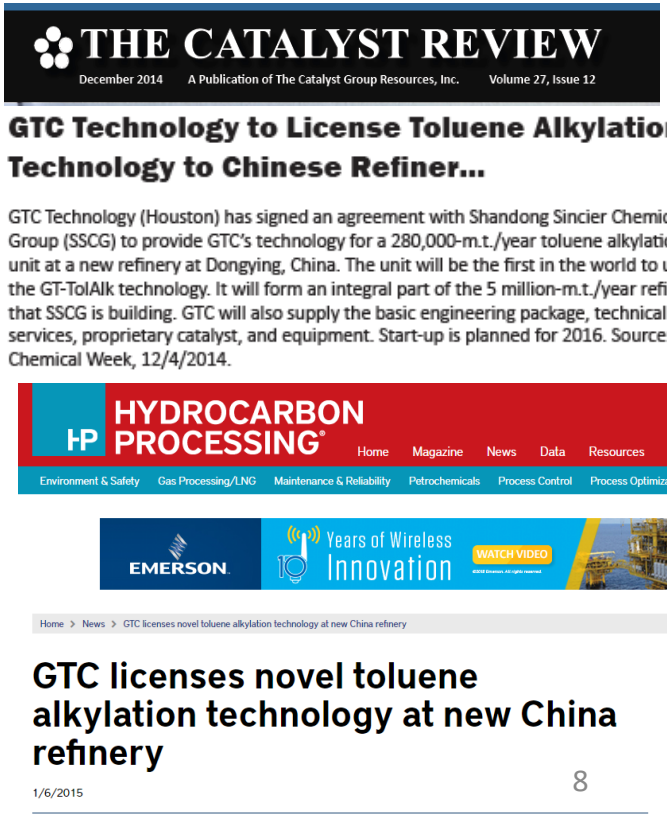
❖ GTC announced GT-Tolalk Technology world wide in 2014.

❖ GTC licenced the technology to a Chinese refinery in 2015.

❖ PPISR received plaques in appreciation by GTC Technology Inc in 2012, 2014 and 2015 for successfully completing projects as PI and developing 1st and 2nd generation catalysts for toluene methylation process.

❖ Dr. Shanbhag visited China for scale-up studies in 2012

❖Dr. Shanbhag and Dr. Maradur visited GTC, Houston for a review meeting on December 2016



THE CATALYST REVIEW

December 2014 A Publication of The Catalyst Group Resources, Inc. Volume 27, Issue 12

GTC Technology to License Toluene Alkylation Technology to Chinese Refiner...

GTC Technology (Houston) has signed an agreement with Shandong Sincier Chemical Group (SSCG) to provide GTC's technology for a 280,000-m.t./year toluene alkylation unit at a new refinery at Dongying, China. The unit will be the first in the world to use the GT-TolAlk technology. It will form an integral part of the 5 million-m.t./year refinery that SSCG is building. GTC will also supply the basic engineering package, technical services, proprietary catalyst, and equipment. Start-up is planned for 2016. Source: IHS Chemical Week, 12/4/2014.

HYDROCARBON PROCESSING

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EMERSON 10 Years of Wireless Innovation WATCH VIDEO

Home > News > GTC licenses novel toluene alkylation technology at new China refinery

GTC licenses novel toluene alkylation technology at new China refinery

1/6/2015

Ongoing Research Programs 2024

SL	Title	Sponsor company	Principal Investigator/ Co-investigator	Duration		Funding
1	Synthesis of fertilizers via carbon dioxide mineralization	**SABIC R and T India** Private Limited, Bengaluru	Dr. Ganapati Shanbhag/ Dr. Naresh Nalajala	October 2023 to December 2024	15 months	Rs. 35 Lakhs
2	Development of methods to synthesize nanoclays and their detailed characterizations	**Hindustan Petroleum Corporation Ltd**. (HPCL) Bengaluru	Dr. Ganapati Shanbhag/ Dr. Nagasuresh	April 2024 to March 2025	12 months	Rs. 21 Lakhs
3	DFT modeling for reaction optimization: Prediction of reactivity and selectivity for the catalytic halogenation reactions	**Sravathi AI Technology** Pvt Ltd	Dr. Sanjeev Maaradur	January 2021 to March 2024	12 months	Rs. 11 Lakhs
4	"Design and development of UV-visible light active rooftop photocatalyst panels for green H2 generation and value added chemicals from sunlight harvesting"	**SERB-DST,** Govt of India	Dr Naresh Nalajala	January to December 2025	24 months	Rs. 33 Lakhs

Potential research areas

- Novel micro/mesoporous materials for green chemical processes
- Biomass conversion to value-added products
- Catalytic CO_2 utilization by converting into useful chemicals
- Mesoporous polymers for catalysis and other applications
- Functional inorganic nanomaterials as applied to
- photoluminescence
- Hybrid nanomaterials

Expertise available in Materials Science and Catalysis Division to work on following areas

- **Catalyst and process development** for the synthesis of fine and specialty chemicals: The department is equipped with the full pledged research facility to undertake any developmental work on heterogeneous catalysis and process development. The equipment facility includes vapor phase catalyst testing units, high pressure autoclaves, dedicated analysis facility is available.
- **Biomass conversion to value added products:** Over the past 12 yrs, lot of research work has been carried out in value addition of biomass derived glycerol and furfural to make high value chemicals.
- **Catalytic CO_2 utilization by converting into useful chemicals:** Catalyst and process development on converting CO_2 to high value chemicals like carbonates, substituted, urea, olefins and methanol has been successfully proven. Any research and developmental work in this area can be undertaken.
- **Hybrid Nanomaterials:** Utilization of hybrid nanomaterials to be used in photocatalysis and hydrogen production has been established. Any new challenges in in this field can be undertaken.
- **Gas adsorptions:** Scientist of MSCD had undertaken developmental work on development of adsorbents for the removal of harmful gases in the streams like H_2S, CO_2. Any project related to gas adsorptions can be undertaken.

Biological Sciences Division

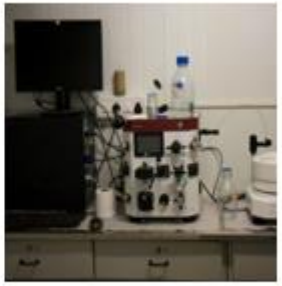
Biological science division works in key areas such as use of active biomolecules from endophytic fungi against diabetes, bioremediation using fungal enzymes, cancer immunotherapy, novel antibiotics against purine and pyrimidine pathways of pathogenic microorganisms, and chemical modification of proteins for therapeutic purpose. The division possess facilities for gene cloning, protein expression, refolding, purification and crystallization of biomolecules. Facilities for the isolation of endophytic fungi, molecular identification, bulk extraction of secondary metabolites and their respective assays have also been established. The research activities in the department are supported by PPISR and as well as grants from government funding agencies such as Department of Biotechnology (DBT), Board for Research in Nuclear Science (BRNS), Vision Group On Science and Technology (VGST) and Department of Science and Technology (DST).

Major Research Highlights

- Biological Sciences Division has received six research grants from granting agencies such as DBT, DST and DAE, Govt. of India and VGST, Govt. of Karnataka since 2012 and support from global pharmaceutical company *Bristol Myers Sqibb*. The division has 40 research publications to its credit, four PhD degrees were awarded and six students received the best oral presentation awards since 2011.
- The division has established collaboration with several national and international organizations.
- Around 25 protein structures were determined and around 20 of them were deposited in Protein Data Bank (PDB) from PPISR since 2011.
- Thirty two endophytic fungi were identified by genomic sequencing of internal transcribed spacer (ITS) region and were deposited in GenBank in the name of PPISR.

Research Facilities in Biological Sciences Division

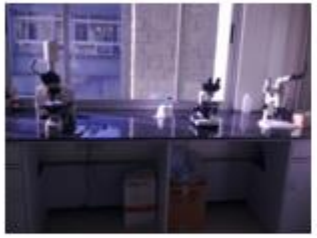
Shimadzu HPLC



Akta Start FPLC

Laminar flow

PCR Thermocycler



Phase Contrast Microscopes

BOD incubators and Autoclave

Cold Centrifuge

4 °C Cold Room

-20 C Freezer

Milli-Q water purifier

ICE flaker

Rotary Evaporator

Expertise available in Biological Sciences Division to work on following areas

1. **Isolation of bacteria and fungi :** from different sources like plants, soil, water or any other materials can be made and supplied
2. **Long and Safe preservation of microbial isolates**, DNA, clones etc can be done at very low cost against existing system of preservation
3. **Extraction of antidiabetic compounds** from natural inhibitors from plants, fungi and bacteria can be made and supplied as crude/semi purified compounds.
4. **Extraction of anticancer compounds** from medicinal plants, fungi and bacteria can be made and supplied as crude/ semipurified compounds
5. **Purification of Proteins** such as albumin, hemoglobin and any other protein of interests and preparation of bio-conjugated molecules can be made as per the requirements

Continued…

6. **Bioanalytical assays** for the synthetic and natural compounds can be provided for the following : antimicrobial assays, anti-oxidants assays, anti-diabetic assays, cell –line studies, anti-cancer assays, protein assays, phytochemical assays, Electrophoresis etc

7. **Bioremediation of industrial waste** dyes, pharmaceutical wastes, and plastic wastes using fungal enzymes can be provided.

8. **Biogas production** from bio wastes using microbial consortium can be made and supplied of biogas for cooking as well as fertilizer for the agriculture.

9. **Microbial fermentation** of waste rice for value-added food products can be made and supplied.

10. **Different products from mushrooms** such as nutritious food, neurostimulators, immune boosters, anti-diabetic, anticancer etc. can be prepared and supplied.

11. Many more aspects can be made depending on the requirements of the customers/consultants

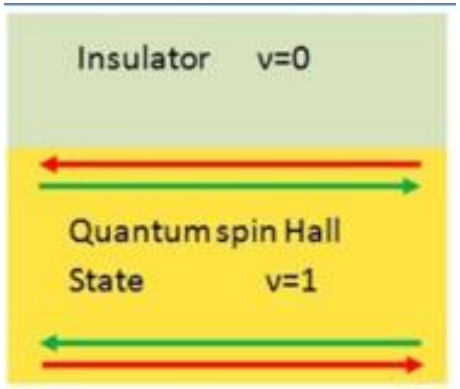
Theoretical Science Division

Theoretical science seeks to unravel the scientific and mathematical structure underpinning Nature and Her physical laws, and how these relate to the macro-world in a testable way. The broad research areas of the Division include quantum many-body and mesoscopic physics, nanoscience, quantum information theory, quantum foundations and Solar physics. There are 2 core facilties in the division and currently, there are five PhD students in the group, Two students have already obtained their PhD The students were all hired under DST/SERB or DRDO projects. All of our former students have moved on either to postdoctoral work in eminent research groups or taken up faculty positions in a university. The Doctoral Advisory Committee (DAC) members overseeing the current set of students are Prof. C. Sivaram (Emeritus, IIA, Bangalore), Prof. B. S. Ramachandra (Director, CFRCE, Benaluru), Prof. Rajeev Joshi (Dept. of Physics, Central University of Karnataka, Dharwad) and Dr S. K. Srivatsa (DEPA, Bengaluru), whose areas of expertise span theoretical astrophysics, black hole cosmology, soft condensed matter and crystallographic studies.

Research Profile of Division

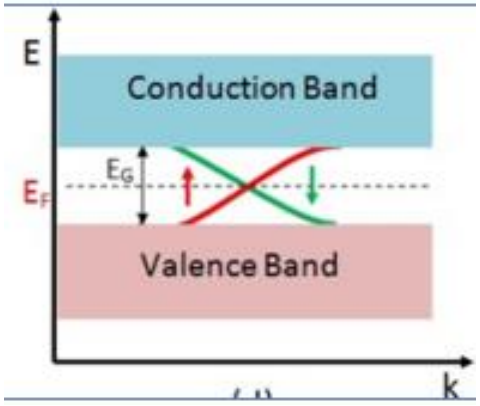
Total PhD students = 4 + (current) 2

Areas of research: Quantum information processing, quantum computation, quantum foundations, Solar physics



Major Research Highlights

- More than 100 publications in the area of theoretical physics and mathematics in reputed international journals like Scientific Reports (Nature), Physical Review A, Physical Review B, Nuclear Physics B, Quantum Information Processing, Physica B: Condensed Matter, Physica Scripta, Physics Letters A, Quanta, Advance in Theoretical & Mathematical Physics, among others. Two book chapters were also contributed by this division.
- Seven sponsored research projects till 2018 were sponsored by Govt. agencies and two PhDs were graduated from this division
- The faculty have several scientific collaborations with scientists at reputed institutes in India and abroad



Planned future areas:

Quantum error mitigation in near-term quantum computers | Quantum field-theoretic study of spacetime geometry | Post-quantum cryptography | Quantum ML | Quantum computing & cryptocurrency | Quantum algorithms for topological systems | Quantum sensors & radars | Topological insulators & phase transitions | AI & ML (BharatGPT) applied to philosophical-scientific issues: identity, individuation, free will and consciousness in general purpose AI | NISQ algorithms such as VQE & QAOA applied to electronic structure problems (quantum chemistry) | AI & ML applied to Solar physical image processing |

Funding: governmental sources (e.g., SERB, QuEST, NQM, DRDO CARS, IKS) + industrial partnership (e.g., QDit Labs, DEPA)

Specific research projects being sought

DRDO (ER & IPR) : Triple-field quantum key agreement

NQM-1: Quantum computing: Quantum algorithms + applications to real life tasks [Rs 75 L]

NQM-2: Quantum devices: Quantum thermodynamics [Rs. 50L]

NQM-3: Quantum communication: fiber-based terrestrial QKD [Rs. 50L]

IKS: ML / AI / BharatGPT in the context of quantum foundations || course work design

AI / ML footprint

Efforts are being made in collaboration with physicists to identify areas of applying AI / ML in quantum foundations and philosophy of science

Currently a 1.5 x 14 hours lecture series for our students by Prof Kallol Roy , Professor of Data Sciences (Univ. of Tartu, Estonia) planned

Poornaprajna Analytical Center

Poornaprajna Analytical Center (PAC) is available for all researchers from academic institutions and industry to characterize their samples. Below mentioned are the instruments available at PAC.Atomic absorption spectrophotometer (AAS) (Perkin Elmer), Fourier Transform Infrared Spectrophotometer (FTIR) (Bruker), Ultra Violet-Visible Spectrophotometer (UV-VIS) (Perkin Elmer), Powder X-Ray Diffractometer (PXRD) (Bruker), Chemisorption instrument(TPD, TPR, TPO), Surface Area Analyzer (N_2 sorption, BET), Simultaneous Thermal analyzer (TGA/DTA/DSC) (Perkin Elmer)

Scientific Collaborations

- The faculty of PPISR have international collaborations with reputed institutes like Albert Einstein College of Medicine New York USA; Karlshure Institute of Technology Germany; Oakridge National Laboratory (ORNL) USA and University of Newcastle Austrailia
- The institute has MOU with many institutes for collaborative research like Argonne National Laboratory Chicago, Indo-Korea Science & Technology Center Bengaluru, IIT- Madras Chennai, Central University Gulbarga, Chrish University, Gitam University, Reva University, St Aloysius College Mangalore, SIT Tumkur, MSRIT Bengaluru, Nagarjuna College of Engineering and Technology Bengaluru
- The research groups of PPISR have academic research collaborations with many national institutes like IISc Bengaluru, JNCASR Bengaluru, RRI Bengaluru, NIT Suratkal, MIT Manipal, IIT Ropar, IIT Rajastan, Bose Institute Kolkota, JIIT Noida, VBU Hazaribag, NCL Pune, IIT Kharagpur and Central University Kerala, Andhra University

Advantages for Industries joining hands with PPISR

1. Private Organization → Better proactive administration

2. Non-government Funded → Flexible rules and regulations; No govt restrictions

3. Young Institute → Thrust to do research and motivated to establish as the best research institute

4. High caliber scientists and students → High Quality Research

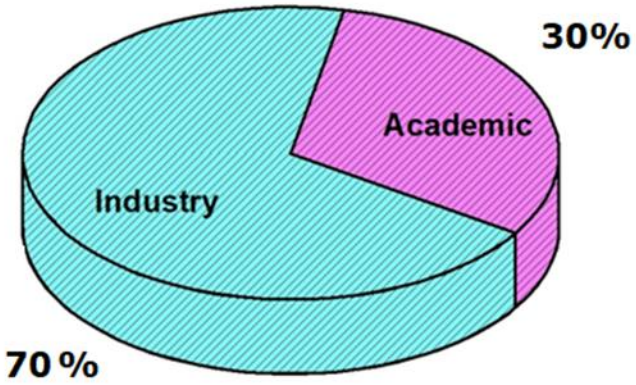
Continued…….

5. Advanced Research facilities and easy access to outsourced facilities → Ability to do time-bound research with high quality

6. No academic obligations like teaching → 100% dedication to research

SPONSORED PROJECTS (LAST 13 YEARS)

Grant share



Industry Sponsored Projects executed by PPISR

24 industry sponsored projects 2011-2022

Sulzer GTC Technology US Inc. — 2021-2022, 2022-2023

GTC Technology — 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2019

GTC VORRO Environmental Services LLC — 2021-2022

HP — 2012-2014, 2015-2018, 2015-2018, 2020-2022

Shell — 2012-2013

Sabic — 2023-2024

Clariant — 2018

Deepak Novochem Technologies Limited — 2018-2019, 2020-2022

Deepak Nitrite — 2018-2019

Thermax — 2015, 2018

Sravathi — 2020

Sravathi AI — artificial intelligence in chemistry innovations — 2021-2022

Bristol-Myers Squibb — 2019-2020, 2021-2022

Sunlux — Reliably Creative — 2019-2020

Bhat Bio-Tech India (P) Ltd. — Infinite Possibilities for a Healthier Tomorrow — 2022

Government Sponsored Projects

26 Government sponsored projects 2011-2022

iNSERB DIA — Science & Engineering Research Board, Department of Science & Technology, Government of India

Karnataka Science and Technology Promotion Society — KSTePS

Department of Biotechnology, Govt. of India

BRNS — Atoms in the Service of the Nation

UGC DAE

Defence R&D Organisation — Ministry of Defence

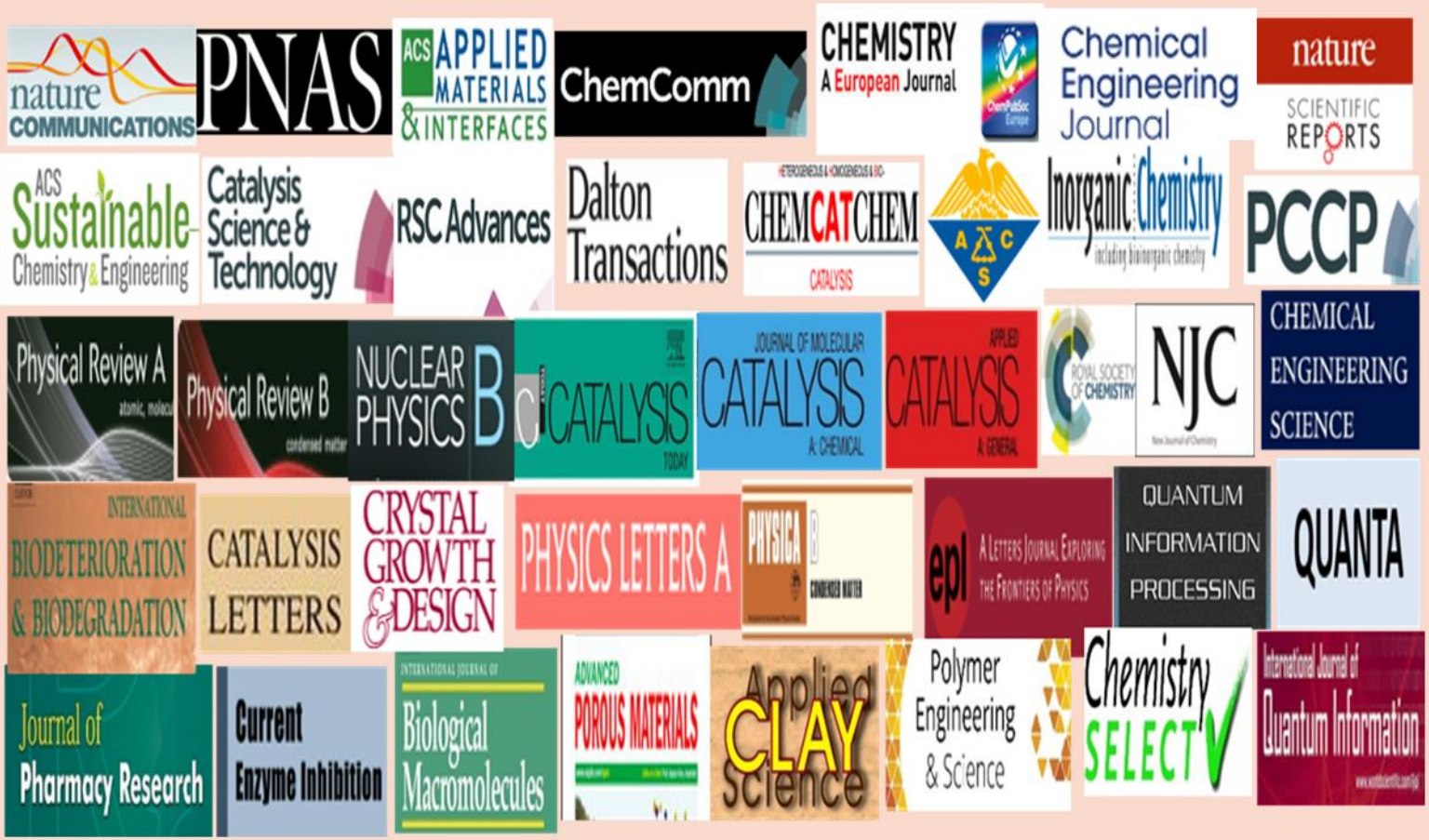
PUBLICATIONS BY PPISR

Total publications in high impact journals ~400

Best Presentation awards: 40

US Patents: 2; Indian Patents 2

Book Chapters: 12



Thanks for your attention !