Department of Science & Technology, Government of India

सत्यमेव जयते

THE NATIONAL ACADEMY OF SCIENCES, INDIA (NASI)

&

BHABHA ATOMIC RESEARCH CENTRE (BARC)

NASI

BARC

REQUEST YOU

FOR ATTENDING THE

93RD ANNUAL SESSION OF NASI AND SYMPOSIUM

ON

'INDIA SECURE @75'

(An endeavour to celebrate and support Atma Nirbhar Bharat)

AT

DAE CONVENTION CENTRE, BARC, MUMBAI

3RD – 5TH DECEMBER 2023

NASI: A Brief Profile - The idea of establishing a forum for Indian scientists, which would help them on one platform to discuss and find scientific solutions to the problems of the country, was mooted by **Prof. Meghnad Saha**, a great scientist, visionary and the then Professor of Physics at the University of Allahabad. His views were published in an article titled '**A Plea for an Academy of Sciences**' in December 1929 issue of the University of Allahabad magazine; in the very next year, The National Academy of Sciences, India was established as the first Science Academy of this country. Speaking in the inaugural session, Prof. Saha said:

"An Academy of Science can do a great deal by educating public opinion, undertaking particular problems, and bringing out scientific workers in various fields for discussion and cooperative research. But the main function of the Academy should be towards cultural improvement by contributions to human knowledge."

NASI got the mandate of Science and Society by its Founder. Presently, the programmes are being steered by **Prof. Balram Bhargava** (former Secretary to the GoI; and presently at AIIMS, New Delhi), **President of the Academy**. The Past Presidents, namely **Prof M. S. Swaminathan, Prof. P. N. Tandon, Prof (Mrs.) Manju Sharma, Prof Ashok Misra, Prof Asis Datta, Prof. J. P. Mittal, Dr V. P. Kamboj, Dr. K. Kasturirangan, Prof. Akhilesh K. Tyagi, Prof. Anil Kakodkar, Prof. G. Padmanaban** and **Prof. Ajoy K. Ghatak** have been taking keen interest in the progress of Science and the Academy, in particular. The Academy was also nurtured especially by **Late Prof M. G. K. Menon, Prof A. K. Sharma, Prof S. K. Joshi, Prof. U. S. Srivastava** and **Dr V. P. Sharma -** Past Presidents, NASI (it is not possible to mention the names of all the past presidents, here).

NASI envisions the cultivation and promotion of Science & Technology in all its branches. Such as: (1) publishing two quarterly journals (Proceedings of the National Academy of Sciences, India- Section A (Physical Sciences) and Section B (Biological Sciences) and one bi-monthly journal (National Academy Science Letters); (2) holding an Annual Session in a scientific and academic institution every year; (3) organizing symposia, seminars and workshops on subjects of current national and scientific interest; (4) planning and executing science communication programmes like Science Extension Lectures, State level Science Contests (Quiz, Debate, Oration, Exhibition, Essay, etc), Talent Search, Teachers' Workshops, Summer/Winter Schools, Vocational Training Programmes, National level Scientific Creative Writing Contest, Celebration of National Technology Day, National Science Day, National Mathematics Day and World Environment Day, etc.; (5) recognizing the significant contributions of scientists at every level by honoring them with Fellowship/Membership/Awards such as Lecture Awards, NASI-Reliance Awards, NASI-SCOPUS Awards, NASI-Young Scientist Awards etc.(continued till 2022); (6) instituting prestigious Research Fellowships/Chairs/Senior-Scientist Fellowships etc. to honor distinguished scientists; (7) organizing sensitization programmes for women researchers/scientists all across the country; (8) conducting the 'Safe water' project; (9) organizing/conducting other projects and schemes, such as Nutrition Programme for eradicating malnutrition, Science Awareness Programme for adopting COVID Appropriate Behaviour, Entrepreneurship Development Programmes and a joint programmes of NASI, ICAR and ICMR; (10) establishing River Galleries; and (11) organizing Rural/Tribal Welfare Programmes.

Besides the above mentioned activities, the Academy also organizes several other activities jointly with other two National Science Academies- INSA and IASc- all through the year. Since the year 2000, the annual sessions have been held at places such as Allahabad, Pune, Shillong, Ahmedabad, Jaipur, Pondicherry, Mumbai, Mysore, Chandigarh, Kolkata, Jaipur, Trivandrum, Varanasi, Goa, Jodhpur, Bhubaneswar, Dehradun, Pune, Chitrakoot, Hyderabad and Prayagraj. These annual sessions provide a platform for the scientists across the country to interact, present their papers and exchange expertise with each other. The Academy is also maintaining a well-organized library; and it has 22 Chapters all across the country to organize scientific activities in and around their respective regions.

BARC: A Brief Profile – India is the only developing nation to have indigenously developed, demonstrated and deployed nuclear reactors for electricity generation. This was made possible through several decades of extensive scientific research and technology development primarily in BARC. In this regard, **Dr Homi Bhabha** was the architect. The country has nuclear ores from which a total of about 78,000 tonnes of uranium metal and about 518,000 tonnes of thorium metal can be extracted. If the entire uranium resources are first used in natural uranium–fueled pressurized heavy water reactors (PHWRs), it is estimated that about 420 GWe-yrs of electricity can be produced. The resulting depleted uranium and separated plutonium from these PHWRs, if used in fast breeder reactors (FBRs), could generate an additional 54,000 GWe-yrs of electricity. In these FBRs, production of uranium-233 (U233) can also be achieved by loading thorium assemblies in their blanket and low-power zones. Eventually by transitioning to generations of Th-U233 fueled breeder reactors, India should be able to produce an additional 358,000 GWe-yrs of electricity. Thus, even at an installed nuclear power capacity of 500–600 GWe, the country's nuclear resources will be able to sustain its electricity generation needs far beyond the extinction of its coal deposits.

After entering into International Civil Nuclear Cooperation agreement in 2008, India was bestowed with opportunity of setting up nuclear reactors with international cooperation. This treaty also ensured continuous supply of fuel for Indian NPPs. BARC plans to develop PWRs indigenously for accelerated capacity building. BARC has achieved forging technology for pressure vessel, reactivity drives, etc to initiate the indigenous PWR programme.

The Indian molten salt breeder reactor (IMSBR) is the platform to burn thorium as part of 3rd stage of Indian nuclear power programme. The fuel in IMSBR is in the form of a continuously circulating molten fluoride salt which flows through heat exchangers for ultimately transferring heat for power production to Super-critical CO2 based Brayton cycle (SCBC) so as to have larger energy conversion ratio as compared to existing power conversion cycle. Because of the fluid fuel, online reprocessing is possible, extracting the 233Pa (formed in conversion chain of 232Th to 233U) and allowing it to decay to 233U outside the core, thus making it possible to breed even in thermal neutron spectrum. Hence IMSBR can operate in self-sustaining 233U-Th fuel cycle. Additionally, being a thermal reactor, the 233U requirement is lower (as compared to fast spectrum), thus allowing higher deployment potential.

These reactors require several new technology development which are being undertaken by BARC. These include 7Li enrichment, salt preparation and purification, salt characterisation and chemistry, structural material development and characterisation, nuclear grade graphite development and characterisation, component development, SCBC and reprocessing for IMSBR. In addition, a dedicated facility, Molten Salt Breeder Reactor Developmental Facility (MSBRDF) is being designed for full scale demonstration of all major systems for the 5 MWth IMSBR. BARC has also developed Ni-Mo-Cr-Ti alloy for the vessel. R&D is being undertaken for fuel salt optimisation, characterisation, salt preparation, thermal hydraulic and corrosion studies of IMSBRs.

BARC has active groups for Research and Development in Reactor Technologies, Fuel reprocessing and waste management, Isotope Applications, Radiation Technologies and their application to health, agriculture and environment, Accelerator and Laser Technology, Electronics, instrumentation and reactor control and Materials Science. Strong emphasis on basic and applied research in a number of core disciplines of Science has made synergy between basic research and technology development possible.

The NASI is grateful to **Dr. Ajit Kumar Mohanty**, Director, BARC and also to **Prof. S. M. Yusuf**, Director, Physics Group, BARC, Mumbai for extending their helping hand and inviting NASI to organize its 93rd A. Session there at Mumbai.

Symposium on 'India Secure @75' – A Prologue: For an all-round progress of a nation, we need to be able to project our national power beyond borders through our foreign policy, our cultural ambassadors, sportspersons, Indian diaspora and science academies. As India has completed 75 years of Independence, we need to look at how secure we are as a nation. Today, we are the sixth largest economy with a GDP of $3.17 trillion in 2021 and are expected to become the 5th largest economy by the end of 2022. But when compared to the United States, with a GDP of $23 trillion or China with around $18 trillion economy, we can see that the country has to travel far before becoming competitive with the superpowers. It is time we start working at the challenges we face, the opportunities, the internal dynamics at play and how the world views us!! With a country as diverse as ours, we need to discuss every challenge and have a workable solution. As our ancestors have shown, out of every *Manthan* some *Amrit* always comes out. We have a proud legacy of universally accepted *sanskritized* cultural heritage, which is more than 1000 years old; and depicted systematically in many scriptures/treasure books known world-wide. The *vaidic* culture, the glorious achievements of our scientists of 17th - 19th century e.g. Aryabhatta, Shushrut, Ramanujan, Meghnad Saha, P C Ray, J C Bose, S N Bose, C V Raman, and many; and the recent advancements of Indian Science, not only give us a sense of accomplishment but also inspiration to achieve more.

The victory of Bharatiya Vaccines to eradicate CORONA & Plague; the misson mode success of the missile & rocket programmes; successful launch of Chandrayaan-III, and Suryaan also just after that; the Nuclear energy emission plans and renewable energy generation, etc. are some of the great achievements and a leap forward, especially in the areas of transformational science. The Telecom, Artificial Intelligence, Information Technology, Biotechnological advancements especially its applications in the field of medicine, agriculture, food security, etc. are the recent path breaking milestones achieved by the scientific community of our motherland. Therefore, when we are celebrating '*Azadi ka Amrut Mahotsav*' with the motto of becoming *Atma Nirbhar*, it is high time to assess & evaluate our caliber in terms of pursuing our goal towards becoming 'Self-Reliant' during the *Amrit Kaal* (till 2047), as prophesied by the Hon'ble Prime Minister of India.

Therefore, let us introspect to extrapolate our targeted goals & achievements in terms of a developed country by 2047. Accordingly, under the leadership of Prof. Balram Bhargava, President, NASI, and with valuable inputs from other senior fellows, as Prof. Manju Sharma, Prof. Ashok Misra, Prof. Akhilesh K. Tyagi, Prof. Anil Kakodkar, Prof. J P Mittal, Prof. Ajoy Ghatak, Prof. Jayesh R Bellare and others, a scientifically synthesized programme has been developed by Prof. S M Yusuf (Convener) to delve on several contextual issues in different fields of science & technology.

Before delving into those domains, it is good to remember that the security of a nation essentially translates into the freedom to pursue the nation's aspirations and to neutralize and ward off any obstacle in the way of achieving them. The obstacles which come in the way are referred to in security terms as threats. Two very basic needs to keep any nation secure in the modern world remain a resilient economy and energy security, both bottom line needs. And our experience show that these could be achieved only when there is a concerted/coordinated effort to harmoniously utilizing our resources; and to create an ecosystem of transformational technologies to attain the best possible results. For this, special emphasis will be given to discuss & deliberate on the issues, as –

a) Agriculture & Food Security@75
b) Drug-Pharmacy & Bio-applications for Security@75
c) Forest, Climate & Environmental Security@75
d) Energy Security@75
e) Electronics & Cyber Security@75
f) Space Security @75
g) Medical & Health Security@75

THE NATIONAL ACADEMY OF SCIENCES, INDIA (NASI)

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PhD, FNASc, FNAE, FEMSI, FMAS
General Secretary, NASI
Prof. Seikh Mohammad Yusuf
PhD, FNA, FNASc, FASc, FMASc
Convener, Symposium/Session

5, Lajpatrai Road,
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16.09.2023

Dear Sir/Madam,

We are happy to inform you that the ***93rd Annual Session of the National Academy of Sciences, India*** and **Symposium on '*India Secure @75*'** will be held during **December 3-5, 2023** at DAE Convention Centre, Bhabha Atomic Research Centre (BARC), Mumbai.

On behalf of The National Academy of Sciences, India and the Bhabha Atomic Research Centre, Mumbai, we have great pleasure in inviting you to attend these events and participate in the deliberations.

Scientific Sessions

The Scientific Sessions will be held in two sections: **Section of Physical Sciences**- Sectional President: **Prof. Jitendra Kumar Bera**, ***FNASc***, IIT Kanpur; and **Section of Biological Sciences**- Sectional President: **Prof. G. Taru Sharma**, ***FNASc***, NIAB, Hyderabad.

The scientific papers are presented by selected researchers/scientists in scientific sessions, for which prior submission of the Abstract(s)/Paper(s) is necessary (for which the 'Invitation/General Circular' was circulated earlier; now the date of submission has been extended till **30th Sept**. 2023). All abstracts/papers submitted for presentation through the portal (**http://www.nasi2023.in**), will be screened. Authors whose papers are accepted will be informed at the earliest. The decision of the Academy for the acceptance/rejection and also for the mode of presentation (Poster only) would be final. The travel/ticket charges (AC-III, shortest route) will be reimbursed to the presenting authors, only.

Symposium

A Symposium on **'*India Secure @75*'** will be held during the Annual Session, as proposed by **Prof. Balram Bhargava**, *MBBS, MD, DM, FNASc, FACC, FAHA, FAMS,* **President, NASI**; and also accepted by the NASI-Council. **Presentation of papers in the Symposium would only be through invitation.** The **Convener** of the Symposium is **Prof. Seikh Mohammad Yusuf**, *PhD, FNA, FNASc, FASc, FMASc*, Director, Physics Group, Bhabha Atomic Research Centre, Trombay, Mumbai – 400085, who is being supported by a group of NASI Fellows, and other scientists at BARC.

All interested persons are invited to attend the Symposium and Scientific Sessions of Physical and Biological Sciences by registering/applying on the email (nasi.barc2023@gmail.com). ***Fellows and Members of NASI are exempted from the registration fee; but they will have to register on the aforesaid mail by 31st October 2023, if they wish to attend the Session***. Further, moderate charges are also to be given for the accommodation.
The BARC will inform through the 2nd Circular about the accommodation charges, local transport arrangements, entry procedures, etc.

Publication of full length Papers

In case it is desired that a paper presented at the Annual Session be considered for publication in the journals of the Academy, viz. Proceedings of the National Academy of Sciences, India- Part A (Physical Sciences) or Part B (Biological Sciences)/National Academy Science Letters, it must be submitted on line as per the prescribed procedure of submission. **(For details please see the website of the Academy)**. These manuscripts will undergo the usual processing and refereeing as

per rules of the Academy. **Papers sent for the Session will not be automatically considered for publication in the journals of NASI.**

Fellows Meeting and Annual General Body Meeting

The aforesaid meetings will also be held during the 93rd Annual Session; the notices for the same will be sent separately to the Fellows/Members.

We once again extend a very cordial invitation to you to participate in the ***93rd Annual Session of the National Academy of Sciences, India*** and **Symposium on *'India Secure @75'*** will be held during **December 3-5, 2023** at Bhabha Atomic Research Centre (BARC), Mumbai.

Yours truly

Sd/ **Prof. Jayesh R Bellare**
General Secretary, NASI, Prayagraj

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N.B. - In the 2nd Circular the host institution (BARC) will inform in detail about the programme, stay arrangements & other logistics, by the end of October 2023.

A panoramic view of the Ganga-gallery at NASI

DAE Convention Centre at BARC, Mumbai