

Department of Science & Technology

Monthly Report

May, 2024

I. Important policy decisions taken and major achievements during the month:

A. Technology Development

- Under clean coal technologies, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) has prepared a thin cermet coating which was deposited using HVAF technique on pump shaft sleeve on both internal and external surfaces for component level demonstration and ODS iron aluminide powder filled cans (72 mm diameter and 200 mm long) of 7 nos. and further delivered to Nuclear Fuel Complex for upset forging and hot extrusion. Under the DRDO-ISRO project related to Facility and realization of low-expansion glass ceramics (LEGC), a set of glass blocks were developed for laser gyroscope applications and were delivered to DRDO for optical qualification.
- ARCI signed a Technology transfer agreement with M/s. Altmin Pvt Ltd., Hyderabad on 3rd May 2024 for Making Lithium Iron Phosphate (LFP) Cathode Powder Material for Li-ion Batteries (Non-Exclusive Rights within India).
- Centre for Nano and Soft Matter Sciences (CeNS) researchers have fabricated flexible piezoelectric energy generators and road safety sensors using a new polymer nanocomposite material. The prototype device displayed outstanding power density. The real-time demonstration as a road safety and smart door sensor proves that the new polymer nanocomposite will be a potential candidate for developing highly efficient, flexible, and sensitive energy harvesting and pressure sensing devices.
- Complex oxides, especially spinel ferrites, have emerged as a promising alternative to conventional binary oxide semiconductors owing to their tuneable physicochemical properties. Researchers of CeNS have developed a high-performance NO_x sensor that has the potential to overcome the limitations of existing sensing devices by leveraging the mixed spinel structure of ZnFe₂O₄ (mZFO).

B. Science for Society

- National Innovation Foundation (NIF) initiated a program of interaction with farmers, students, and women on May 5, 2024, under the theme “Innovative Idea Competition and Grassroots Innovation Poster Exhibition”. The event was held at Alipurduar district, West Bengal. This program created awareness on Grassroots innovation, understanding the local challenges, and documented new traditional knowledge-based herbal practices. 130 participants and visitors participated from the different forest villages and tea garden workers’ community.
- Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) held on 7th May, 2024 a one-day Science Outreach Programme in Pithoragarh, Uttarakhand. 350 students and 50 teachers from grades XI and XII participated. The programme emphasized the importance of scientific research and innovation, engaging participants with hands-on activities and insightful discussions. A two-day review camp, during 8-9 May 2024, was conducted in

association with Himalayan Gram Vikas Samiti (HGVS) Gangolihat, Uttarakhand. 90 students and 15 teachers from grades XI and XII, were actively involved in various scientific activities. The event aimed to foster a deeper appreciation for scientific inquiry and exploration among the participants.

- Aryabhata Research Institute of Observational Sciences (ARIES) organised the 7th Aditya-L1 Support cell workshop during 21-30 May 2024, for postgraduate students in order to train students on various topics related to Aditya L1 mission. For the first time, data from Aditya L1 payloads were used during the hands on sessions as part of the workshop.
- North East Centre for Technology Application and Reach (NECTAR) supported Tofu making and packaging project, which is a shining example of how technology and training can drive sustainable development. This initiative has helped turning a simple agricultural product into a high-value commercial commodity. In North East India, Wild Organic Tribal Food, supported by NECTAR, has launched Lemon Grass Tea, Kiwi Jam, and Kiwi Squash. These innovative products showcase local produce while empowering tribal communities.
- NECTAR organized a 7-days training Program from 09 – 15 May, 2024, on the Carpenter job role under the auspices of the Pradhan Mantri Kaushal Vikas Yojana (PMKVY). The program aimed to equip participants with essential carpentry skills, fostering their employability and entrepreneurial prospects. A week-long training program was held from 15-22 May 2024, focusing on the Carpenter job role as part of the PMKVY initiative. 27 participants participated in the program.
- Indian National Science Academy (INSA) organised NCR Zonal Science week during May 02-07, 2024 at Bawal, Haryana jointly with Chaudhary Charan Singh Haryana Agricultural University. During this week, various activities were organised such as a science exhibition, hands-on science experiments, visits to labs, interaction with scientists, expert lectures, poster-making competitions etc. The main aim of this science week was to promote science education among students of different schools and to encourage them for higher studies. National Academy of Sciences (NASI) organized a series of awareness Programme on ‘Snake bites and safety’ to educate the community about the behaviour of snakes, precautionary measures and appropriate response protocols in case of snake bites. The programme played a crucial role in mitigating risks and saving lives.
- DST organized a two-days’ National ‘Climate Change Conclave (C3)– Inception, Implementation, and Impacts (I3)’ from 27th-28th May 2024 in association with IIT Delhi, BHU, Delhi University, and IIT Bhubaneshwar, at Research and Innovation Park, IIT Delhi. During the event discussions were held to chart a comprehensive long-term research agenda for the nation's climate priorities.
- The second level of the Expert Panel meeting was held on 22nd-23rd May 2024 at CSIR-NCL Pune for evaluation of 23 shortlisted proposals received against Funding Opportunity Announcement (FOA) RD&D in the area of CCUS with MI Partnership 2023.
- A Field Monitoring Committee meeting was held on 14th May 2024 at IIT Bombay to review the progress of the Sustainable Energy System for Achieving Novel Carbon Neutral Energy Communities (SUSTENANCE) project.
- The first level evaluation meeting was held in DST from the 20th and 21st May, 2024 to review 617 applied research proposals received against WTI call to develop techs to address

challenges associated with CECs, As, salinity, water scarcity, and industrial wastewater treatment.

C. Human Capacity Building

- Under Vigyan Jyoti scheme a meeting was held with stakeholders to discuss scheduled activities, new interventions and the implementation of Vigyan Jyoti Phase V, collection and maintenance of data, etc. 68 Orientations and Students & Parent Counselling Sessions and four Career counselling sessions have been conducted at different JNVs.
- Eight Role Model Sessions, one tinkering workshop, one science camp, and ten subject specific lectures have been conducted for Vigyan Jyoti Scholars.
- Knowledge Centre Solapur conducted a session on "How to develop software" for Vigyan Jyoti Scholars.
- Under WISE Post-Doctoral Fellowship (WISE-PDF) meetings of Subject Expert Committees (SECs) were conducted on Earth & Atmospheric Sciences (EA), Life Sciences (LS) and Engineering and Technology (ET). SECs recommended 12 projects in EA, 12 in LS and 12 projects in ET to support women to carry out Post-Doctoral research.
- Under WISE Fellowship for Ph.D. (WISE-PhD) 2 SECs meetings were conducted and 8 women scholars in Earth & Atmospheric Sciences and 21 women scholars in Engineering & Technology were selected to pursue Ph.D.
- Under INSPIRE –MANAK (Million Minds Augmenting National Aspirations and Knowledge), State Level Exhibition and Project Competitions were organized in Kendriya Vidyalaya; District Level Exhibition and Project Competition were organized in Rajasthan (26 Districts) and mentoring Workshops were organized for selected students of Andaman & Nicobar, Ladakh, Delhi, UP, Haryana, HP, Uttarakhand.
- Under INSPIRE Fellowship 88 INSPIRE Fellows was converted from JRF to SRF.
- Under INSPIRE Faculty Fellowship preparations are under way for IFF-2024 Call. A meeting with TERI, New Delhi and Amity Software was organized on 31st May 2024 towards accomplishing output analysis of IFF program and necessary preparation were carried out in the web portal for obtaining data through survey questionnaire from IFF (Batch IFF-2011 to IFF-2020).

D. Scientific Research

- Scientists of S. N. Bose National Centre for Basic Sciences (SNBNCBS) has demonstrated a novel approach to obtain the possible form of the space-time geometry from the entropy of the black hole for a given horizon radius. The uniqueness of this approach for a given energy-momentum tensor has also been discussed. A set of quantum Einstein vacuum field equations is proposed that leads to a space-time solution. Also, a direct connection between the quantum Einstein vacuum field equations and the first law of black hole thermodynamics has been shown. In another study, Scientists of SNBNCBS proposed a simple yet effective technique for the synthesis of few-layered MoS₂-WS₂ (Molybdenum sulfide -Tungsten disulfide)

composite structures and highlights the potential of these nano-composites as low-cost Surface-Enhanced Raman Spectroscopy (SERS) substrates. The study provides a new incentive for metal-free and low-cost SERS sensing by engaging 2D materials.

- Scientists from Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow have initiated a genetic based study on the Ahom population of Assam to validate the historical narratives of Ahom dynasty. They generated whole genome data of the Modern Ahom population residing in Assam and ancient DNA data from the skeletal remains of the royal Maidam (unique burial complex). Genetic analysis on the modern day Ahoms suggest a substantial admixture of the Ahom population with the local Tibeto-Burman groups. However, genetic data of the human skeletal remains excavated from the Royal Maidam are different compared to the modern day Ahoms. The analysis linked that modern day Ahom individuals have more genetic closeness with the Kusunda (a language isolated from Nepal) and Khasi (an Austroasiatic population of Meghalaya). In summary, a significant deviation of Ahom from their ancestral homeland and extensive admixture and assimilation with the local South Asian populations is observed.
- Wadia Institute of Himalayan Geology (WIHG) has conducted a study to understand the Spatio-temporal fluctuations of Pancha Chuli glacier in Kumaun Himalaya. The study indicates that the total basin area is ~ 58.28 km² out of which ~ 15.89 km² is glaciated. The glacier area loss is ~ 2.44 km² (14%). During 2001-2023 the total glacier length changed by 678.25 m (approx. 29m/year); Glacier retreat in the Suru and Doda river basins, Ladakh Himalaya, is calculated between 2015 and 2023. The Pensilungpa and Parkachik glaciers, located in the Suru River basin, retreated 80 m and 181 m at the rate of 10 m/y and 26 m/y, respectively. Whereas, Durung-Drung Glaciers, located in the Doda River basin, retreated 166 m at the rate of 26 m/y between 2015 and 2023; Another study suggested that the Himalayan headwaters are the primary locus of atmospheric CO₂ sequestration and it is observed that the tectonic activity controls the erosion and weathering in the Himalayan sector, at least in the Teesta basin.
- Minkowski functionals describe the morphology of smooth random fields and they are widely used to examine statistical properties of cosmological fields. Scientists of Indian Institute of Astrophysics (IIA) extended the Minkowski Functional formulas to composite fields which are sums of two fields and explicitly derive the expressions for the sum of uncorrelated mildly non-Gaussian and Gaussian fields.
- In the field of quantum information theory, scientists of Bose Institute (BI) have exactly calculated the optimum probability of extracting nonlocal information encoded in entangled quantum systems within the paradigm of entanglement-assisted local operations and classical communication. In addition, they have proved that optimal extraction of quantum information from a sequence of quantum states requires measurements on individual quantum systems and no joint measurement is necessary.
- Scientists of Raman Research Institute (RRI) studied the shear thickening of dilute suspensions of fractal silica aggregate suspensions of hydrophilic fumed silica (FS) particles in glycerol. A strong dependence of the onset stress for shear thickening on the volume fraction of fractal objects and a reversible weakening of the shear thickening response was observed. Finally, the spatio-temporal flow properties during shear thickening for different fumed silica systems were mapped.
- The study of eclipse flares is used to obtain additional clues regarding the size of the reprocessing region which is used to distinguish various components of the X-ray spectrum observed during the eclipse. Scientists of Raman Research Institute (RRI) Studied three

sources: Vela X-1, LMC X-4, and 4U 1700-37 and compared their spectral properties of the eclipse flare and non-flare data. In this study the fluxes of prominent emission lines showed a similar increase as the overall X-ray flux during the eclipse flare, which suggest that the lines originate in the binary environment and not in the interstellar medium. Scientists of Aryabhata Research Institute for Observational Sciences (ARIES) have studied time-dependent transonic viscous accretion flow around black holes to explain Quasi Periodic Oscillations (QPOs).

- Scientists of Centre for Nano and Soft Matter Sciences (CeNS) in collaboration with researchers from National Chemical Laboratory (CSIR-NCL), Pune have reported a new criterion to evaluate the efficiency of the catalysts used for Direct Methanol Fuel Cell (DMFC) using simple Cyclic voltammetry (CV) technique.
- As the demand for highly efficient UV-protective sunscreens continues to rise, the exploration of advanced materials becomes imperative. Researchers of Centre for Nano and Soft Matter Sciences (CeNS) in collaboration with University of Mysore have shown a novel approach to synthesize zinc oxide (ZnO) nanomaterials through one-step solvothermal (ZnO–A) and sonochemical (ZnO–B) methods, eliminating the need for stabilizers or capping agents. The synthesized ZnO nanomaterials are seamlessly incorporated into a pure cream matrix at varying concentrations, offering a versatile application for skin protection against UVA/UVB irradiation.

E. Publications of research papers, articles, journals & granting of Patents by Research Institutes

- Agharkar Research Institute (ARI) published 05 research papers, Birbal Sahni Institute of Palaeosciences (BSIP) published 15 research articles, Indian Institute of Astrophysics (IIA) published 11 papers, Centre for Nano and Soft Matter Sciences (CeNS) published 07 articles, Aryabhata Research Institute of Observational Sciences (ARIES) published 10 research papers, Sree Chitra Tirunal Institute of Medical Science and Technology (SCTIMST) published 13 research papers in various national and international journals of repute. Indian Academy of Sciences (IASC) published 98 articles in their 11 different journals. SCTIMST reported that a design registration was granted for Portable X-Ray Protection Barrier and Examination Box. CeNS reported that 01 patent was granted. NIF facilitated in granting 06 patents and Technology Information Forecasting and Assessment Council (TIFAC) facilitated in granting 07 patents.

F. International Cooperation

- A Sub-committee meeting was held on 16th May 2024 at DST to review the progress of “U.S.-India collaborative for Smart Distribution System with Storage (UI-ASSIST)”, a project supported under the Indo-US Joint Clean Energy Research and Development Centre (JCERDC) program.
- DST officers attended the World Hydrogen Summit 2024 in Rotterdam and a key part of India Pavillion was set up. The DST team presented digital posters highlighting the key features of all four HVICs and engaged in cross-border consultations with industry and academic leaders in the domain of green hydrogen.

- Survey of India held meetings with other national mapping agencies of Sri Lanka, Madagascar and Qatar, through virtual mode, to explore scope of collaboration and mutual co-operation for exchange of knowledge in the field of geospatial technology.

G. National Technology Mission

- The 4th National Workshop on Technology Innovation in Cyber Physical Systems (TIPS) under NM-ICPS was organized at IIT Bombay during May 13-14, 2024, to assess the progress made by all the Technology Innovation Hubs (TIHs). During this workshop, theme-wise presentations were made by the TIHs, focusing on five areas of national importance: Agriculture, Environment (including Energy, Water, etc.), Health, Defense, and Infrastructure (includes Industry, Transportation, Communication etc.).
- The Workshop included two days Exhibition (Tech Expo), wherein the start-ups supported by the TIHs exhibited and demonstrated their cutting-edge technologies to stakeholders. It also included an 'Investor Pitch' event where DeepTech startups working in the CPS domain, supported by TIHs, pitched their ideas to esteemed VCs and Angel Investors for funding support. The TIPS was attended by the members of Mission Governing Body (MGB), Scientific Advisory Committee (SAC) and various stakeholders from Industries, representatives of Venture Capitalists, line ministries & PSUs alongwith the Project Director/CEOs of all the 25 TIHs and representatives from the Start-ups supported.
- A Quarterly Bulletin (April, 2024 edition) on the activities undertaken and a compendium of break-through technologies developed by each Technology Innovation Hubs (TIHs) indicating highlights of their achievements were brought out by the Mission Office, NM-ICPS and were released during the Workshop.
- Third-Party Review Committee of the Mission also interacted individually with all the 25 TIHs during 2 days' workshop, facilitating constructive feedback and insights to enhance their initiatives.
- First tranche of grant towards implementation of the TSA Model has been released as per the DoE's OM dated 9th March, 2022, from the current FY 2024-25 under NM-ICPS.
- The 1st Working Group Committee meeting was held on May 24, 2024 in Hybrid Mode for formulating guidelines/policies/agreements for implementation of National Quantum Mission.
- The 3rd meeting for preparing guidelines for supporting startups under National Quantum mission was held on May 24, 2024 in virtual mode.

H. Scientific Infrastructure Building

- Scientists from DST attended a meeting on 7th May, 2024 where the Director, Mahalanobis National Crop Forecast Centre (MNCFC), Ministry of Agriculture and Farmers Welfare presented the recent initiatives of the centre on Geospatial Technology utilization in agriculture.
- As a part of the India delegation, DST participated in the United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP) Executive Board meeting and the Locate 24 conference held on 6th May 2024 and from 7-9 May 2024 respectively at

the International Conference Centre in Sydney, Australia. Participation in these conferences was beneficial in understanding the UN Policies related to GGIM and implementation of the UN guidelines in respect of our various divisional sub-schemes. Also UNGGIM Forum provided an opportunity for DST to exchange the views and knowledge on latest trends in Geospatial Information Management and facilitated in understanding the United Nations policies, data quality and maintenance and standards.

- DST presented its Geospatial Innovation and R&D initiatives in a meeting chaired by Chairman GDPDC on 15th May, 2024.
- DST participated in the Geospatial World Forum, 2024 held at Rotterdam, The Netherlands from 13th to 16th May, 2024 where discussions were held on the theme Geospatial Transition: Powering the World Economy.
- A virtual meeting was held to discuss the activities to be carried out by Geospatial Innovation & Research Centre set up through an MoU between DST, NIGST (SoI) and IIT Tirupati NiH. During the meeting it was decided to start ad-hoc recruitment for starting the activities of the Centre and create a webpage for showcasing its ongoing and upcoming activities. IIT Tirupati NiH informed that the first CORS data based Hackathon will be held by 15th June, 2024.
- DST has initiated two CCU pilot projects in May 2024, which are aligned with national missions like Atmanirbhar Bharat and Make in India. Two pilot projects have been approved to be established in Pune and Hyderabad, led by the IIT Delhi-Thermax Pvt Ltd consortium and the CSIR-IICT-BHEL consortium, respectively.
- Site visit of CSIR-IICT-BHEL pilot setup in Hyderabad was conducted on 16th May 2024. CSIR-IICT-BHEL will deploy CO₂ capture and conversion to dimethyl ether (DME) technologies at a scale of 0.18 TPD.
- The First Review meeting to review the progress of Multilateral Accelerating CCUS Technologies (ACT) Project - PERBAS - was held on 17th May 2024 at CSIR NGRI, Hyderabad. On the 17th May, experts conducted a site visit of CSIR-NGRI group, which is working on CO₂ sequestration in basalt rocks and is leading the PERBAS project.
- Site visit of IIT Delhi-Thermax Pilot Plant in Pune was conducted on 24th May 2024. During the visit researchers and engineers discussed the integration of CCU technology in the existing coal-to-methanol pilot plant, which aims to produce 1.4 TPD methanol.
- The Department of Science & Technology has issued a call for proposal for support under Promotion of University Research and Scientific Excellence (PURSE) 2024. In response, 148 applications have been received and are being processed for screening by the newly established Program Management Board. Each proposal will undergo thorough evaluation by the board members, and the results of these evaluations will be discussed in detail at the next meeting.
- The Sophisticated Analytical & Technical Help Institute (DST-SATHI) facility at the Indian Institute of Technology, Hyderabad, has received a capital grant of INR 32.25 crores and procurement process for acquiring state of art national level facility, 3D-Atom Probe Tomography (APT), has been initiated.