

IWSA NEWSLETTER

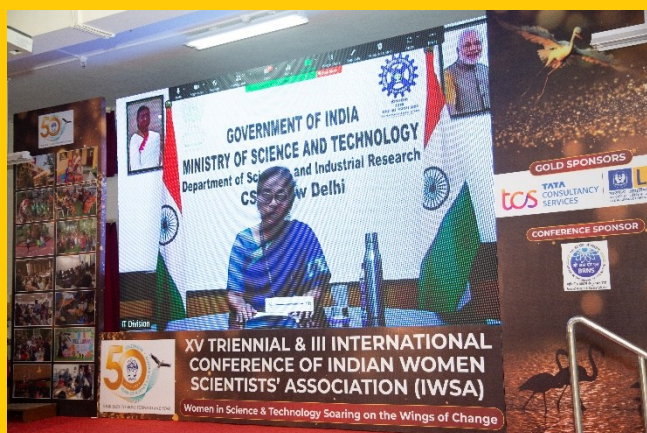
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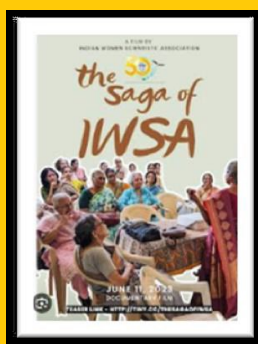
Inaugural Speech by Dr. N. Kalaiselvi, DG, CSIR
Triennial Conference 11-13 June 2023



Release of the book '*The Fifty-Year Saga of the Indian Women Scientists' Association*' by Dr Pheroza Godrej, Chairperson, Godrej Archives Council & Advisor, Godrej Mangroves



Release of the Film "*The Saga of IWSA*" by Founder Member Dr Sudha Padhye



Release of Book "*Millet for Children*" by Mrs. Mini Ipe, Managing Director, LIC India

Glimpses of Inaugural Session of Triennial Conference

BRANCHES

Roorkee 1979, Hyderabad 1979, Pune 1980, Nagpur 1982, Kolhapur 1982, Delhi 1987
Kalpakkam 1987, Baroda 1988, Amravati 2010, Bengaluru 2018, Nellore 2018

BRNS sponsored Popular Science lectures at schools and colleges



BRNS Lecture at Union Christian College, Aluva, Kochi, on 7th July 2023



BRNS Lecture at SVKM'S Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce and Economics (AUTONOMOUS), Vile Parle (West), Mumbai on



BRNS Lecture at New Horizon Public School, Panvel, Navi Mumbai on 5th August 2023



BRNS Lecture at Modern School & Junior College, Vashi on 12th August 2023

Triennial Conference- June 11th – 13th



IWSA members felicitated at the Triennial with other members

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From the Editor's Desk

Dear Readers,

As I take over as the Editor of the IWSA Newsletter (2023-2025), I send you my warmest greetings of the season! With this new responsibility I hope I can carry forward the legacy up to your satisfaction, and live up to your expectations!

It is my privilege to be the editor during the closing of the Golden Jubilee celebrations of IWSA, so that as per our Golden jubilee motto, I can “look back” over the last half a century of the amazing work @ IWSA, “to move forward” into the next decade, with the passion and dedication of our veterans, with newer ideas relevant to the changing times, and with higher goals to aspire for. Keeping this in mind, we would attempt to make every issue of the Newsletter a source of knowledge and inspiration to our readers to dream big and aim high!

The grand finale of the Golden Jubilee Celebrations, the XV Triennial & III International Conference of IWSA titled ‘Women in Science & Technology - Soaring in the Wings of Change’ was organized at IWSA HQ, Vashi, from 11th to 13th June 2023. The conference comprised of 10 sessions, with 33 lectures by reputed women scientists and technologists, covering a wide range of areas in Basic Sciences, Mathematics, Technology, Health and Entrepreneurship. The two poster sessions, showcased nearly 70 posters. Approximately 200 delegates enrolled for this Conference.

The keynote address was delivered by Dr. N. Kalaiselvi, Director General, CSIR, and Dr. Bakhtaver Mahajan, Secretary, Board of Trustees, IWSA, presented a beautiful review of the 50 years of IWSA gone by. Two seminal books ‘*The Fifty-Year saga of the Indian Women Scientists’ Association*’ and ‘*Millets for Children: Rhymes, Recipes and Resources for All Ages*’ were launched, and a 30-minute film on IWSA was released by Dr. Sudha Padhye, during the inaugural session. The brief summary of the Conference proceedings presented in this issue, would give a glimpse of all that transpired.

IWSA HQ, Vashi, also conducted 2 BRNS lectures for colleges, 2 for schools and 1 Vigyan Prasar Hands-on activity for school children. The Nursery and School education committee, The Day Care and Hostel committee, Computer Science Centre and the Library held various activities with full enthusiasm. Our Branches at Delhi, Kalpakkam, Kolhapur, Nagpur and Roorkee have contributed a fair share to IWSA activities.

To commemorate the spectacular landing of Chandrayan 3 on the moon, on August 23rd, 2023, a wonderful article summarizing the various *ISRO Missions of Chandrayaan*, has been compiled by Dr Radhika Ramachandran, Former Director, Space Physics Laboratory, Vikram Sarabhai Space centre, and presented in this issue. The women power behind all the Chandrayaan missions has been beautifully highlighted by Dr Radhika Ramachandran and Dr Susan Eapen. Kudos to all these women achievers!!

We end the report of this quarter with an obituary to Dr Mangala Narlikar, one of the most inspiring women mathematicians of India. She passed away on 17th July 2023.

We hope to keep our readers engaged for hours with this issue of the Newsletter!

Sheela Donde (drdonde@gmail.com)

President's Message



Dear IWSA Members,

We witnessed several important events during the period of report of this Newsletter. The crowning glory of IWSA's Golden Jubilee Celebration was the XV Triennial & III International Conference of IWSA titled 'Women in Science & Technology - Soaring in the Wings of Change' organized at IWSA headquarters, Vashi, from 11th to 13th June 2023. All the invited speakers of this conference were women who have risen to the highest levels in various fields of Science and Technology. It was a unique conference showcasing women of excellence in STEAM and how multidisciplinary sciences converge on a common vision for dissemination of knowledge. We were proud to have Dr. N. Kalaiselvi, the First Woman Director General of CSIR Laboratories as the Keynote speaker. She outlined the efforts and policies of the government to support and encourage women scientists to excel and grow in their professional careers. We witnessed three important events during the Inauguration of the Conference: (i) Release of the book entitled 'The Fifty-Year saga of the Indian Women Scientists' Association' describing the journey of IWSA over the five decades through interesting narrations and photographs, (ii) Release of the 30 minute film on IWSA activities by Dr. Sudha Padhye, our Founder Member and (iii) Release of the book entitled 'Millets for Children: Rhymes, Recipes and Resources for All Ages' describing the various millets and their nutritive values. While the first two events were significant as celebration of Golden Jubilee of IWSA, the third event was a tribute to the International Year of Millets. A special session was devoted for felicitation of IWSA member achievers, both from headquarters and branches in recognition of their exemplary careers, their immense contribution to the growth of IWSA and those who have marked their presence by being leaders and role models in diverse areas.

Another important event during the reporting period of this Newsletter is the successful soft landing of Vikram of Chandrayaan -3 on the lunar surface on 23rd August 2023. A comprehensive article summarizing the various *ISRO Missions of Chandrayaan* appears in this issue along with highlights of the achievements of Women Scientists of ISRO and their contributions to the Chandrayaan missions.

We, at IWSA, have successfully completed 50 years of service for the society, aiming to impart scientific temper for a meaningful life as a responsible citizen. Now we look forward to soaring high to fulfil our mandate for nurturing science and invoking scientific thinking amongst all strata of the society with deep regards to our visionary founders and confidence in our future flag bearers.

Shyamala Bharadwaj
shyamala.bharadwaj@gmail.com

Reports from Head Quarters

Science Awareness Programs

A. IWSA – BRNS Popular Science Lectures for Colleges

These lectures were conducted onsite at various Colleges on the topics of interest to the College. The speakers were identified by IWSA. Students from various classes-FY BSc-to-MSc, attended the lectures along with faculty. For each of the lectures the audience was informed about IWSA and the college. The lectures were followed by discussions with the speaker.

1. Date: 7th July, 2023

Topic: **Advances in Millet Genomics for Food and Nutritional Security**

Speaker: **Dr. Manoj Prasad**, Prof. and J.C. Bose National Fellow, National Institute of Plant Genome Research (NIPGR), New Delhi

Venue: **Dept. of Biosciences and Botany, Union Christian College, Aluva, Kerala**

Abstract: Human population is racing towards 10 billion by the year 2050 and ensuring the basic needs of the growing population is going to be a challenging task. Climate change, decrease in total arable land, and reduction in yields due to biotic and abiotic factors pose a significant threat to agriculture. The drastic difference in the population and the crops that are being consumed, there is an immediate requirement to mainstream the crops that are less popular and remains underutilized. One such potential but neglected and underutilized crop species are the millets, particularly, small millets. These minor millets are marginally cultivated but have the potential to withstand minimal irrigation, climate stress, insect-pest attack, diseases, etc. Foxtail millet (*Setaria italica*) was once a neglected species; however, the release of the genome sequence information has enabled several studies, including: (i) development of large-scale genome-wide molecular markers; (ii) high-throughput genotyping and genome-wide association studies for major traits; (iii) characterization of genes and gene families; and (iv) construction of comprehensive databases for open access into the genetic and genomic resources developed so far. This has accentuated the crop as a species with rich genetic and genomic resources, and also, the research on this crop has paved a roadmap for executing similar studies in other minor millet species. In this context, the talk will give an overview of tools and approaches used in millet genomics research and their application in generating climate-resilient major cereal crops. High temperature-induced crop failures are prominent nowadays in major staples, including rice, wheat, and maize; however, crops such as foxtail millet (*Setaria italica*) are resilient to temperature stress. We have identified a total of 113 heat shock protein (HSP) encoding genes in foxtail millet and a novel sHSP of foxtail millet, SisHSP27 was characterized for its role in conferring tolerance to high-temperature stress. SisHSP27 is a panicoid-specific gene, which is highly upregulated during high-temperature in leaves, and the protein is localized in the chloroplast. Its expression is directly regulated by heat shock factor, SiHSA2e, during temperature stress. Further, overexpression of SiHSP27 in rice enhanced the survival of transgenics during high-temperature stress (>80% survival frequency), and the transgenic lines showed improved plant architecture and overall grain yield. Compared to WT plants, transgenic lines maintained optimal photosynthesis rates with higher photosystem efficiencies at high temperatures, and this is conferred through protecting the components of photosystems, chlorophyll-binding proteins, and chloroplast-localized functional proteins by SisHSP27. Prolonged high-temperature stress showed minimal damage to chloroplast proteins resulting in comparatively lower yield loss (35-37%) in transgenic lines. Altogether, the study suggests that SisHSP27 is a potential candidate for designing thermotolerant crops for climate-resilient agriculture.

Outreach: 135

2. **Date: 1st August, 2023**

Topic: Nanotechnology - From Fundamentals to Applications

Speaker: Prof. **Deepa Khushalani**, FRSC Professor in Materials Chemistry
Department of Chemical Sciences, Tata Institute of Fundamental Research (TIFR),
Mumbai

Venue: **SVKM'S Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce and Economics (AUTONOMOUS)**, Vile Parle (West),
Mumbai

Abstract: Nanoscience involves the synthesis and the study of properties of structures which are on a size of 1-100 nm. Over the last few decades, this area of research has become overwhelming and it is important to understand the chemical and physical fundamental aspects that make nanomaterials truly unique. In this talk, I will try and convey some crucial aspects of nanomaterials, starting from (a) what are the basics of the science involved that make these structures so interesting, (b) how to synthesize/fabricate them while maintaining homogeneity and mono dispersity, (c) popular methods of characterising these structures and some common mistakes that are found in literature regarding such small materials. Moreover, I will also showcase the manner in which these materials can be utilized in advanced applications and as such what is making them so ubiquitous in our daily lives.

Outreach: 123

B. IWSA – BRNS Popular Science Lectures for Schools

These lectures were conducted onsite at various schools on the topics of interest as advised by the principal. The speakers were identified by IWSA. Students from classes-8th Std to 12th Std attended the lectures.

1. **Date: 5th August, 2023**

Topic: Play and Learn the Periodic Table

Speaker: **Mr. Nikhilesh Iyer**, Scientific Officer, BARC.

Venue: New Horizon Public School, Panvel

Abstract: Periodic Table of elements can be seen as the most amazing jigsaw puzzle solved by humans. It deserves its own rituals of celebration and spread of joy of knowing the building blocks that make each and every one of us know about all that we see, touch, smell, hear or taste. Play and learn pedagogy is developed precisely to spread the joy of learning chemistry! First a brief backflash was given to understand the physical basis and a historical visit to pay respect to those involved in its creation. The session then proceeded to play card games to learn the atomic number, name, valency and all the fundamental rules of how the electronic configuration of the first 36 elements are organized in a layered onion like structure. After that the discussion was on how the elements were arranged in a 2D grid of periods and groups, and why the outermost shell electron arrangement was very important. All this information gave a basic understanding of the Periodic Table. The students thoroughly enjoyed learning periodic table by playing.

Outreach: 87

2. Date: **12th August, 2023**

Topic: **Space Missions: Unveiling the secrets of the universe**

Speaker: **Ms. Sampada Gaonkar.**

Venue: **Modern School and Junior College, Vashi**

Abstract: Throughout history, human curiosity has been the driving force behind various explorations. The desire to discover the unknown, to unravel mysteries, and to push the boundaries of knowledge has led mankind on remarkable journeys. One of the most compelling frontiers has always been space- the vast expanse that houses countless celestial bodies, including the mesmerizing twinkling stars in the dark night sky. The latter half of the twentieth century witnessed remarkable developments in technology, particularly in space exploration. These advancements led to the creation of spacecrafts capable of undertaking special space voyages, which paved the way for significant achievements in our understanding of the cosmos and proved as a benefit for humanity. The talk highlighted some of these significant achievements and future endeavours of space missions.

Outreach: 123

C. IWSA – BRNS “Science and Our Life” (SAOL) Series of Webinars

The following webinar was conducted online through Zoom platform during May to August 2023 under “Science and Our Life” Series.

36th SAOL talk

Date: **12th August, 2023**

Topic: **DNA: The Sensible Molecule that has impacted life**

Speaker: **Prof. Jacinta S. D’Souza** FRSB, FMASc, UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, Mumbai

Abstract: Living organisms and we humans are made up of cells that contain deoxyribonucleic acid (DNA), a polymer made up of units of four different nucleotides arranged in specific sequences characteristic of genes that govern inheritance. The discovery of the structure of DNA has led to the rapidly evolving understanding of the flow of information from genes through RNA to proteins. With this discovery, several scientists worked on varying aspects of this macromolecule, especially to understand how these building blocks of life make us what we are! Sequencing of genomes and their mapping has made DNA the most important molecule leading to applications in several fields including Medicine and Agriculture. The journey of discovery of DNA to its important applications using tools in molecular biology was discussed.

Outreach- 24

D. IWSA – Student Internship Program

Duration: 12th May - 12th June 2023

Name of student: DIYA SINHA

Affiliation: Sarla Anil Modi School of Economics, NMIMS University, Mumbai

Title: "Socio-economic importance of urban gardens and their management"

Mentors: Dr Rita Mukhopadhyaya, Ms. Vijaya Chakravarty, Ms. Sukhwinder Sandhu and Dr Paramjit Anthappan

Abstract

The internship project was aimed at highlighting the accomplishments of the garden initiative at the Indian Women Scientists' Association. The study focused on the types of the plants that are nurtured in the garden. Gardens have been associated with therapy and educational value, this combined with the current state of the environment, wherein gardens have been gaining attention and importance today. Using reviews of literature, the study amalgamated the existing information about gardens and urban gardens, incorporated with expert views. The review singled out the advantages and necessity of gardens in today's day as well as the various benefits that plants or green spaces bring to the table. The objectives of the study undertaken included [1] Analysis of impact of gardens on the public through the conduction of a survey, [2] Comparison of IWSA's Learning Garden Living Museum with other garden initiatives in Navi Mumbai as well as New Jersey, [3] Drafting a proposal for potential investors with a finance quote to support enhanced management of a few of IWSA's garden initiatives.

A research paper report entitled 'An economic account of the Learning Garden Living Museum at IWSA', was submitted for the Information KIOSK, @ IWSA during Triennial, 2023

E. Activities in Collaboration with Vigyan Prasar

VIPNET Science Club

Following is the activity of the VIPNET Science Club (VP-MH 0248), held online, on the google meet platform during the period May to August 2023 which was for the benefit of VIPNET members from Maharashtra (Students and Teachers) and IWSA Members:

ACTIVITY 15

Date: 25th August, 2023

Topic: Learn Science: Making Toys from Trash

Speaker: Mr. Shivaji Mane, a tinkerer

The monthly activity of the IWSA- VIPNET Science Club (VP MH 0248) was restarted after a long gap. It was held to promote scientific learning, for the VIPNET club members. Mr. Mane demonstrated how variation of length of air columns could produce sounds of different pitches using simple paper straws. He further demonstrated how a simple wine glass could be used to produce sound by wetting its rim.

Mr. Mane showed several toys constructed using simple Neodymium magnets, 35gauge copper wire of 1000 turns, LED bulbs and cardboard boxes, CDs, PVC pipes and other such waste materials. He showed mechanical pulleys, simple electromagnets, rotors, generators many such DIY scientific demonstrative models. Children tried to make a paper helicopter shown by him at the end of the program.

Outreach: 30

F. Garden-Based Learning (GBL) Activities

1. Talk on Biodiversity. Vijaya Chakravarty delivered a lecture on Biodiversity to 50 Students and 6 faculty members of Rajiv Gandhi college, Vashi on 30th June 2023. It was an interactive session of two hours. Services rendered by biodiversity, types of biodiversity, in- situ / ex- situ conservation and eco-restoration were discussed.

Community Programs

A. Indirabai Padhye Nursery School and Education Committee

The new batch of ECCE (Early Childhood Care and Education), consisting of 27 girls, commenced in June 2023. Besides Theory Classes, Practical Sessions were conducted for the trainees. Trainees attended many workshops such as Workshop on Fun with crayons (19th and 20th July), A to Z of ECE online workshop by Dr Swati Papat Vats, President, Early childhood Association, Podar Education Network, Workshop on Making Teaching Aids & Puppets (8th to 11th August), Workshop on “Executive functions and types of cognition” at Prangan, Matunga, for ECCE trainees (18th August). A lecture on breast feeding was delivered on 7th August by Dr Suparna Patil, Principal, School of Nursing – Women’s India Trust and Art Therapy sessions were conducted by Shirin Chimthanawala on 14th and 16th August.

Twelve admissions were received for the Nursery school for the new academic year, starting from 15th June 2023, with timings from 10 am to 12 noon. Independence Day Activity for Nursery children was conducted on 15th August and Onam and Raksha bandhan were celebrated on 29th August.

B. IWSA’s Day Care and JMM Working Women’s Hostel

Independence Day was celebrated in the hostel premises on the 15th August 2023 with flag hoisting at 9 am followed by a meeting with hostel inmates at 10.30 am. Raksha bandhan was also celebrated.

Repair and renovation work was taken up in the hostel during this time.

The Hostel Girls and Day Care Children celebrated the Independence Day by showcasing their talents in singing, dancing and elocution.

The play area of Day Care Children was decorated by painting done by the ITM internship students.

C. IWSA's Satish Haware Computer Education Centre

Courses: Basic Tally course of duration of 15 days was conducted in May 2023 and MHCET examination was conducted in August 2023.

Digitization of Records: IWSA's Life Membership forms were digitized so that the record of all members is kept at one place in the digitized format and a database of IWSA members is created so that it can be used for future communications.

D. IWSA's Piroshja Godrej Foundation Library

1. In May, 2023, three new CCTV cameras were received and successfully installed along with monitor screen and cable under the support grant scheme from state government. This will enable monitoring areas of library, tree library, computerisation area in CEC and entrance passage to these.
2. National Librarian's Day was celebrated on 19th August, 2023 with an invited talk on Padmashri S. R. Ranganathan by Shri Prashant Patil, District Library Officer, Thane. He also mentioned challenges faced by libraries and librarians today. All the book editors of our Triennial book releases and our library staff were felicitated on that day, including an avid reader of library books, Mrs Rajani Apte. The Golden Jubilee Year Celebrations of the library were also announced on the same day.

E. Green Initiatives

Dry leaves composting: Process for composting 50 kg litter was initiated in June 2023. Mobile compost pit has been put up near the existing biogas plant. One cycle of 45 days is completed and the compost is ready awaiting its use after the monsoon. Gardeners have been trained to follow up the process. Current generation of kitchen waste (10 -12kg per day) can be composted too.

Other Activities

XV TRIENNIAL & III INTERNATIONAL CONFERENCE:

WOMEN IN SCIENCE AND TECHNOLOGY- SOARING IN THE WINGS OF CHANGE

Twelve women scientists, representing a wide spectrum of scientific disciplines and associated with different scientific institutions in Mumbai, came together in 1972 and registered Indian Women Scientists' Association (IWSA) on 13th June, 1973 under the Society Registration Act and later on 19th July, 1973 under the Public Trust Act. Thus, IWSA completed fifty years of dedicated service to Science and Society on the 13th of June 2023. All these fifty years, IWSA, now with 11 branches and close to 2200 members, has upheld the conviction and zest of these twelve visionaries to convey the ethos of science and technology to society at large, especially for the upliftment of women and the underprivileged class of society.

As the grand finale of the year-long Golden Jubilee Celebrations (GJC), the XV Triennial & III International Conference of IWSA titled 'Women in Science & Technology - Soaring in the Wings of Change' was organized on hybrid platform at IWSA's ICICI Multipurpose Hall in Vashi, Navi Mumbai from 11th to 13th June 2023. (The GJC started from 13th June 2022, when IWSA ushered the Golden Jubilee year by organizing an international conference with the theme- "One Earth- One Family, Rebalance Energy to Sustain"- see IWSA NL May to August 2022 issue for details.) This Triennial was truly a unique conference showcasing women of excellence in STEAM and how multidisciplinary sciences converge on a common vision for dissemination of knowledge. There were close to 200 participants including members and other mid-level scientists and students. The conference comprised of ten sessions, with thirty-three lectures by reputed women scientists and technologists. A wide range of areas in Basic Sciences, Mathematics, Technology and Health sciences as well as a session on entrepreneurs and innovators were included. Invited lectures covered some of the topics in the frontier areas of Science and Technology such as- Elementary particles, Click chemistry, Genome editing, Nanotechnology, Accelerators, Space technology, Environmental science & Climate change. There were two poster sessions for young and active researchers in which about seventy posters were presented, onsite and online. It was heartening and inspiring to have one of the 12 founders Dr Sudha Padhye, who has completed 91 years, grace the occasion in person. The energetic participation of other senior life members, especially Ms Kumudini Balakrishnan, Drs. Mehtab Bamji, Niyati Bhattacharyya, Sunita Mahajan, Sudha Rao, Devaki Ramanathan, who are in their eighties, was equally inspiring. IWSA was fortunate to receive congratulatory messages and best wishes from our Prime Minister, Mr. Narendra Modi, Minister of Women and Child Development, Ms. Smriti Zubin Irani and Principal Scientific Advisor to Government of India, Mr. Ajay Sood, on this important occasion.

The conference began on 11th June with the befitting keynote speaker, Dr. N. Kalaiselvi, Director General, CSIR Laboratories and Secretary DSR. She outlined the efforts and policies of the government to support and encourage women scientists to excel and grow in their professional career ladders. Dr. Bakhtaver Mahajan, Secretary, Board of Trustees, IWSA, presented a glimpse of IWSA @ 50, remembering each milestone during this journey and the members who made them possible. Two seminal books and a film on IWSA were released during the inaugural session. The book entitled 'The Fifty-Year saga of the Indian Women Scientists' Association' describing the journey of IWSA over the five decades through interesting narrations and photographs, was released by Dr Pheroza Godrej, Chairperson, Godrej Archives Council & Advisor, Godrej Mangroves. She applauded the efforts of IWSA in spreading science to the societal level, especially in fostering young students in science and assured support from the Godrej Foundation in future. The second book entitled 'Millets for Children: Rhymes, Recipes and Resources for All Ages' describing the various millets and their nutritive values through play way was released by Ms. Mini Ipe, MD, LIC of India. She congratulated IWSA for publishing this book as a tribute to the international year of millets. The 30-minute film on IWSA activities was released by clicking the link button by Dr Sudha Padhye and later felicitating the film maker Mr. Sourav Datta.

First session was on Basic Sciences, chaired by Prof. Meera Venkatesh, Former Director, Division of Physical & Chemical Sciences, IAEA, Vienna, Austria. Prof. Archana Sharma from CERN, Switzerland, in her talk titled "Blue Sky Research, Corona Virus and Why Should I Care?", emphasized the importance of basic research or curiosity driven research in high end physics laboratories like CERN, which ultimately has transformed mainstream life, be it world

wide web (www), medical imaging, diagnostic and treatment techniques, high-performance computing, or fighting Covid, - to name a few. Some of the recent Nobel Prize winning discoveries were covered in this session, namely CRISPR technology in genome editing by Dr. Chitra Seetharam Misra from Bhabha Atomic Research Centre (BARC) and Click Chemistry by Prof. Nandita Madhavan, IIT Bombay. Prof. Neena Gupta from Indian Statistical Institute talked on “Genesis and some very early results of Polynomials”. Thus, this session covered the four most important pillars of Basic research in science, namely Physics, Biology, Chemistry and Mathematics.

The second session on Mathematical sciences was chaired by Prof. Mythily Ramaswamy, NASI Senior Scientist, ICTS-TIFR. Prof. Aditi Sen De, Harish Chandra Research Institute, Prayagraj (Allahabad), talked about Technologies in the Quantum World, where she covered principles of quantum computers and quantum entanglement, which is key to quantum communication, quantum cryptography etc. The third and last session on the first day was on Health Sciences, chaired by Dr. Priya Abraham, Senior Professor from Christian Medical College, Vellore. Dr. Manjula Reddy from CSIR-Centre for Cellular & Molecular Biology, Hyderabad talked on “Break to make: Dynamics of the bacterial cell wall”. She elaborated on her studies on bacterial cell wall biology, which helps to better understand the fundamental cellular processes, as well as to identify novel therapeutic targets. “Learnings from Outbreaks of Viral Infections in the 21st Century“, which included Nipah virus outbreak, H5N1 avian influenza outbreaks from China, Middle East Respiratory Syndrome (MERS), zika virus outbreak and many more up to covid 19, were discussed by Dr Nivedita Gupta of ICMR, New Delhi. She informed how India has scaled up laboratory diagnostic capacity for early detection of such outbreaks and how our COVID-19 pandemic experience can be leveraged to create a responsive and solution oriented public health system in India. Dr Michelle Gomes from Knight Cancer Institute, Oregon Health and Sciences University, USA talked on “mRNA Vaccines and Applications in Healthcare. The science and technologies behind mRNA vaccines, their development, advantages and the potential of mRNA platform to contribute to public health by protecting against diseases like TB, malaria, and HIV and to treat diseases like cancer and genetic disorders.

The first session on the second day was on Technological contributions of Women, where Ms. Keerti Rane, Director Level Principal Lead Program Manager, Microsoft, Seattle, USA, talked on the Challenges faced by Women in the Software Industry and D. K. Umasankari, Head, Reactor Physics Design Division, BARC, talked on Women in Nuclear Energy. Dr Radha Bahukutumbi from Laboratory for Laser Energetics, University of Rochester, USA talked on the Prospects for Fusion Energy through Inertial Confinement. This session was chaired by Dr.Sulabha Kulkarni, INSA Senior Scientist from CMET, Pune. Next session was on Environmental Sciences and Climate Change, chaired by Dr Anuradda Ganesh, Chief Technical Advisor of Cummins India Pvt Limited. There were 3 talks, Prof. Gawsia Wahidunnessa Chowdhury from University of Dhaka, Bangladesh talked on Plastic Pollution in River and Ocean and her vast experience in Community Based Gender Equitable Solution to this problem. Dr Lee Kheng Heng, Section Head, Soil and Water Management & Crop Nutrition Subprogram, IAEA, Vienna, Austria spoke on Nuclear and related techniques for climate smart land & water management. Prof. Deepa Khushalani from TIFR, Mumbai talked on Climate Change & Environmental Science: Indian Scenario – and analysed How Bright our Future is.

The 6th session on Entrepreneurship and Innovations was chaired by Dr. K. Rajeshwari, Founder and Managing Director, Bioklone Biotech Private Limited, Chennai. It was very interesting to listen to three women entrepreneurs, Ms. Saloni Godbole Tewari, Co-founder &

CEO, Occamy Biosciences Pvt. Ltd, Ms. Nidhi Pant Co-Founder, Science for Society, S4S Technologies, Dr. Kirti Poonia, Cofounder Relove, all from Mumbai. The respective topics were “Entrepreneurship in the context of science and Women Soaring High on the Wings of Change”, “Technological solutions to address Poverty, Gender Inequality, and Post Harvest losses in rural women farmers” and “Circular Economy and Sustainability in Fashion Clothing”. The last session of the day was on Space Technology, chaired by Ms. B. P. Dakshayani, Former Director, Flight Dynamics, and Space Navigation Group, ISRO Satellite Centre, Bengaluru. Dr Hashima Hasan, NASA Program Scientist for NuSTAR, the Keck Observatory & ADCAR, Deputy Program Scientist, James Webb Space Telescope, NASA HQ, Washington DC, USA talked on Unlocking the Secrets of the Early Universe with James Webb Space Telescope and Dr Deepti Deobagkar, Former ISRO Chair Professor, ISRO Space Technology Cell, Savitribai Phule Pune University, Pune, talked on Societal Applications of Space Technology. Dr Ritu Karidhal, Group Director of Mission Planning and Operations Group, ISRO presented her “Challenges and experiences of Working in Mars Orbiter Mission”.

The third day started with a session on Nuclear Science and Technologies, chaired by Dr. Sunita Mahajan, former BARC scientist and member of Board of Trustees, IWSA. Dr. Kitheri Joseph, Associate Director, Metal Fuel Reprocessing Group IGCAR, Kalpakkam talked on A brief perspective of Metal fuel, pyroprocessing and waste management and Dr. Sehila Gonzalez de Vincente, Global Director, Fusión Programme, Clean Air Task Force, Boston, USA, on Nuclear Fusion as an attractive zero carbon source of energy. This was followed by a special session for felicitation of IWSA member achievers, a great moment to appreciate and honour our distinguished members, who have marked their presence by being leaders and role models in diverse areas. Dr. Sudha Padhye and Dr. Lalit Narurkar were felicitated in gratitude for being with IWSA as role model founder members. Dr. Mahtab Bamji, D. Niyati Bhattacharyya, Dr. Anuradha Gadkari and Dr Usha Thakare were also felicitated in gratitude as senior members who immensely contributed to IWSA activities. Sixteen IWSA members from headquarters and branches were felicitated in recognition of their exemplary careers. First conveners of the branches till 2000 were also felicitated during this occasion.

The poster presentation sessions were in the afternoon on 11th, 12th and forenoon on 13th June, 2023. These sessions provided an opportunity to several young women scientists to showcase their work, interact in person with subject experts and meet role models. A total of 63 abstracts were received, out of which 49 abstracts were from the fields of Biological Sciences, and 14 abstracts were from the fields of the Physical Sciences. Of these, 48 posters were presented on site and 12 online. Five posters were adjudged as best based on several criteria set by the judges, four from Biological Sciences and one from Physical sciences. The winners were Ms. Komal Patel from Department of Biosciences & Bioengineering, IIT Bombay, Powai, Mumbai, (Design and development of functional amyloid-based hydrogels as a versatile drug-delivery depot), Ms. Neha Deora from Centre for Bio-Separation Technology, Vellore Institute of Technology, Vellore, Tamil Nadu (Aloe vera (L.) Burm. f. extract ameliorates diabetic and obesogenic milieu in WNIN/GR- Ob rats through therestoration of β -cell function and lipid metabolism), Anjulal from Department of Biotechnology, Savitribai Phule Pune University, (Biodegradation of polyhydroxybutyrate based bioplastic by an indigenous tropical marine *Actinomycete*), Dr. Arsha V. R. (Arshakochuvilayil) from Achutha Menon Centre for Health Science Studies, Thiruvananthapuram, Kerala (Caregiver Burden, Quality of life and Depression: A comparison between older and younger caregivers of primary palliative care patients in Kerala), and B. Sasi from Non- Destructive Evaluation Division, Indira Gandhi Centre for Atomic Research, Kalpakkam, Tamil Nadu (Development of Eddy current sensors for quality

control of nuclear components). These awardees presented their work in session 10, which was chaired by Dr. Devaki Ramanathan, Member, Board of Trustees, IWSA.

The valedictory session was chaired by Dr. Shyamala Bharadwaj, Vice President, IWSA. Ms. Marja Einig, Deputy Consul General, Consulate of the Federal Republic of Germany in Mumbai gave a message to “Scientists of Tomorrow”. Valedictory address was delivered by Dr. Archana Sharma, Director, Beam Technology Development Group, BARC and Professor, HBNI, Mumbai on various BARC Technology Solutions for Sustainable Development. Feedback and Concluding Remarks were given by Dr. Surekha Zingde, Member, Board of Trustees, IWSA and Dr. Sudha Rao, Treasurer, Board of Trustees, IWSA.

The three days conference was an awesome exposure to the wonderful achievements made by women scientists and entrepreneurs in the all the fields of science and technology, from basic science to rocket science, addressing the most pressing problems of climate change, futuristic energy technology including nuclear fusion, healthcare etc., unveiling the mysteries of bacterial cell wall as well as the vast universe. There were discussions on mitigating challenges faced by women in software industry, which applies to other fields as well. Shift in outlooks, flexible timing, work from home alternatives, restarting after breaks in career due to motherhood etc. were also discussed.

In addition to the inspiring treat of scientific achievements, there were multi state gastronomic treat served to soothe body and mind on all three days. The evening cultural programs subtly highlighted the need to have a holistic approach in life. Young students of Smt Gayatri Subramanian of Guru G.V. Ramani Natya Kala Foundation performed ‘Draupadi’. On the eve of 50th birthday of IWSA thirty-seven models (members and supportive staff of IWSA) walked as famous Indian women scientists of the 19th, 20th & 21st centuries for the show titled ‘Heritage Textiles: Look back to move forward’. Conceptualized by Dr. Rita Mukhopadhyaya, President, IWSA, this unique show was put together by young talents from SNDT University, Juhu and ITM, Kharghar, under the guidance of Dr. Hemalatha Jain, Founder, Punarjeevana Trust, and a participant in the conference.

The onward journey and growth of the association was marked by planting a sapling of *Sterculia striata* (Pagal patta), a symbol of unity in diversity like the essence of members of IWSA.

Reports from Branches

Delhi Branch

Date: 22nd May 2023

Event: Half day camp on “Mental Health and Well Being

Speaker: Dr. Amit Madan, Research Officer, CARI

This event was held at the Vivekananda Hall in association with CSIR-NIScPR, with the help of Central Ayurveda Research Institute (CARI). A health check-up session was also conducted after the mental health programme. The camp was attended by about 150 participants.

Kalpakkam Branch

1. Date: 29th May, 2023

Event: Technical Talk on “My journey as an analytical chemist in IGCAR

Speaker: D. S. Vijayalakshmi, Head, Analytical Chemistry & Spectroscopy Division, Fuel & Materials Group, IGCAR

The talk was organized at the Conference Hall, HASD, SQRM Group, IGCAR. Dr. S Vijayalakshmi talked about various techniques used in analytical chemistry for detection, quantification and separation of different elements at different scales of concentrations at nuclear installations. She also shared her challenges faced and experiences while working on various techniques in her service. During an interactive session, she cleared lot of doubts and queries posed by members and colleagues.

IWSA-K gave a warm farewell to Dr. S. Vijayalakshmi and Smt. Sumangala R Krishnan, Supdt. Air cleaning service, INRPK, NRB, BARC. Many members shared the memories of their interactions with them and wished them a happy and healthy retired life. IWSA (K), as a token of love and affection, presented a memento to both of them.

2. Date: 27th June, 2023

Event: Technical Talk on “Studies on Corrosion Control of Structural Materials in Nuclear Reactors & Ion Exchange Materials

Speaker: Dr. Padma S. Kumar, Water Chemistry Division, BARCF

This event was organised by IWSA, Kalpakkam branch at NDED Auditorium, MMG, IGCAR. The program started with a welcome address by Smt. K. Shivakamy, Treasurer, IWSA (K), Kalpakkam. Dr. Veena Subramanian introduced the speaker. Dr. Padma S. Kumar talked about various techniques and developmental procedures employed to understand corrosion resistance behaviour of various structural materials used at nuclear installations. She also explained the salient results from these studies. During an interactive session, she cleared many queries posed by members and colleagues. After the talk, IWSA gave warm felicitation to Dr. Padma S. Kumar, life member of IWSA, who is superannuating in the month of June, 2023. Members appreciated her dedicated tireless social activities and shared the memories of their interactions with her and wished her a peaceful retired life. As a token of love and gratitude, IWSA (K) presented a memento.

3. Date: 19.07.2023

Event: Technical talk on “An overview of developmental procedures towards radiation protection

Speaker: Mrs. Letha Sebastian, HP, NRB, BARCF(K),

This lecture was organized in the Lecture Hall, WIP, BARCF(K). Mrs. Letha Sebastian talked about the importance and necessity on the stringent measures followed for radiation protection. She detailed the various devices developed for meeting the required sensitivity in radiation monitoring. The interactive session had lot of discussions and she cleared many doubts posed by colleagues. Mrs. Letha Sebastian, who is superannuating in the month of July, 2023 is an IWSA life member, and was felicitated after her talk Members shared the

memories of their interaction with Mrs. Letha Sebastian and wished a wonderful retirement filled with good health, relaxation and happiness. As a token of love and gratitude, IWSA (K) presented a memento to her.

Kolhapur Branch

1. Date: **15th and 16th July 2023**

Event: **National workshop on Yamadori, Suiseki and Bonsai**

Venue: **Vengurla, Sindhudurg, Maharashtra**

A national workshop was organized by Kolhapur Bonsai Club (KBC) in association with IWSA Kolhapur, South Asia Bonsai Federation (SABF) and Gardens Club Kolhapur. The theme of the Workshop was "Let's redefine Yamadori for Restoration of plants".

Inauguration of the Workshop and Exhibition started in grand way in the presence of many dignitaries. Mrs. Shantadevi Patil inaugurated the exhibition in the auspicious presence of Arun Narate, Ex- President, National Dairy Association, Chief Officer, Shri. Paritoish Kankal, Vengurla Nagarparishad, Suniti Deshmukh, President, Kolhapur Bonsai Club, Dr. Rita Mukhopadhyaya, President, Indian Women Scientists' Association (IWSA), Mumbai, Shri. Mr. Ravindra Damaodaran, President SABF, Smt. Kalpana Sawant, President Gardens Club, Kolhapur, Dr. Seema Gaikawad, President, IWSA, Kolhapur. Lightening the lamp and watering the Ficus bonsai was done with background song, "Vriksha Valli amha Soyare", which means Plants and Vines our friends, sung by Yuvaradni. The hall was full with youth, nursery men, bonsai artists, scientists with curiosity to know more about Bonsai, Suiseki and Yamadori. Exhibition of 145 plants arranged by KBC members was spectacular. It was kept open for all. Ravindra Damodaran gave lead presentation to explain the concept of Yamadori. He mentioned that it's was his first passion to start bonsai making 40 years back and he was happy about the initiative taken to re-think about Yamadori in the world of bonsai. Second Session started at with a demonstration by Mrs. Suniti Deshmukh and team on Basics of Bonsai followed by Sachin Bongale's demonstration on Group Plantation with Phyllenthus species. Both sessions were very encouraging for beginners as well as members. Mrs. Suniti Deshmukh's experience of 40 years was very inspiring to all.

After lunch, participants were taken to visit Dutch Vakhar. The outing concluded at the Miracle park. Vengurla has proved the best in Maharashtra for waste management project. Systematic garbage collection, segregation and it's recycling into compost is carried out with scientific guidance to solve the issues of waste management, a global threat. Cultural program, which brought all the participants together, made the evening very colourful. Dashavatar, a local folk drama, folk dances of coastal communities and students along with seniors made the environment lighter to set lovely bonds among all. Indian biodiversity and cultural diversity were reflected beautifully.

Sunday, 16th July 2023, started with Yoga on the beautiful clean beach of Sagarashwar. In spite of the drizzling rains everyone enjoyed Yoga on beach. Local group of Ms. Sakshi Bowalekar guided the participants on exercises for good health. Breakfast of local Ghavan Chatani added to the joyful experience.

The workshop session started with a well-organized talk by Ms. Sujata Bhatt, BCI on Saikai, followed by a demonstration. Successful auction of the master piece gave a good idea to the

youth about the economic potential of bonsai skill development. Mr. Sudhit Jadhav's presentation on Suiseki was a new concept for many participants. Results from a small research work was presented by Ms. Dhanusha Kawalkar, senior biologist, SACON, Coimbatore, which supported the above lecture. She showed a thrilling world of Swiftlet birds' colonies settled at Nivati Island. It was co-related with Suiseki design ideas. Exhibition of geological specimens were arranged to create an interdisciplinary bridge among Bonsai artists, Suiseki makers and Geologists. Each of these specialists can add new ideas to the art of Bonsai. Shri. Rajiv Vaidya, SABF, gave the last demonstration of Suiseki, Rock Style. Type of rocks and soil suitable for Bonsai was very well explained along with his demonstration on rock style.

An exhibition of stones with a slogan, "chala dokyat dagad bharuya", meaning let's fill the rocks in our head for understanding Geology, was thoughtfully arranged. Dr. Abhijit Patil and Dr Yogita Patil, Geology Dept. GKG College, Kolhapur displayed more than 300 stones and explained Geology. The feedback received from the participants were very satisfying and encouraging. It was an attempt to unite academicians, Bonsai masters, Scientists and Government officials to think about Bonsai and involve youth to utilize these green skills for sustainable future development. Together hand in hand we can conserve nature, cultures and serve mother Earth.

2. Date: 27th July 2023

Event: Waste Management

Venue: SKN, Kamalapur Tal. Sangola Dist. Solapur

Indian Women Scientist's Association, Kolhapur Branch in association with Inner Wheel Club of Sangola organized a lecture On "Nature Conservation Through Waste Management", with demonstration on 27th July 2023

Activity members were Dr. Seema Gaikwad, Convener, IWSA Kolhapur Branch, Mrs. Lata Kambale, Dr. Sujata Patil SKN, Kamalapur, and Mrs. Savita Latane, president, Inner Wheel Club of Sangola, Members- IWC

Number of Participants: 127

3. Date: 3 Aug. 2023

Event: Forest Conservation Day celebration

Venue: Dr G. Deshmukh Mahavidyalaya, Sangola

Indian Women Scientists' Association, Kolhapur Branch in association with Marathi Vidyan Parishad, Vibhag Sangola celebrated Forest Conservation Day- 2023, World Nature Conservation Day- 2023 and International Tiger Day- 2023 on 3 Aug. 2023. Dr. Seema Gaikwad, Convener, IWSA Kolhapur Branch, Dr. Rajendra Suryvanshi, and Mr. Tukaram Jadhvar conducted the program.

Number of Participants: 108

4. Date: 21st Aug 2023

Event: Slideshow and Interaction with students on the occasion of Nagpanchami – 2023

Venue: Sangola

Indian Women Scientist's Association, Kolhapur Branch in association with Maharashtra

Andhashraddha Nirmulan Samiti, Branch – Sangola jointly organized Slideshow and Interaction with students on the occasion of Nagpanchami – 2023. Dr. Seema Gaikwad, Convener, IWSA Kolhapur Branch, Dr. Prabhakar Mali, Dr. Rajendra Suryvanshi were the activity coordinators. Number of Participants: 110

5. Date: **22 Aug. 2023**

Event: **Mentoring Camp for Adolescent Girls**

Venue: **Vani Chinchale Pragati Vidyalaya and Vaki Gherdi High School**

The program was conducted by the Indian Women Scientists Association, Kolhapur Division and Sangola Inner Wheel Club of Sangola. Guidance was provided on self-defence and budding and diet for girls of class VIII to X. The main guide for this program was Adv. Rajeshwari Kedar (Chairperson - Bharatiya Stri Shakti Maithrin, Kumbut Salla Kendra Sangola) and Chief Guest was Prof. Dr. Seema Gaikwad (Department of Botany, Dr Ganpatrao Deshmukh College, Sangola, Member of Solapur University General Assembly and Convener of Indian Women Scientists' Association, Kolhapur Division). The schools were selected for the program with the idea of reaching out to the underprivileged students from both urban and rural areas. This camp was organized with the aim of making the girl students aware of hygiene during periods, how to use and dispose sanitary napkins, diet and exercise, emotional changes, self-defence etc. In the camp, Rajeshwari Kedar demonstrated different tricks of self-defense to the girls and gave very good guidance about safety. Dr Seema Gaikwad talked about the importance of diet and exercise by giving various examples. Smt. Ulka Rajkar gave guidance on cleanliness and friendship in a very easy and humorous atmosphere. Innerwheel Club President Ms.Savita Latne, Member Ms. Pallavi Thorat and Ashmi India Trust Member Ms. Ulka Rajkar were present on this occasion. The principals and all teachers worked hard to complete the camp.

Activity members: Dr. Seema Gaikwad, Convener, IWSA Kolhapur Branch, Mrs. Savita Latane, president, Inner Wheel Club of Sangola, Members- IWC, Ms. Ulka Nikam.

Total No. of girl students present - 127

<https://youtu.be/doiqN6QTVpM>

6. Date: **23 Aug. 2023**

Event: **Mentoring Programme for college Girls**

The Indian Women Scientists Association, Kolhapur Division in association with Internal Complaint Committee of Sangola College, Sangola, Bhartiya Stri Shakti, Sangola, jointly organized a program for girls staying in hostel on self-defence and prevention of sexual harassment of girls in college campus.

Activity members: Dr. Seema Gaikwad, Convener, IWSA Kolhapur Branch, Mrs. Rajeshwari Kedar, Dr.Chitra Jambhale

Total No. of girl students present – 117

Nagpur Branch

1.Date: **15/07/23**

Event: **Talk on Yoga - Ancient Concept, it's effective use and misconceptions in the modern era**

Speaker: **Dr. Rakhi Vyaghra**, Yoga Expert and IWSA Life member

Dr. Rakhi Vyaghra, life member and Yoga expert spoke on this topic, as she strongly felt that the deep sense of yoga is not being well understood in the modern times.

She elaborated in her talk about how exactly yoga has been described in our ancient scriptures particularly in Vedas and the Upanishads. Originally conceived as a spiritual practice aimed at attaining enlightenment and self-realization, yoga evolved over time to encompass a holistic approach to wellness, encompassing physical postures (asanas), breath control (pranayama), meditation, and ethical principles (yamas and niyamas). She concluded by saying that, one common misconception is that yoga is merely a form of physical exercise or stretching routine, neglecting its deeper spiritual and philosophical dimensions. While physical postures (asanas) are indeed a fundamental aspect of yoga, they are just one component of a comprehensive system aimed at integrating mind, body, and spirit.

The talk was well received and appreciated by all. A memento was presented to Dr. Rakhi Vyaghra.

No of attendees: 40

2. Date: 15th July 2023
Event: Felicitation of Members
Venue: Nikalas Mahila Mahavidyalaya

Following members were felicitated at the AGBM for their achievements:

Dr. Arti Saoji and Dr. Surekha Kalkar for inclusion of their millet recipes in a booklet published by a National Conference on millets.

Dr. Rita Israni for being nominated as part of the Indian delegation of sixth session of Codex Committee on Spices and Culinary Herbs (CCSCH) held from 26th September 2022 to 3rd October 2022.

Dr. Punita Tiwari for being awarded a patent on A quiz Machine learning-based automated approach integrated with IOT for mushroom farming and classification of toxic mushrooms.

Mrs Prachi Lakhe for her being nominated as member on the board of studies of cosmetic technology of RTM Nagpur University.

No of attendees: 40

3. Date: 19th August 2023
Event: Azadi ka Amrut Mahotsav
Venue: SOHAM, a wholesome living environment for elderly

While celebrating with elderly we hoped to gain wisdom and create joy for all. The program featured short deliberations of selected people from different age groups on the topic "Progress and Development of Science in 75 Years of Independent India". The scientific developments as witnessed by people of different age groups were unfolded through their presentations. Dr. Preeti Katakwar, executive member co-ordinated the program.

Dr. Shilpa Paranjape, Chief Medical officer at CSIR- NEERI spoke about developments in health and medical science during seventy-five years of independence of India. Dr. Pradnya Bhalerao spoke about progress of science during these years of independent India. She expressed her views under the topic "Science Culture" and presented a very comprehensive account of India's scientific progress. Dr Anagha Naseri spoke about medical tourism in India. She gave some excellent statistical data on the topic. Student Ms Anagha Mulmule elaborated on how science in India had made huge strides during 75 years of independence. The inmates

at SOHAM were very receptive to the talks and appreciated the organizers. The program was conducted by life member Dr. Sayali Pande. A quiz was organized for the inmates of SOHAM, winners were given prizes. The program concluded with a vote of thanks to the audience, office bearers of SOHAM and all participants and IWSA members.

No of Attendees:65

Roorkee Branch

1. Date: 22nd May 2023

Event: Talk on “Health & Hygiene”

Speaker: Dr. Mridul Khanduri, Head, Department of orthodontics, Uttaranchal dental and medical research institute, Dehradun,

Venue: BML Munjal Green Meadows School, Haridwar.

Outreach: 300 students

Dr. Mridul Khanduri spoke to two Batches of Students: Batch - 1, 150 students of Class 5 to 8 and Batch – 2, 150 students of Class 9-12.

She spoke on Health and Hygiene and how both are related to each other.

She briefed the students of Batch - 1 about oral hygiene to community hygiene and related it to their daily life. It was a very interactive session and children participated very actively and promised to keep the community clean while maintaining the personal hygiene.

During the talk for the students of Batch - 2, consisting of senior students the topic was discussed along with the behavioural responsibility among boys and girls leading to a healthy mind as well.

Both the sessions were for 1hr 20 min each where the last 30 min was devoted to open discussion with children.

2. BRNS Popular Science Lectures for Schools

Date: 7th August 2023 IWSA –

Title: “How to cope up with hormonal changes – Mothers and Daughters”

Speaker: Dr.Aditi Gupta, MBBS, DGO, Gold medallist, KGMC, Lucknow

Venue: BML Munjal Green Meadows School, Haridwar

Objective: To support teenage girls with their Adolescence state who faced many untold stories and confusions during Menstrual & Menopause. Also, there is need to educate their mothers with this new era.

Abstract:

Adolescence has been recognized as a special period that requires specific attention as it marks the onset of menarche, an important milestone, lots and lots of hormone changes and hence good hygienic practices with psychological support during menstruation are crucial to maintain a healthy life. During this important milestone of life, It is always good to understand “why and how”. It’s a natural process. as How eggs form in the body and after completion a cycle how it releases the roughage. It is very -very important to understand “how we can keep ourselves clean and can maintain hygiene to get better health.

Outreach: 300 (200 Students from class 9th to 12th, and about 100 mothers)

Article

ISRO's MISSION CHANDRAYAAN

The Indian Lunar Exploration Programme

*Article compiled from various ISRO and other resources by **Dr Radhika Ramachandran**, Former Director, Space Physics Laboratory, Vikram Sarabhai Space centre.*

Chandrayaan-1, India's first mission to Moon, was launched successfully on October 22, 2008 from SDSC SHAR, Sriharikota and was operated until August 2009. The spacecraft was orbiting around the Moon at a height of 100 km from the lunar surface for chemical, mineralogical, and photo-geologic mapping of the Moon. The main objective of the orbiter was to map the surface topography, mineral, and elemental distribution, study volatiles, and search for surface and sub-surface water-ice signatures. The mission included an orbiter and an impactor. India launched the spacecraft using a PSLV-XL rocket on 22 October 2008 at 00:52 UTC from Satish Dhawan Space Centre, at Sriharikota, Andhra Pradesh.

The Moon Impact Probe (MIP), which is a piggyback module onboard Chandrayaan-1, was released from the Chandrayaan-1 orbiter to impact the South Polar Region. Despite its short lifespan of just under a year, Chandrayaan-1 emerged as a successful mission with several discoveries.

With the remarkable success of Chandrayaan-1, a more complete follow-up mission was configured. Chandrayaan-2 was designed with an orbiter, lander, and a rover to pursue global lunar mapping and initiate in-situ studies in and around the landing site. The hard landing of the lander prevented us from pursuing in-situ science. However, the Orbiter is still active with its scientific payloads onboard, which are conducting remote sensing observations of the lunar surface, as well as in-situ observations of the lunar exosphere.

Chandrayaan-3 followed, which demonstrated landing and roving on the lunar surface, and it complements Chandrayaan-2 orbiter science with in-situ observations.

The Indian lunar exploration programme identified scientific problems of the in-situ study of surface/ sub-surface Water/water-ice and other volatiles at Poles. These missions prompted direct study of the permanently shadowed and permanently illuminated regions at the higher latitudes and poles of the Moon.

Why are we interested in exploring moon?

Today, scientists have identified the moon as the celestial body that can provide clues on the early solar system and thereby enabling us to understand the evolution of the solar system. Being an airless, non-magnetic celestial body, the Moon is also a natural laboratory that can be used to study the interaction of the solar wind and fields with the planetary surfaces. Since it is at the same Sun-Earth distance, it also provides a good reference for studying the effects of the Sun at 1 AU (Astronomical Unit) distance. To add to these advantages, the moon is also conducive for conducting operations using an orbiter, lander/rover, and even sample return missions. Thus, the Moon provides the scientific community an opportunity to understand the inner solar system; both in terms of its evolution and its present status.

Coming to the aspect of using the Moon as a proxy to understand several aspects of the solar system, we will briefly present an overview of the scientific questions that may be addressed once the Moon is studied extensively.

As Moon is considered the record-keeper of the solar system, it can be used to study of the bombardment history of the inner solar system. The structure and composition of the Moon provide information on the evolution of the differentiated planetary bodies of the solar system. Lunar research also provides insight on the diversity of the lunar crustal rocks. Also, the lunar poles are the witness to the volatile flux over the latter part of the solar system history. Study of the lunar volcanism provides clues on the thermal and compositional evolution of Moon. The study of the craters on the lunar surface offers opportunity to understand the impact processes in planetary scale. Moon also provides opportunities for the study of the regolith processes. Moon is considered as the single celestial body that may offer the scientific community a plethora of valuable information on the origin and evolution of the solar system.

Quite intuitively, these aspects have triggered several missions to explore the Moon. The missions have collectively studied the aspects of atmosphere and ion studies, lunar surface chemistry, chemical mapping, lunar dust analysis, lunar geophysics, meteoroid studies, radiation environment studies, soil mechanics studies, solar wind studies, to name a few.

Chandrayaan Series of Missions

In brief, we will now discuss the Chandrayaan series of missions.

The Chandrayaan-1 mission, which was the first mission of the Indian lunar exploration programme, carried scientific instruments for conducting high resolution remote sensing observations of the Moon. It had a suit of eleven scientific instruments from India, as well as several other space agencies and international institutes. In that sense, Chandrayaan-1 was an elegant example of international cooperation in space exploration. The mission was equipped with hyper-spectral imaging technology in the UV-VIS-NIR region using three imaging spectrometers, which, along with a low energy X-ray spectrometer provided mineralogical and chemical composition of the lunar surface at high spatial resolution. The mission also had a terrain mapping camera that provided high resolution three-dimensional images of the lunar surface. In addition to surface-imaging, Chandrayaan- 1 also carried a laser ranging instrument to provide lunar altimetry information. Three payloads – a high energy X-γ ray spectrometer, a sub-keV atom reflecting analyser, and miniature imaging radar were used for the first time for remote sensing exploration, which were meant to investigate the transport of volatiles on the lunar surface, presence of localized lunar mini-magnetospheres, and possible presence of water ice in the permanently shadowed lunar polar region respectively. A radiation dose monitor was also carried by Chandrayaan-1, which provided valuable information on energetic particle flux enroute to the moon, as well as in the lunar orbit.

Chandrayaan-1 also carried the Moon Impact Probe (MIP), which carried an imaging system, a radar altimeter, and a quadrupole mass spectrometer. MIP was released from the spacecraft to impact near the lunar South Pole. Coming to a few significant discovery class 'of findings from Chandrayaan-1 mission, the most significant was the detection of water-ice on the lunar surface in the poles. This interesting result has come from the Moon Mineralogy Mapper (M3) payload of the Chandrayaan-1 mission. It detected the signature of Hydroxyl radical (OH) through the analysis of the reflected solar spectrum from the lunar surface. The presence of

OH was attributed to the possible presence of water-ice molecules on the lunar surface near the Polar Regions.

Another instrument called Chandra's Altitudinal Composition Explorer (CHACE), which was part of the Moon Impact Probe, detected signatures of water molecules in the lunar exosphere. This was a sensational discovery in lunar science, as it was previously believed that Moon was as dry as a bone. The Chandrayaan-1 mission has changed that perspective. Another significant science result was from the Chandrayaan Energetic Neutral Analyser (CENA) device of the SARA (Sub-keV Atom Reflecting Analyser) instrument onboard Chandrayaan-1. As you are aware, Sun emits stream of charged particles at an average speed of ~400 km/s, which comprises charged particles (ions and electrons). This stream of charged particles is called Solar Wind. The solar wind comprises ~96% protons, ~4% He⁺⁺ (doubly charged Helium ion), <1% heavier ions, and equal number of electrons. The SARA observations have revealed that around 20% of the impinging solar wind protons are scattered back to space as Energetic Neutral hydrogen Atoms (ENAs). These are called backscattered hydrogen ENAs realised with the SARA instrument. It also revealed the dependence of the scattered ENA flux on the solar zenith angle.

Coming to results from the C1XS (pronounced as 'Kicks') experiment on board Chandrayaan-1. The C1XS (Chandrayaan-1 X-ray Spectrometer) instrument is meant to measure absolute and relative abundances of major rock-forming elements in the lunar crust, like Mg, Al, Si, Ca, Ti, and Fe. C1XS measures the X-Ray Fluorescence (XRF) from the lunar rock-forming elements in response to the solar X-ray radiation. XRF signatures of Mg, Al, Si and Ca were clearly seen from the lunar surface. C1XS also revealed the first unambiguous evidence of enhanced Sodium on the lunar surface.

Yet another interesting result from the Chandrayaan-1 was that it revealed that the physics of the lunar wake region (the region of space under the shadow of the Moon) was not as simple as it was thought. Previously, it was believed that the solar wind cannot reach the lunar wake region. The SARA instrument (to be precise, the solar wind monitor device SWIM, which was a part of the SARA instrument) onboard Chandrayaan-1, however, detected significant proton fluxes in the near-wake region of the Moon. Also noticed was the distribution of the Argon-40 gas in the lunar exosphere over the ground trace of the MIP (Moon Impact Probe). Although restricted to a single meridian, that was the first-ever measurement of lunar exospheric Argon-40 over the range of latitudes covering the South Polar Region. The CHACE instrument revealed remarkable science results on the detection of lunar exospheric water vapour signature, distribution of lunar exospheric Neon and molecular Hydrogen; it provided indications on the spatial heterogeneity and indications of inter-hemispherical asymmetry of radiogenic activity in the lunar interior.

As the Moon is devoid of any atmosphere and any intrinsic global magnetic field, it is highly vulnerable to meteoritic impacts, radiations, and energetic particles. A possible human settlement on Moon would look forward to a solution to avoid those hurdles. There are a few regions that show the hope of providing safe shelter for the human explorers on the Moon, such as volcanic lava tubes, which are free from the hostile effects. These may be adequate for human settlement which is an important perspective for long term research and development in outer space. The Terrain Mapping Camera (TMC) onboard Chandrayaan-1 has detected a buried un collapsed, near- horizontal lava tube, which could be photographed.

Chandrayaan-2

The lessons learnt from Chandrayaan-1 mission prompted a sequel viz. Chandrayaan-2, India's second lunar mission. An orbiter, lander, and a rover, were planned in the Chandrayaan-2 mission, however, as we know already, the lander suffered hard landing on the lunar surface. The orbiter component of Chandrayaan-2, which is equipped with eight scientific instruments, is still operating, and returning valuable scientific information. The eight scientific instruments onboard the Chandrayaan-2 orbiter address the aspects of elemental composition, mineralogy, hydration, neutral & ion exosphere, as well as imaging.

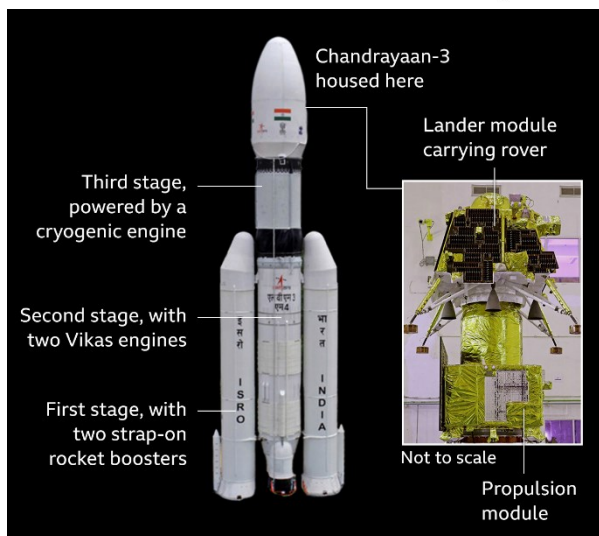
The CLASS (Chandrayaan-2 Large Area Soft X-ray Spectrometer) instrument onboard Chandrayaan-2 is the follow-up of the C1XS experiment, which is studying the X-Ray fluorescence from the elements and minerals on the lunar surface. CLASS is aided by the X-Ray Solar Monitor (XSM) instrument, which is pointed towards the Sun, and studies the solar X-Ray emission. Thus, while the XSM instrument studies the cause (i.e., emission of X-Rays by the Sun), the CLASS instrument studies its effects (XRF of the lunar surface elements). The IIRS (Imaging Infra-Red Spectrometer) instrument onboard Chandrayaan-2 is an infra-red spectrometer, capable of studying the mineralogy of the Moon, as well as the hydration signatures on the lunar surface. Taking lessons from the M3 instrument (which was limited to 2.8-micron wavelength, which could not directly capture the water-ice signature, which could have been observed at 3.0 micron) of Chandrayaan-1, the IIRS instrument is equipped to observe up to 5.0-micron wavelength range. Thus, it is equipped to observe both hydration and mineralogy signatures on the Moon's surface. The Dual Frequency Synthetic Aperture Radar (DF-SAR) is studying the sub-surface water-ice; surface roughness and dielectric constant variation of the lunar surface. The CHACE-2 experiment, which is a follow up of the CHACE experiment onboard the MIP in Chandrayaan-1, is meant to conduct in-situ study of the composition of neutral atoms and molecules in the lunar exosphere. Unlike CHACE, which was a single-shot experiment (as it was impactor-borne, and limited to a single lunar meridian), limited to the mass range of 1-100 amu, the CHACE-2 experiment is studying the lunar exosphere on a global scale, with an increased mass range of 1-300 amu. The Dual Frequency Radio Science (DFRS) Experiment is studying the ionosphere around the Moon. The Terrain Mapping Camera-2 (TMC-2) is engaged in the global imaging of the Moon, with identification of scientifically significant geological features. Another imaging instrument is Orbiter High Resolution Camera (OHRC), which is performing high resolution imaging of lunar surface, with an unprecedented resolution of 25 cm. Chandrayaan-2 orbiter is providing high-quality remote sensing and in-situ observations of the Moon with eight scientific payloads on-board; the data are made available to public with more than 2800 worldwide registered users. Chandrayaan-2 science results have provided new insights to the lunar science research. The major scientific results obtained so far from Chandrayaan-2 orbiter include characterization of hydration features on surface; characterization of young, fresh lunar crater floors; global distribution of Argon-40 in the lunar exosphere; study of the geo-tail dynamics at lunar distances; detection of minor elements, such as Cr and Mn from the orbiter, and mapping of sodium distribution for the first time. The Dual-frequency (L and S band) SAR (Synthetic Aperture Radar) is aimed at providing continuity to the Chandrayaan-1 S-band MiniSAR measurements with enhancements such as L-band for greater depth of penetration (~5-10m i.e. twice that of S-band), which will have potential to retrieve scattering from lunar sub-surface. Craters were revealed hidden below the lunar surface, and disturbed regions which are hidden by the lunar regolith. Coming to the OHRC (Orbiter High Resolution Camera) instrument; as you know, the

lunar surface is uneven; there are numerous boulders of different sizes. Boulders can be easily identified using OHRC images due to its very high spatial resolution. Hundreds of boulders, ranging from 1m to 50m in diameter, are distributed within an ejecta close to the crater rim. These boulders represent the deepest material excavated during crater formation. Boulders on the Moon surface are often found around young impact craters. Apart from characterizing the landing sites, the OHRC images allow scientists to study boulder populations in the region of interest and help them interpret geologic features and derive geologic history for a region.

Chandrayaan-3

The Chandrayaan-3 LM, comprising a lander and rover duo, harbours six scientific instruments. The lander houses ILSA (a seismometer), RAMBHA (Langmuir Probe), CHASTE (a thermophysical property measurement probe), and Lunar Retroreflector Array (LRA) from NASA. The rover carries APXS and LIBS instruments for elemental composition analysis. Upon landing, as the lunar dust settles, the rover rolls out, attached to the lander, poised to initiate a series of Experiments. The CHASTE thermal probe penetrates the lunar surface, measuring temperature profile and thermal conductivity up to a depth of approximately 10 cm. ILSA records surface vibrations, be they seismic or due to impacts, while RAMBHA studies the lunar plasma environment's dynamics. The LRA

The LVM3 launch rocket and Chandrayaan-3



Source: Indian Space Research Organisation

contributes to the study of the Earth-Moon system. The rover, meanwhile, navigates within a few hundred meters around the landing site, employing APXS to study composition through X-ray fluorescence and LIBS to analyse vapor spectra generated upon ablation of the lunar regolith. These scientific endeavours weave a meticulous narrative of lunar exploration, guided by the precision of scientific inquiry. The bedrock of Chandrayaan-3's pursuit lies in its resolute scientific aim – an endeavour to scrutinize the nuanced thermal and physical attributes, seismic phenomena, and elemental composition encapsulated within the precincts of the chosen landing zone. The propulsion module would continue to orbit the Moon. It hosts an instrument called SHAPE to conduct Spectro polarimetric studies of the Earth from the lunar orbit.

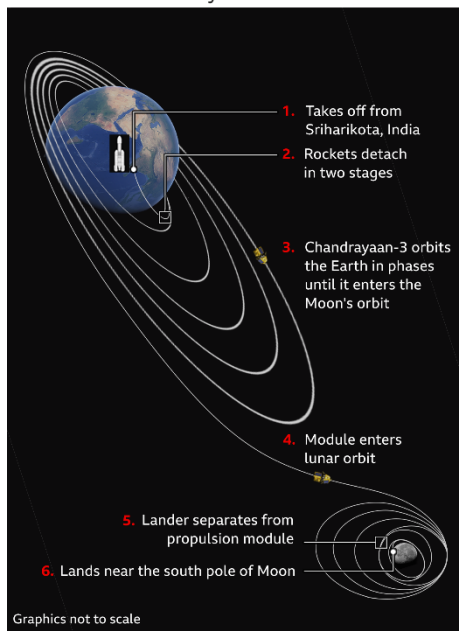
By discerning the distribution of elements across the lunar surface, scientists gain crucial insights into the Moon's formation, evolution, and its connection to Earth's own history. The deployment of instruments like the Alpha Particle X-ray Spectrometer (APXS) and Laser-Induced Breakdown Spectroscopy (LIBS) onboard Chandrayaan-3 rover allows us to decode the regolith's elemental blueprint. The study of the thermophysical properties of the regolith emerges as a compelling inquiry. This scientific pursuit, aiming to understand the material's thermal conductivity, diffusivity, and heat capacity, guides our comprehension of the Moon's thermal history. As the regolith interacts with the ever-changing solar environment, this study helps us decipher its ability to absorb, retain, and radiate heat. Such insights are invaluable, not only for lunar exploration but for potential future human endeavours. The precise analysis of the top few centimetres of the regolith by CHASTE promises to shed light on the material's

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behaviour under the lunar sun, offering a foundation for strategic planning and engineering innovations. Beyond the seemingly serene lunar surface lies an intricate realm of plasma particles. The study of this near-surface plasma environment holds key to our understanding of the Moon's interactions with the solar radiation, solar wind, and cosmic rays. Through instruments like the Langmuir Probe onboard the Chandrayaan-3 lander, scientists would measure the density and properties of this near-surface plasma. Considering the high latitude of the landing site of the Chandrayaan-3, it will be an opportunity to study the diurnal variation of the near-surface lunar plasma, with lower elevations of the Sun. As the Moon also experiences tremors, the study of lunar seismic signatures emerges as a window into its subsurface mysteries. Seismic events, or moonquakes, provide crucial information about the Moon's interior structure and tectonics. By studying the propagation of seismic waves through the regolith and crust, scientists can discern the presence of subsurface layers, faults, and potential lava tubes. This seismic inquiry extends our understanding beyond the visible surface, offering a glimpse of the Moon's geological history and its relationship with Earth. The ILSA instrument onboard Chandrayaan-3 is understood to capture the vibrations of the lunar surface, which may be due to Moonquakes, meteorite impacts, as well as the microphonics induced by the movement of the rover on the lunar surface.

Thus, the pursuit of understanding the Moon's elemental composition, thermophysical properties, near-surface plasma environment, and seismic signatures are the key priorities in the Chandrayaan-3 mission. These will collectively deepen our comprehension of the Moon's history, formation, and evolution, while also offering practical insights for future exploration, as well as conducting science experiments from the Moon.

How India's Chandrayaan-3 will reach the Moon



Source: Indian Space Research Organisation



The Journey of Chandrayaan-3 to the Moon

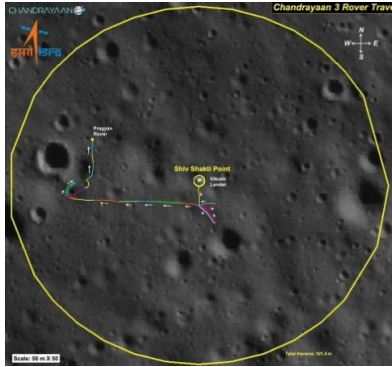
On the 14th of July in 2023, Chandrayaan-3 embarked on its journey, launched by the LVM3 M4 launch vehicle from the Satish Dhawan Space Centre. The Chandrayaan-3 module was guided into a trajectory encircling Earth, specifically a 169 km x 36,490 km orbit with an inclination of 21.3 degrees. This began with the first orbit-raising manoeuvre on July 15th, 2023, where the spacecraft ascended to a 41,762 km x 173 km Earth orbit. Following this, a sequence of orbit-raising manoeuvres on July 17th elevated the spacecraft to a 41,603 km x 226 km orbit. Further Earth-bound manoeuvres on July 22nd and 25th set the stage for the forthcoming lunar transition. The moment of liberation from Earth's gravitational field arrived on August 1st, 2023, as the Trans Lunar Injection was executed. Chandrayaan-3 achieved the escape velocity, charting a trajectory that released it

from the Earth's gravitational influence, setting it on a hyperbolic trajectory toward the Moon. After a journey in the coasting phase that lasted for four Earth-days, Chandrayaan-3 came under the influence of lunar gravity on August 5th, 2023, orbiting at an intended altitude of 164 km x 18,074 km. Subsequent manoeuvres further refined its lunar trajectory, culminating in a descent to 170 km x 4,313 km orbit around the Moon on August 6th. Meticulously orchestrated moon-bound manoeuvres on August 9th, 14th, and 16th achieved orbits of 174 km x 1,437

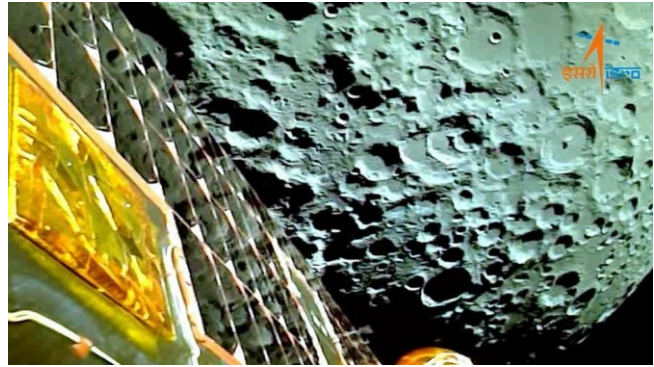
km, 151 km x 179 km, and 153 km x 163 km, respectively. An important milestone arrived on August 17th, 2023, as the Lander Module (LM) embarked on an independent journey, detaching itself from the Propulsion Module (PM). A carefully orchestrated sequence of de-boost operations unfolded, culminating in a refined orbit of 25 km x 134 km. The LM settled into position, awaiting the lunar dawn at the designated landing site. On August 23rd, 2023, at 17:47 hours, the pivotal moment of the powered descent commenced. The Autonomous Landing Sequencer (ALS) initiated the descent at the peri-Selene point, gradually slowing the LM's speed. A sequence of braking phases, rough and then fine, meticulously managed the velocity components, culminating in a hovering phase where the LM hovered approximately 800 meters above the lunar surface. Subsequent manoeuvres guided the LM in its descent, with careful assessment by the hazard detection system. No retargeting was required, and the LM descended directly. As it approached the final phase, the LM's vertical velocity slowed to approximately 1 m/s, gently touching the lunar surface.

Thus, on the 23rd day of August, 2023, a Wednesday, at 18:04 IST, India's Chandrayaan-3 mission accomplished a graceful descent, achieving a soft landing on the lunar terrain. The intricate interplay between the lander and rover components culminated in a meticulously executed powered descent, gently settling on the predetermined landing coordinates of 69.3 degrees S, 32.3 degrees E. This milestone elevates India to a distinguished echelon, joining the ranks of Russia, the United States, and China as the fourth nation to master the art of a soft lunar landing. The Honourable Prime Minister of India has named the Chandrayaan-3 landing location as the 'Shiva Shakti point', and announced August 23 as 'National Space Day', to commemorate the feat of soft-landing of Chandrayaan-3. Honourable Prime Minister of India has also named the location where the Chandrayaan-2 lander hard-landed, as 'Tiranga'. The choice of the Chandrayaan-3's landing site was meticulously made, drawing upon a meticulous analysis of diverse datasets sourced from previous lunar missions. These datasets encompassed insights from Chandrayaan-1, Chandrayaan-2, Selene, and the Lunar Reconnaissance Orbiter (LRO) mission. Central to this selection were a set of criteria meticulously considered: the topography, slope, illumination, and the imperative of hazard avoidance. Each of these facts was weighed and evaluated with precision, guiding the site's ultimate designation. At the core of this achievement is the interplay of the lander-rover operations, comprising the Vikram lander and the Pragyan rover. Both entities are endowed with a suite of sophisticated instruments, as mentioned earlier, all set to unravel the mysteries of the lunar expanse.

Taking cognisance of the harsh lunar nights, the science experiments were scheduled only for one lunar day (14 earth days). So, after one lunar day the science instruments were planned to be put to 'sleep.' Before the Chandrayaan-3 lander and rover were put to sleep mode as the lunar evening embraced the landing site, ISRO also demonstrated 'hopping' of the Vikram lander on September 3, 2023. The lander was lifted to a height of less than a meter through a small-duration firing. The lander was "commanded to fire its engines, it rose up by about 40cm and landed at a distance of 30-40cm". This "successful experiment" gives confidence to use the spacecraft in future to bring samples back to the Earth or to use it for human missions. It also demonstrated that the craft has the "capacity for lift-off in a lunar soil environment since so far the testing and real lift-off has only been from Earth.



A series of images sent by Chandrayaan-3 show the craters on the lunar surface getting larger and larger as the spacecraft gets closer, also marked is the path traced by Rover



Pictures of the lunar surface taken by Cameras onboard Chandrayaan-3 during Lunar Orbit Insertion

Meanwhile, the Pragyan rover completed hundred meters of travel on the lunar surface. With the advent of the lunar dawn, efforts have been made to establish communication with the Vikram lander and Pragyan rover to ascertain their wake-up condition. As of now, no signals have been received from them. Efforts to establish contact will continue.

Will there be a Chandrayaan-4?

The Indian Space Research Organization (ISRO) and the Japan Aerospace Exploration Agency (JAXA) has plans to collaborate on the Chandrayaan-4 mission that is expected to be launched sometime in 2026. The mission will be the Lunar Polar Exploration Mission (Lupex) and is also being referred to as Chandrayaan-4.

About Dr Radhika Ramachandran



Radhika Ramachandran, joined ISRO in 1984 after her post-graduation from Kerala University.

“I could grow from there to be a technical liaison officer in the ISRO office in New Delhi, and also at the Indian embassy in Paris. Later, I became the director of the Space Physics Laboratory. Merit mattered – and will matter – the most at ISRO.”

The author thanks Dr G. Madhavan Nair. Former Chairman of ISRO for fruitful suggestions.

Women Power in Chandrayaan missions

Chandrayaan programme is an ongoing series of outer space missions by Indian Space Research Organization (ISRO) for exploration of the Moon. There have been three Chandrayaan missions so far. Chandryan1 launched in 2008 was a major boost to India's space programs since India developed indigenous technology to explore the moon. Chandrayaan-2 although failed to soft land on the moon due to software error, it provided a wealth of data on landing parameters. Chandrayaan-3 successfully landed on the south pole of the moon on 23rd August 2023 making India the first nation to successfully land a space craft on the lunar south pole and fourth country to soft land on the moon after Soviet Union, USA and China.



Chandrayaan mission team is a mammoth one with several project executives and project managers of varied expertise spread across various centers of ISRO. The mission underscores the value of cross-functional teamwork, where experts from different domains united their skills for a common goal. Women scientists and engineers in the mission have played a crucial role in the success of Chandrayaan mission. About 20 - 25% of ISRO employees are women. The missions were accomplished by scientists and engineers supported by strong team of trail blazing women project directors, deputy directors, operators and technical staff. Chandrayaan-3 included about 500 engineers and scientists and among them about 27% were ladies in senior executive positions such as project director, associate mission director etc. This article is intended to showcase some of the women executives and scientists involved in the various aspects of the Chandrayaan missions.

Members in the Mission Team

Vanitha M., Project Director, Chandrayaan-2



As the Project Director of Chandrayaan-2, India's second mission to the moon, Vanitha displayed remarkable leadership in bringing together various complex subsystems to realize this highly challenging mission. Chandrayaan-2 consisted of an Orbiter, Lander, and Rover, where she made significant contributions in the design by understanding the mission requirements, carrying out trade-off studies and finalizing the configuration. Under her leadership, the lander and rover underwent numerous field tests in order to simulate scenarios that Vikram lander will experience during lunar touch down and rover mobility tests on lunar regolith test beds. The test results were meticulously analyzed and reviewed leading to feedback into the design. As the overall lead, she also had to rise to the challenge of managing a large inter-center team to realize various subsystems as per the project timeline and to optimize resources such as mass, power and area.

Projects of this scale require exceptional team management skills apart from the technical knowledge. The team she led rose to the challenges to deliver all the subsystems and payloads, carried out the spacecraft integration, tested and realized a flight worthy spacecraft. This project was also very challenging since it was the first mission to land near the lunar south pole. Even though Vikram hard landed, many of the technologies that are required for soft and safe landing could be evaluated in Chandrayaan-2. Chandrayaan-2 mission provided a wealth of data on the performance of all the systems during the various phases of landing. The lessons learnt were critical for ISRO in achieving success in Chandrayaan-3 mission.

Vanitha joined ISRO in June 1987 as a young Electronics Engineer and held various posts like Project Manager, Deputy Project Director, Group Director, Deputy Director and Associate Director in the course of her career. She was bestowed the Astronautical Society of India award for the best Women Scientist for the year 2006 and AeSI award for Outstanding Woman Scientist/Engineer/Technologist of the Year 2019. She was a recipient of ISRO Team achievement award for Megha-Tropiques satellite. She and her team received the International Women's Day Award 2021 from Delhi Commission for Women in Chandrayaan-2 mission.



Ritu Karidhal, Mission Director - Chandrayaan-2

Ritu Karidhal joined ISRO in 1997, after completing her Masters in Physics from University of Lucknow and masters in aerospace engineering from IISc, Bangalore. She was the Mission Director of Chandrayaan-2 and the Deputy Operations Director of Mangalyaan. As the Mission Director, she was responsible for the overall planning, execution, and management of the mission. This includes coordinating the various teams and departments involved in the mission, as well as ensuring that all mission objectives are met. Apart from this, she has also worked on the Chandrayaan-1 mission, Mangalyaan mission and the GSAT-6A and GSAT-7A missions.

She has published over 20 papers in both national and international journals. She has received many awards such as the 'ISRO Young Scientist Award' from the former President APJ Abdul Kalam, 'ISRO Team Award for MOM (2015)', 'ASI Team Award', and 'Women Achievers in Aerospace (2017)' by Society of Indian Aerospace Technologies & Industries (SIATI).

K. Kalpana, Associate Project Director, Chandrayaan-2 & 3



As Associate Project Director of Chandrayaan-3, K. Kalpana played a pivotal role in the realization and successful completion of the Chandrayaan-3 project; she helped to accomplish the mission goal of soft landing on lunar surface, marking a significant milestone in India's iconic space journey on 23rd August, 2023. This achievement has placed India as the fourth country to successfully master the technology of soft-landing on the Moon and first country to land a Lander and Rover near the lunar south polar region.

She was instrumental in handling a team of such a large scale while executing the project seamlessly under a tight schedule. Adoption of efficient work strategies and concurrent system engineering techniques played a major role in the flawless execution of the mission.

Kalpana joined ISRO as a Radar Engineer at SDSC SHAR, Sriharikota in 1999 and worked for 5 years there before she moved to the U. R. Rao Satellite Centre, Bengaluru in 2005 as Satellite Systems Engineer. She has held various positions at ISRO as Project Manager of Indian Mini Satellite (IMS-1) & Youthsat, Deputy Project Director of SARAL-Satellite for Argos and Altika (ISRO-CNES collaborative mission), Associate Project Director of Electrical Systems for Chandrayaan-2 and Associate Project Director for Chandrayaan-3.

Kalpana has a Bachelor's degree in Electronics and Communication Engineering from Madras University. She has received the International Women's Day award from Delhi Commission for contribution towards Chandrayaan-2 mission and honored with several

felicitations/citations/awards for contributing to the successful completion of the Chandrayaan-3 mission.



H. Revathy- Group Director

Mrs. Revathi Hariharakrishnan is a Control System designer. During her long-standing career in ISRO spanning 36 years, she has significantly contributed in diverse areas which include design and development of control system components and systems for the Liquid Propulsion stages of ISRO launch vehicles and system engineering and end-to-end design, development, validation and induction of electrical systems for liquid propulsion modules. Currently, Mrs. Revathi Hariharakrishnan is Group Director, Electronics Systems Group, Liquid Propulsion Systems Centre, ISRO and mentors a group of young dynamic engineers in designing and developing electrical and electronic components and subsystems meeting the stringent quality standards posed by launch vehicles and satellites, and also meeting the tight schedules projected by ISRO programmes. Mrs. Revathi Hariharakrishnan graduated in Electrical and Electronics Engineering from M.A. College of Engineering, Kothamangalam, Mahatma Gandhi University. Later she acquired her post graduate M.Tech. degree in Control Systems from NIT, Calicut, Kerala. She joined LPSC/ISRO in December 1987.

Her outstanding contribution with respect to Chandrayaan mission has been the Design and development of FPGA based Throttleable engine control electronics module (TECEM) for Throttleable flow control valve in throttleable propulsion system of Chandrayaan-2 and Chandrayaan-3. For the exciting missions of ISRO to Moon, the Chandrayaan-2 and Chandrayaan-3, state-of-the-art and trending design concepts were incorporated into the control electronics.

Kalpana Aravind, Deputy Project Director, Chandrayaan-2



As a Deputy Project Director of Chandrayaan-2, Kalpana Aravind's task was to deliver the Altitude sensors like Star sensors, Sun sensors and Processing electronics package for the Orbiter. These sensors will help to reach Moon's orbit with required Orientation, precise Orbit and ensures efficient fuel management. New Navigation sensors like Laser Altimeter (LASA) for position measurement and Lander Horizontal Velocity Camera (LHVC) for along and across axis Velocity measurement were developed, qualified and flown in Vikram Lander as Navigation sensor during soft landing, under her guidance.

For the first time MEMS based capacitive sensor developed in-house, was qualified as Seismometer and Inclinometers also flown in 'Vikram'. Two navigational cameras along with inclinometer were delivered to 'Rover' for path planning in semi-automatic mode. Laser Induced Breakdown Spectroscopy instrument was developed to study the chemistry and mineralogy of the lunar soils. All these sensors were developed under her guidance, qualified and calibrated on ground. The performance of sensors was as designed and satisfactory onboard Chandrayaan-2.

She has published more than 50 papers in National and International Journals and have patents as well. She has received the awards of “Women Scientist of the Year 2005“, by Astronautical Society of India, 'International Women's Day Awards' by Delhi Commission for Women on 08-03-2017 & 2021, ISRO Team Awards – 2017, 'International Women's Day Sakthi Award' from Puthiya Thalaimurai TV Channel for the year 2023 etc.

Naga Manjusha, Operations Director, Ch-2 and 3 missions



Naga Manjusha with a Bachelor's degree in Electronics and Communications from University Visveswaraya College of Engineering (UVCE), Bangalore University, joined ISRO in 2010 and has been working in the area of mission operations. She has worked in many Earth observation missions such as Cartosat-2 series, Yuthsat, Scatsat and EOS-06 in various capacities from team member to Operations Manager to Operations Director. Her main contribution in the Chandrayaan-2 and 3 missions was as its Operations Director. Currently she is working for Aditya L-1 as its Operations Director.

As Operations Director for both the missions, she was responsible for overall planning and execution of the satellite operations. These missions had a series of orbit manoeuvres involved in reaching the lunar orbit and were the key to successfully reaching the moon. The conversion of the manoeuvre plan into satellite commands and planning for all the contingencies were part of the operations. Several calibration exercises were performed to achieve the required accuracies of precise landing. In addition to the mission operations, she has also contributed to the selection of landing site for both the missions. Most of these operations were carried out round the clock and was a very demanding activity.

Rethika, Operations Director, Ch-3 Rover



As Operations Director for Chandrayaan-3 Rover, the responsibility of Ms. Rethika was to achieve the prime objectives of the Rover i.e., safe mobility on lunar terrain by avoiding toppling of the rover, performing scientific payload operations at every parked position, coordinating the entire ground segment chain activities and round the clock operations for 14 earth days to achieve maximum scientific output from the Rover. Also, it is required to orient the Rover towards the sun at the end of mobility for power generation. The task was really challenging as the lunar terrain is filled with craters and boulders and the navigation

is semi-autonomous from ground. The only eyes of the Rover to see the front path for mobility, were the two Navigation Cameras, and the images from these cameras take a turnaround time of about 30-40 minutes to reach the ground. The processed images from these cameras were used for planning the path and mobility of the rover. The entire Rover operations were well planned and executed achieving a maximum Rover movement of ~103.05m on the tough Lunar terrain. This was the first time; indigenous Rover operations have been carried out by ISRO and all the operations have been executed efficiently and flawlessly.

Roopa M. V., Deputy Project Director, CH-3



As a Deputy Project Director, ISTRAC elements for CH3 Mission, Ms Roopa provided ground support for Launch and Mission operations like, flawless command operation, CH-3 health monitoring and analysis round the clock, made 18 ground antennas ready for CH-3 mission support, ensured communication establishment from all ground antennas to control centre and to subsystem designers, computer network establishment with high security.

She has secured the ASI (Astronautical Society Of India) Space Gold Medal in the year 2018.

S. Megala, Deputy Director, Space Program Office



With her background in Physics, Megala was responsible for the 'Science co-ordination' in all the Chandrayaan missions. Space exploration is driven by payloads or instruments which define the science from the missions. In Chandrayaan-2 and Chandrayaan-3, her main task was to enable the open call for payload proposals, organize the payload selection process leading to the selection of instruments on the Orbiter, Lander and the Rover. As part of her work, she actively monitors the payload progress and organizes science reviews. 'Science plan', 'Data guidelines' and 'Data user's manual' for maximising the science outcome from the missions, were all part of the process. 'Lunar Science Meets' were

conceptualized to provide a forum for users, to participate in outreach programs. Again, it was her role to get the data peer reviewed and release the data in the public domain.

Principal Investigators of Payloads

Dr. Shyama, Co- Principal Investigator, CLASS payload, Ch-2



Dr Shyama's Ph.D. work involved characterization of Chandrayaan-1 X-ray Spectrometer (C1XS) which was built at the Rutherford Appleton Laboratory (RAL) in UK. Chandrayaan-2 carried an experiment called CLASS that is larger and thus more sensitive to map the surface composition of the Moon. She is currently leading the scientific analysis of lunar X-ray data and have derived the first direct global elemental maps of the Moon at high spatial resolution. One of the new findings from CLASS is a map of sodium on the Moon suggesting a volatile component that is the source of the tenuous lunar exosphere. As part of the Chandrayaan-3 science working group, she is also involved in the discussions on the scientific investigations of the lunar surface.

She has received Lunar & Planetary Science Institute's (LPI) Career Development award, ISRO Chandrayaan-1 Team award, European Geophysical Union's Young Scientist Travel award and Astronomical Society of India's Zubin-Kembhavi award for CLASS team.

Dr. G. Manju, Pricipal Investigator, RAMBHA-Langmuir Probe, Ch-2 and 3 missions



As the Principal Investigator of RAMBHA-LP payload on Chandrayaan-3 (as well as Chandrayaan-2), Dr Manju was responsible for the design, development and testing of the RAMBHA-LP probe. The spherical probe design with the specified diameter was finalized based on extensive theoretical simulations on the expected background plasma parameters in the lunar ionosphere. The probe was also thoroughly tested under different scenarios, in the high vacuum facility at Space Physics Laboratory, to ensure proper functioning in the lunar ambience, to facilitate the estimation of the correct plasma parameters from the collected data. Further, she has taken the lead role in developing the science data pipeline for the RAMBHA-LP payload. The RAMBHA-LP payload data collected during the mission is presently being analysed by herself and colleagues to bring out the first ionospheric observations of the near surface plasma environment in the lunar polar region.

Dr. Nizy Mathew, Principal Investigator, ChaSTE payload



Dr Nizy is the Principal Investigator of the Chandra's Surface Thermophysical Experiment (ChaSTE) payload on-board the Lander of Chandrayaan-3 mission developed by Space Physics Laboratory (SPL) in collaboration with various entities of VSSC and Physical Research Laboratory (PRL). ChaSTE has measured the temperature profile of the 10 cm lunar surface regolith and conducted experiments to measure thermal conductivity of the lunar soil. Her contributions to the Chandrayaan-3 project include the design and development of the ChaSTE payload, its testing, qualification, calibration, and characterization, spacecraft integrated testing, payload health monitoring, the operation, the payload on the moon, the data processing pipe line, and the scientific analysis and interpretation of the measurements.

Over the past few decades, the contributions of women in Science and Technology have gone up and Chandrayaan mission is no exception. The women in Chandrayaan missions have carved a path for women in space technology and will continue to inspire girls to take up space technology.

Compiled by: Dr Radhika Ramachandran and Dr Susan Eapen

Women Achievers

Dr Preeti Aghalayam, first woman Director of an IIT Dr Preeti Aghalayam has been appointed as the director of the newly established IIT in Zanzibar, Tanzania, which was set up through an educational partnership between India and Tanzania. She is the first woman to lead an IIT and this appointment reinforces the importance of striving for gender



balance and equality. India and Tanzania recently inked a Memorandum of Understanding (MoU) which facilitated IIT Madras to launch its first international campus in Tanzania's Zanzibar. The institute is offering two full-time academic programs, a four-year Bachelor of Science in Data Science and Artificial Intelligence,

and a two-year Master of Technology in Data Science and Artificial Intelligence. With 70 seats up for grabs, admissions are open for both Indian and foreign students.

Preeti Aghalayam is an alumnus of IIT Madras, where she completed B.Tech in Chemical Engineering in 1995. Subsequently, she went to University of Rochester in New York to pursue an MS in the subject, and later she pursued her Ph.D. at the University of Massachusetts Amherst, completing it in 2000. Following her doctoral studies, she served as a postdoctoral researcher at MIT, Cambridge and later joined as a faculty member at IIT Bombay. Since 2010, Aghalayam has been associated with IIT Madras, where she currently holds the position of Professor in the Chemical Engineering department. Recently, she received recognition as one of the 75 Women in STEAM from the Principal Scientific Advisor's office.

Among her co-workers and students, Aghalayam is known for her incredible passion for her subject as well as research and methodical thinking. Aghalayam is also the nodal officer for the 'Gender Advancement for Transforming Institutions' initiative at IIT-Madras. It seeks to work for advancement of women in the fields of science, technology engineering and mathematics, and to develop and implement policies and address issues relating to the same in a systematic and timely manner.

As part of her efforts, Aghalayam was able to identify the gender disparities at IIT-Madras and propose action plans to mitigate the same. Dr Aghalayam is an inspiration and a role model for aspiring women in the field of STEM.

Ref: <https://theprint.in/india/education/from-alumnus-to-1st-woman-to-lead-an-iit-all-about-iit-ms-zanzibar-campus-head-preeti-aghalayam/1667110/>

<https://www.thehindubusinessline.com/on-campus/out-of-africa-an-iit/article67135154.ece>

Obituary

Dr. Mangala Narlikar, one of the most inspiring women scientists passed away on **17th July 2023**.

She was IWSA's life member, Pune branch.



A bigwig in the field of mathematics, her interests in the subject range from real and complex analysis, analytic geometry, number theory to algebra and topology. Born in 1943, Narlikar studied from the University of Bombay and received degrees of B. A. (Maths) in 1962 and MA in 1964. She worked in different roles in School of Mathematics, TIFR and abroad. She obtained her PhD from Bombay University in 1981, and after that worked in the University of Mumbai and Pune. She has contributed immensely to generating interest among laypeople in mathematics through various articles in publications like the Scientific Age, where she would break down concepts in a language everyone could understand.

This created an interest in the subject amongst her readers. Her calibre to make children understand Math in a simple yet fun way, led to her involvement in to Bal Bharati, the Maharashtra State Bureau of Textbook Production & Curriculum Research centre. Not only did she go on to write books but also made concrete changes to the way textbooks are published. The books that she wrote were sold for just Rs 10 so that every child could afford them. As for textbooks, there were more pictures and interactive problems. Appointed chairperson of Bal Bharti, she made several significant changes in the state vernacular curriculum. Leelavati's Daughters, a book on women scientists in India, published by DST, has an article by her, where she describes her story as "a representation of the lives of many women of my generation who are well educated but always put household responsibilities before their personal careers." But she did contribute immensely by making mathematics more interesting to students who were fond of the subject as well as to those who were afraid of it.

IWSA Members Honoured



massive global and influential women's networks, focuses on empowerment and policy making.

Dr. Bindu Menon, Convenor, IWSA, Nellore branch, was awarded "National Indian Medical Association Doctors Day Award 2023" for community service. This was presented to her at New Delhi on Doctors Day July 1st 2023, where chief guest was Devusinh Jesingbhai Chauhan, Minister of State for Communications of India. She was also appointed as a "Council Member for the Women's Indian Chamber of Commerce and Industry" (WICCI) -Delhi External Affairs Councils. WICCI, supported by the

IWSA-- BRNS Popular Science Lectures in Schools and Colleges



SVKM'S Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce and Economics (AUTONOMOUS), Mumbai on 1st August



BRNS Lecture at Modern School & Junior College, Vashi on 12th August 2023

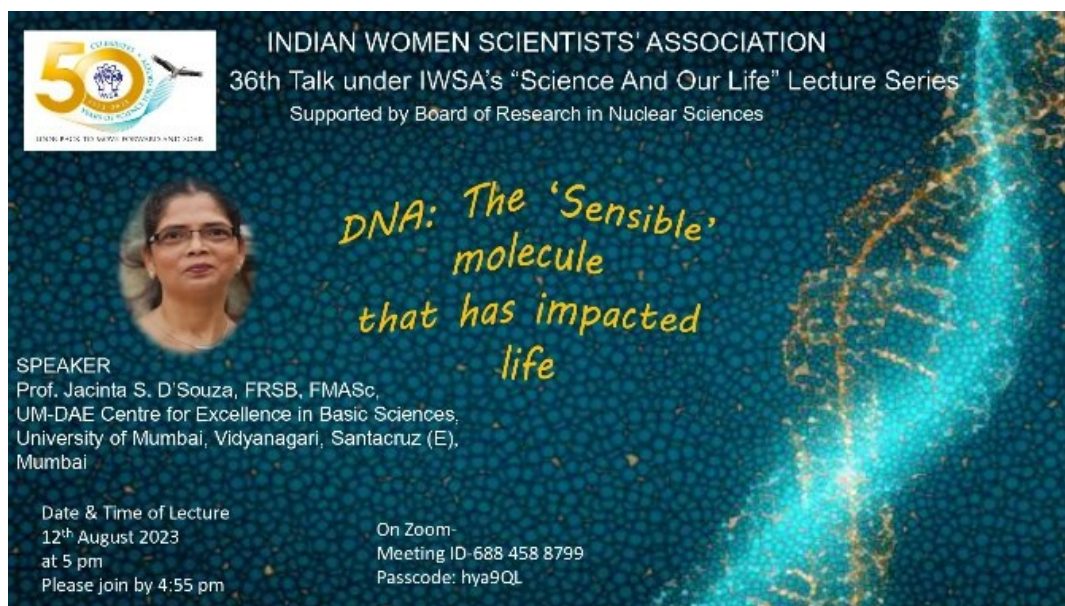


BRNS Lecture at Union Christian College, Aluva, Kochi, on 7th July 2023



BRNS Lecture at New Horizon Public School, Panvel, Navi Mumbai on 5th August 2023

IWSA – BRNS “Science and Our Life” Series of Webinars



50 CELEBRATING 50 YEARS OF SCIENCE
LOOK BACK TO MOVE FORWARD AND SOME

INDIAN WOMEN SCIENTISTS' ASSOCIATION
36th Talk under IWSA's "Science And Our Life" Lecture Series
Supported by Board of Research in Nuclear Sciences

DNA: The 'Sensible' molecule that has impacted life

SPEAKER
Prof. Jacinta S. D'Souza, FRSB, FMASc,
UM-DAE Centre for Excellence in Basic Sciences,
University of Mumbai, Vidyanaigari, Santacruz (E),
Mumbai

Date & Time of Lecture
12th August 2023
at 5 pm
Please join by 4:55 pm

On Zoom-
Meeting ID-688 458 8799
Passcode: hya9QL

IWSA VIPNET Activities



50 CELEBRATING 50 YEARS OF SCIENCE
LOOK BACK TO MOVE FORWARD AND SOME

INDIAN WOMEN SCIENTISTS' ASSOCIATION
Science Awareness Committee in Collaboration with Vigyan Prasar
Activity no. 15
IWSA- VIPNET Club (UID- VPMH0248)

Science is a way of thinking
much more than it is a body of knowledge
-Carl Sagan

Learn Science: Making Toys from Trash

Mr. Shivaji Mane
Design Lab Head,
DLRC School,
Sus Road, Pune

Date- 25th August 2023
Time- 4:30 PM
Place-
<https://meet.google.com/nom-tfx-pfu>

Learning Garden Activities



Talk by Ms. Vijaya Chakravarty on Biodiversity at Rajiv Gandhi college, Vashi on 30th June 2023.

IWSA's Piroshja Godrej Foundation Library



Celebration of National Librarian Day on 19th August

Green Initiatives of IWSA



Biowaste composting in IWSA premises

Nursery and ECCE Activities



Nursery Children enjoying nature and classes



Lecture on breastfeeding on 7th August by Dr. Suparna Patil



Puppetry Workshop and some finished products - 8th to 11th August

Day Care and JMM Working Women's Hostel



Rakshabandhan



Independence Day



Independence Day Celebration on 15th August



DCC kids in Tree Library



DCC kids engaged in garden activities

Triennial Conference June 11th to 13th



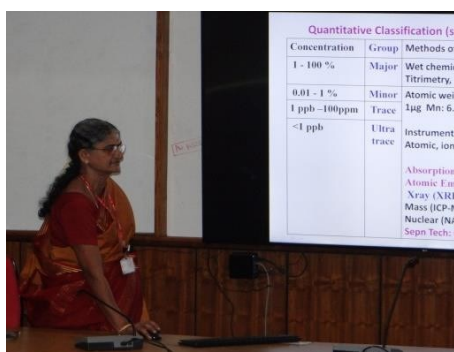
Activities from our branches

Delhi



Half day camp on “Mental Health and Well Being on 22nd May

Kalpakkam



Technical Talk by Dr. Vijayalakshmi on 29th May 2023



Technical Talk by Dr. Padma S. Kumar on 27th June



Technical talk by Letha Sebastian on 19th July

Kolhapur



National workshop on Yamadori, Suiseki and Bonsai at Vengurla, Sindhudurg, Maharashtra, 15th and 16th July 2023



Talk on "Waste Management" at SKN, Kamalapur Tal. Sangola on 27th July 2023



Celebration of “Forest Conservation Day” at Dr G. Deshmukh Mahavidyalaya, Sangola on 3rd Aug. 2023



Slideshow and Interaction with students on the occasion of Nagpanchami – 2023 21st Aug 2023



Mentoring Camp for Adolescent Girls on 22nd Aug 2023



Mentoring Programme for college Girls on 23rd Aug. 2023



Nagpur



Azadi ka Amrit Mahotsav at SOHAM, senior citizen's living on 19th August

Roorkee



Talk on "Health & Hygiene" on 22nd May in BML Munjal Green Meadows School, Haridwar



**IWSA – BRNS Popular Science Lectures for Schools
Lecture on 7th August 2023 at BML Munjal Green Meadows School, Haridwar**

BOOK POST

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Creating History: Successful launch of Chandrayaan 3 on 14th July 2023 making India the first country to soft-land near Lunar south pole on 23rd August 2023.



**IWSA's Millet Mascot,
strong and smart.
(Made with millets during
the Triennial Conference)**



**From History: Discovery of Higgs Boson,
which was announced on 4th July 2012**

To

From
IWSA Head Office
Plot No.20, Sector 10A
Dr Mar Theophilus Road, Vashi
Navi Mumbai: 400703
Tel: 27661806,
Email: iwsahq@gmail.com
Website: www.iwsa.net

Published by Dr Shyamala Bharadwaj, President, IWSA, Plot No.20, Sector 10A, Vashi, Navi Mumbai 400703.
Editor Dr. Sheela Donde