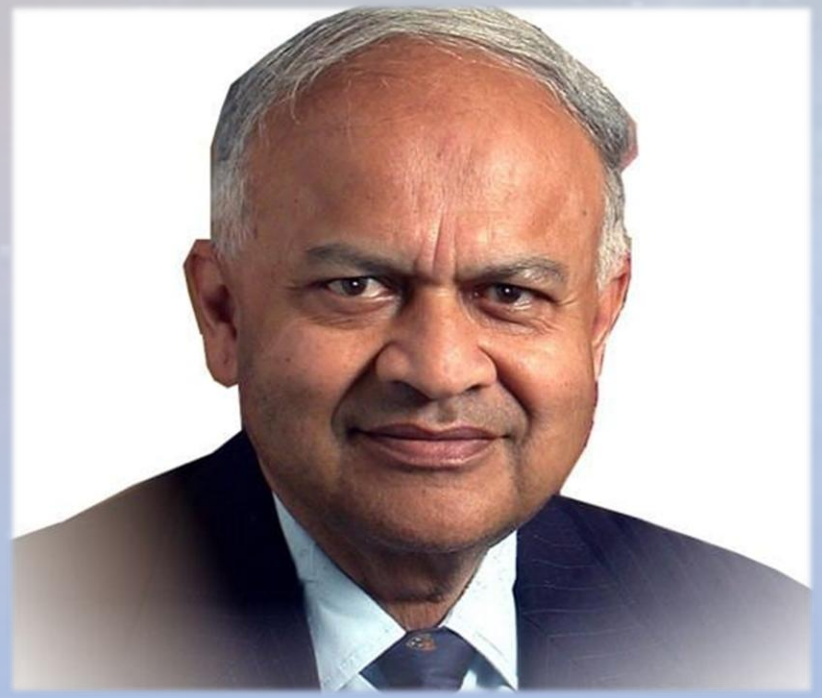
INDIAN STATISTICAL INSTITUTE

Presents

An Exhibition On

Exploring the Cosmos: The Legacy of Professor Jayant Vishnu Narlikar

Curated by: Library Division, ISI Kolkata



Professor Jayant Vishnu Narlikar
1938 - 2025

Welcome to an extraordinary journey through the mind of a man who dared to rethink the universe and the nation that fueled his genius. This exhibition celebrates the life and legacy of Professor Jayant Vishnu Narlikar, a colossal figure in cosmology. Professor Narlikar's story is a powerful testament to curiosity. His journey shows how passion and rigorous thought can challenge even the most established ideas. His legacy is not just in theories. It is in bricks, books, and a relentless drive to nurture the next generation. His story is inextricably linked to India's own scientific saga. As you explore, we hope you are inspired by the journey that proves that with curiosity, perseverance, and a strong scientific temperament, you too can aim for the stars and contribute to the vision of India. We hope these stories inspire you to become the next generation of explorers and innovators.

Photo Courtesy: BCCL

Making of an Astrophysicist



Image Courtesy: Shutterstock

Born on 19 July 1938, Kolhapur, Maharashtra, India



Image Courtesy: J V Narlikar's Blog

His father, Vishnu Vasudev Narlikar, was a mathematician and theoretical physicist at BHU, and his mother Sumati Narlikar was a scholar of Sanskrit



Image Courtesy: Wikipedia

1940s–1957
Early schooling at Central Hindu College in Varanasi. He then studied at Banaras Hindu University, where he received a Bachelor of Science degree



Image Courtesy: Peakpx.com

1963
Narlikar began his research career as a doctoral student in theoretical cosmology under the guidance of Fred Hoyle at the University of Cambridge



Image Courtesy: : Photograph by I.amkingming, https://creativecommons.org/licenses/by-sa/4.0/)

1964
Narlikar earned an additional Master's degree in astronomy and astrophysics when he was a postdoctoral fellow at King's College in Cambridge

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Making of an Astrophysicist



Image Courtesy: TIFR

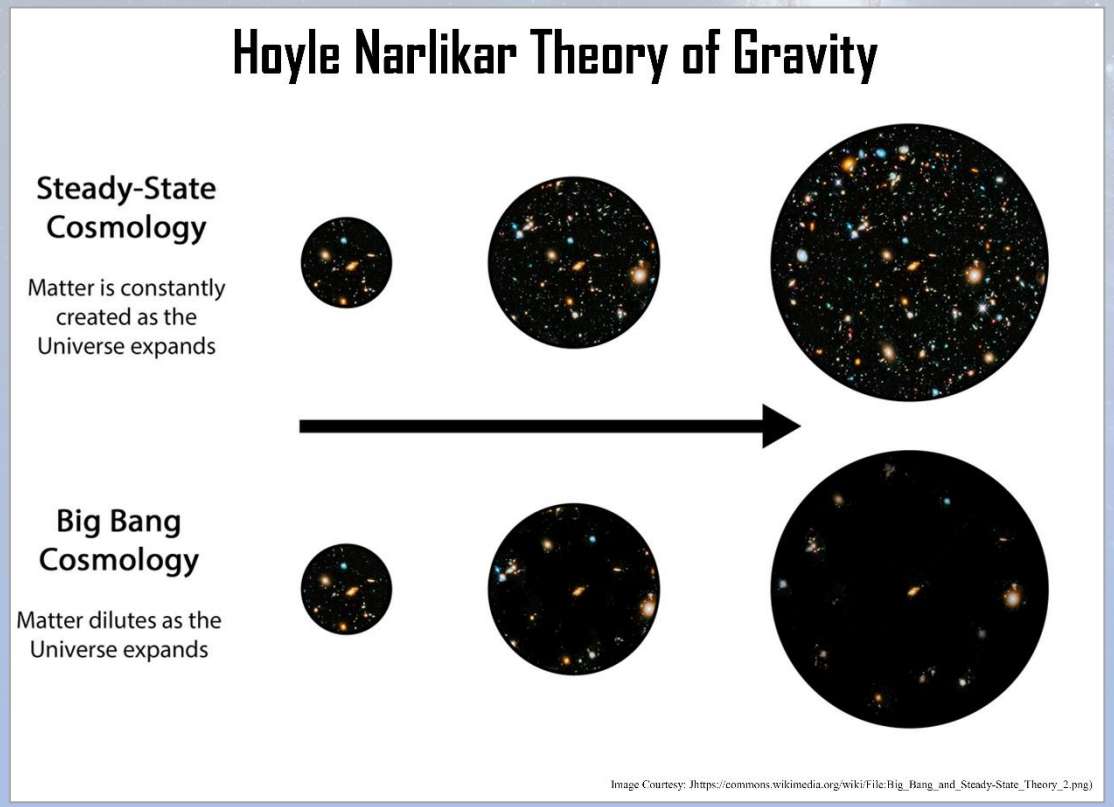
1972
Narlikar joined the Tata Institute of Fundamental Research, Mumbai



Image Courtesy: IUCAA

1988
Founded and served as the first Director of IUCAA (Inter-University Centre for Astronomy and Astrophysics)

Scientific Contributions of J. V. Narlikar



The Steady State cosmology is an alternative to the Big Bang cosmology, proposed in 1948 by Hermann Bondi, Thomas Gold, and Fred Hoyle. The steady state model asserts that the Universe has no beginning and no end. Instead, it maintains the so-called perfect cosmological principle:

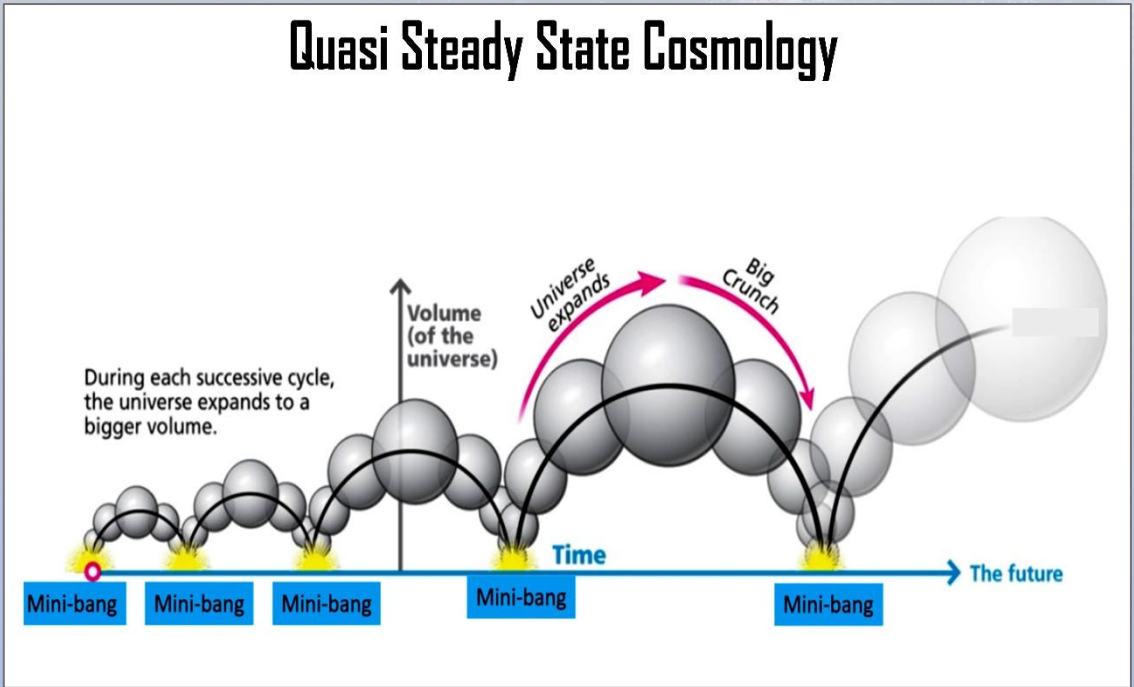
- The Universe looks the same everywhere in space (spatial homogeneity and isotropy, same as Big Bang cosmology).
- The Universe is statistically the same at all epochs (temporal invariance).

To keep the average density constant as the Universe is observed to be expanding (Hubble's law), the theory requires a continuous creation of matter from the vacuum. To explain that, Fred Hoyle and Jayant V. Narlikar proposed a theory of gravity in 1964 as an alternative to Einstein's General Relativity by incorporating:

- Mach's principle: The inertia of a particle is not an intrinsic property. Instead, it arises through an interaction with all other particles in the Universe.
- Mass Field: There is effectively a scalar 'mass field' that interacts with spacetime geometry.
- No Singularities: The cosmological solutions avoid singularities (like the Big Bang or black hole singularities).

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Scientific Contributions of J. V. Narlikar

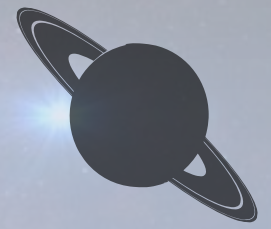


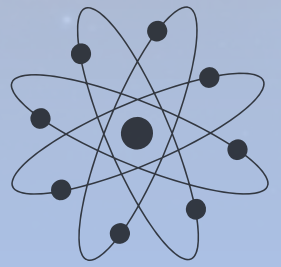
Scientists first debated between the Big Bang and the Steady State model. Over time, discoveries like the cosmic microwave background and evolving galaxies showed that the Universe really does change, strongly favoring the Big Bang. In the 1990s, Fred Hoyle, along with Jayant V. Narlikar and Geoffrey Burbidge, proposed a new idea called Quasi Steady State Cosmology. This model tried to rescue the spirit of the Steady State by saying the Universe still has no beginning or end, but instead of being perfectly unchanging, it goes through cycles of expansion and contraction. Each oscillation corresponds to what this diagram calls a 'Mini-bang': bursts of matter creation in localized regions. This way, the Universe looks old and eternal, but also shows changes over time. Over billions of years, the average density stays roughly constant, preserving the spirit of Steady State. However, the Quasi Steady State Cosmology struggled to match the detailed observations of the Cosmic Microwave Background, galaxy evolution, and element abundances. Today, it is studied more as a creative alternative that shows how scientists keep testing bold ideas, but the Big Bang model remains the best explanation of the Cosmos.

Professor Narlikar-A Master Communicator



How do you explain a black hole to a child? How do you make a nation look up at the night sky with wonder? Professor Jayant Narlikar had the answer. A brilliant astrophysicist and a master communicator, Prof. Narlikar dedicated his life to bringing the wonders of the universe down to Earth for every Indian. Professor J.V. Narlikar has been contributing towards the popularisation of science in many different ways. Apart from his scientific research, Narlikar wrote extensively in English, Hindi, and Marathi, making complex concepts accessible to all. His popular science books and articles with captivating storytelling with scientific clarity, inspiring generations. Through beloved television programmes like 'Akashashi Jadale Nate' (Marathi), 'Brahmand' (Hindi), and appearances on 'Surabhi', he became a guide to the cosmos, reaching millions across the country. Professor Narlikar has been in great demand as public speaker in different parts of India and has been regularly delivering popular talksin different parts of the country. For his contributions for science popularization, Professor Narlikar was awarded the Indira Gandhi Prize by the Indian National Science Academy in 1990, and the Kalinga Prize by UNESCO in 1996.Narlikar was awarded'Padmabhushan' in 1965, at the young age of 26. In 2004 he was awarded Padmavibhushan. In 2011, the Government of the State of Maharashtra honoured him with the State's highest civilian award of Maharashtra Bhushan. In 2014, the Sahitya Akademi, the premiere literary body in India, selected his autobiography for its highest prize in regional language (Marathi) writing.







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Professor Narlikar- A Master Communicator

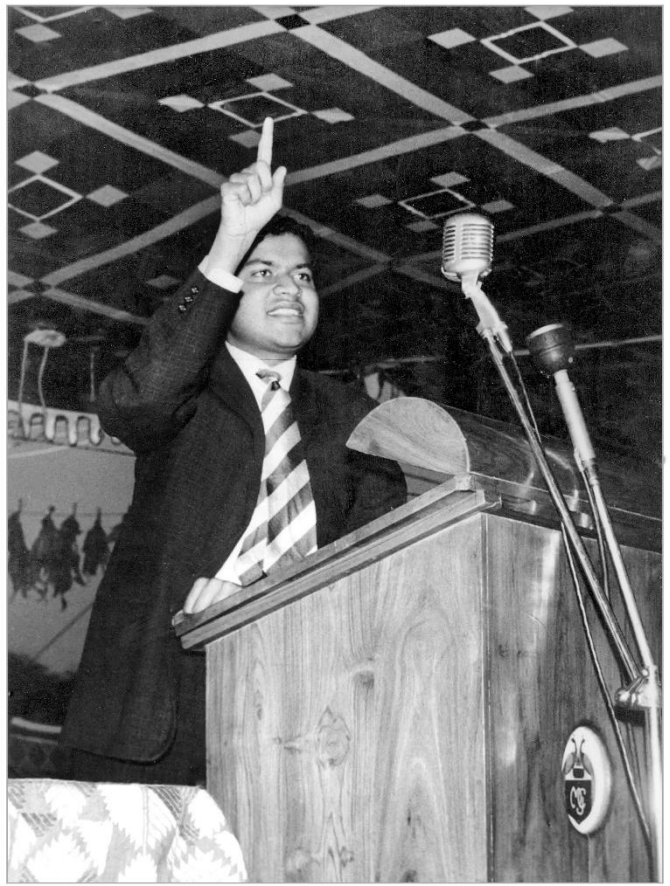


Image Courtesy: JV Narlikar's Blog

JVN Delivering a Lecture on his Bharat Darshan Tour in 1965



Image Courtesy: JV Narlikar's Blog

Professor Narlikar with India's Prime Minister Lal Bahadur Shastri and Finance Minister T. T. Krishnamachari in 1965

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Professor Narlikar - A Master Communicator



Image Courtesy: JV Narlikar's Blog

JVN Answering Questions Asked by School Students at Nehru Planetarium, New Delhi

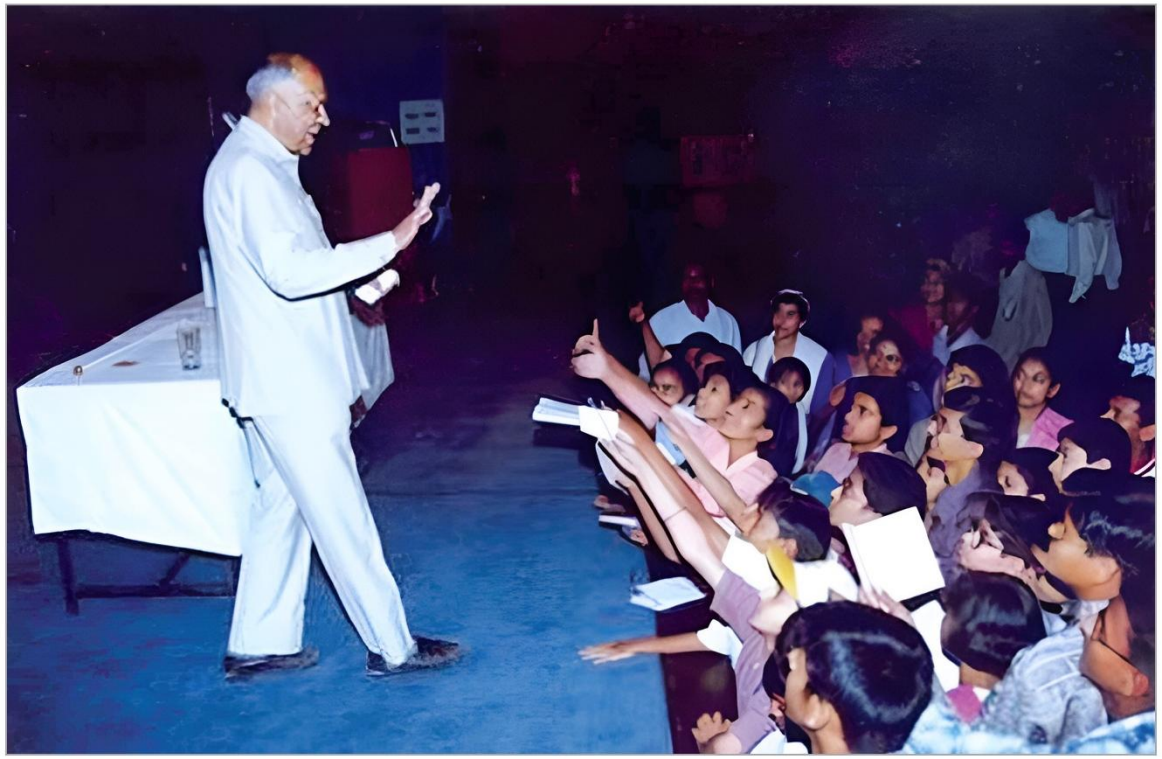
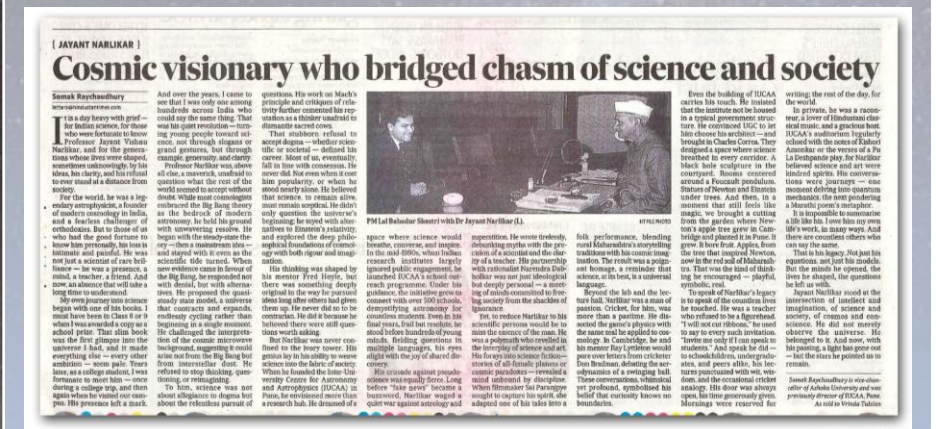


Image Courtesy: JV Narlikar's Blog

JVN Answering Questions Asked by School Students at Nehru Planetarium, New Delhi

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Professor Narlikar - A Master Communicator



{ JAYANT NARLIKAR }

Cosmic visionary who bridged chasm of science and society

Somak Raychaudhury

letters@hindustantimes.com

IT'S a day heavy with grief — for Indian science, for those who were fortunate to know Professor Jayant Vishnu Narlikar, and for the generations whose lives were shaped, sometimes unknowingly, by his ideas, his clarity, and his refusal to ever stand at a distance from society.

For the world, he was a legendary astrophysicist, a founder of modern cosmology in India, and a fearless challenger of orthodoxies. But to those of us who had the good fortune to know him personally, his loss is intimate and painful. He was not just a scientist of rare brilliance — he was a presence, a mind, a teacher, a friend. And now, an absence that will take a long time to understand.

My own journey into science began with one of his books. I must have been in Class 8 or 9 when I was awarded a copy as a school prize. That slim book was the first glimpse into the universe I had, and it made everything else — every other ambition — seem pale. Years later, as a college student, I was fortunate to meet him — once during a college trip, and then again when he visited our campus. His presence left a mark.

And over the years, I came to see that I was only one among hundreds across India who could say the same thing. That was his quiet revolution — turning young people toward science, not through slogans or grand gestures, but through example, generosity, and clarity.

Professor Narlikar was, above all else, a maverick, unafraid to question what the rest of the world seemed to accept without doubt. While most cosmologists embraced the Big Bang theory as the bedrock of modern astronomy, he held his ground with unwavering resolve. He began with the steady-state theory — then a mainstream idea — and stayed with it even as the scientific tide turned. When new evidence came in favour of the Big Bang, he responded not with denial, but with alternatives. He proposed the quasi-steady state model, a universe that contracts and expands, endlessly cycling rather than beginning in a single moment. He challenged the interpretation of the cosmic microwave background, suggesting it could arise not from the Big Bang but from interstellar dust. He refused to stop thinking, questioning, or relinquishing.

To him, science was not about allegiance to dogma but about the relentless pursuit of questions. His work on Mach's principle and critiques of relativity further cemented his reputation as a thinker unafraid to dismantle sacred cows.

That stubborn refusal to accept dogma — whether scientific or societal — defined his career. Most of us, eventually, fall in line with consensus. He never did. Not even when it cost him popularity, or when he stood nearly alone. He believed that science, to remain alive, must remain sceptical. He didn't only question the universe's beginning; he toyed with alternatives to Einstein's relativity, and explored the deep philosophical foundations of cosmology with both rigour and imagination.

His thinking was shaped by his mentor Fred Hoyle, but there was something deeply original in the way he pursued ideas long after others had given them up. He never did so to be contrarian. He did it because he believed there were still questions worth asking.

But Narlikar was never confined to the ivory tower. His genius lay in his ability to weave science into the fabric of society. When he founded the Inter-University Centre for Astronomy and Astrophysics (IUCAA) in Pune, he envisioned more than a research hub. He dreamed of a space where science would breathe, converse, and inspire. In the mid-1990s, when Indian research institutes largely ignored public engagement, he launched IUCAA's school outreach programme. Under his guidance, the initiative grew to connect with over 500 schools, demystifying astronomy for countless students. Even in his final years, frail but resolute, he stood before hundreds of young minds, fielding questions in multiple languages, his eyes alight with the joy of shared discovery.

His crusade against pseudo-science was equally fierce. Long before "fake news" became a buzzword, Narlikar waged a quiet war against astrology and superstition. He wrote tirelessly, debunking myths with the precision of a scientist and the clarity of a teacher. His partnership with rationalist Narendra Dabholkar was not just ideological but deeply personal — a meeting of minds committed to freeing society from the shackles of ignorance.

Yet, to reduce Narlikar to his scientific persona would be to miss the essence of the man. He was a polymath who revelled in the interplay of science and art. His forays into science fiction — stories of all-female planets or cosmic paradoxes — revealed a mind unbound by discipline. When filmmaker Sai Paranjpye sought to capture his spirit, she adapted one of his tales into a folk performance, blending rural Maharashtra's storytelling traditions with his cosmic imagination. The result was a poignant homage, a reminder that science, at its best, is a universal language.

Beyond the lab and the lecture hall, Narlikar was a man of passion. Cricket, for him, was more than a pastime. He dissected the game's physics with the same zeal he applied to cosmology. In Cambridge, he and his mentor Ray Lyttleton would pore over letters from cricketer Don Bradman, debating the aerodynamics of a swinging ball. These conversations, whimsical yet profound, symbolised his belief that curiosity knows no boundaries.

Even the building of IUCAA carries his touch. He insisted that the institute not be housed in a typical government structure. He convinced UGC to let him choose his architect — and brought in Charles Correa. They designed a space where science breathed in every corridor. A black hole sculpture in the courtyard. Rooms centered around a Foucault pendulum. Statues of Newton and Einstein under trees. And then, in a moment that still feels like magic, we brought a cutting from the garden where Newton's apple tree grew in Cambridge and planted it in Pune. It grew. It bore fruit. Apples, from the tree that inspired Newton, now in the red soil of Maharashtra. That was the kind of thinking he encouraged — playful, symbolic, real.

To speak of Narlikar's legacy is to speak of the countless lives he touched. He was a teacher who refused to be a figurehead. "I will not cut ribbons," he used to say to every such invitation. "Invite me only if I can speak to students." And speak he did — to schoolchildren, undergraduates, and peers alike, his lectures punctuated with wit, wisdom, and the occasional cricket analogy. His door was always open, his time generously given. Mornings were reserved for writing; the rest of the day, for the world.

In private, he was a raconteur, a lover of Hindustani classical music, and a gracious host. IUCAA's auditorium regularly echoed with the notes of Rahul Anandkar or the verses of a Pu La Deshpande play, for Narlikar believed science and art were kindred spirits. His conversations were journeys — one moment delving into quantum mechanics, the next pondering a Marathi poem's metaphor.

It is impossible to summarise a life like his. I owe him my own life's work, in many ways. And there are countless others who can say the same.

That is his legacy. Not just his equations, not just his models. But the minds he opened, the lives he shaped, the questions he left us with.

Jayant Narlikar stood at the intersection of intellect and imagination, of science and society, of cosmos and conscience. He did not merely observe the universe. He belonged to it. And now, with his passing, a light has gone out — but the stars he pointed us to remain.

Somak Raychaudhury is vice-chancellor of Ashoka University and was previously director of IUCAA, Pune. As told to Vrinda Talesra

PM Lal Bahadur Shastri with Dr Jayant Narlikar (L). HT FILE PHOTO

Image Courtesy: IUCAA

Cosmic visionary who bridged chasm of science and society. by Somak Raychaudhury, Vice-Chancellor, Ashoka University



'Dogma fighter' who brought universe closer to India

Gayatri Vajpeyee

puneletters@hindustantimes.com

PUNE: On Tuesday, India lost one of its most brilliant scientific minds—Dr Jayant Vishnu Narlikar. A cosmologist of global renown, he was also a passionate science communicator, a teacher to generations, and a staunch believer in questioning dogma—scientific or otherwise.

Dr. Raghunath Srianand, current director of the Inter-University Centre for Astronomy and Astrophysics (IUCAA) that Narlikar founded in 1988, called his passing a "big loss" to the world of science. "His vision was to empower researchers from across India, especially those from remote regions, to pursue high-quality research in astronomy and astrophysics," said Srianand. "He laid the foundation for what is now known as cosmology in India."

While the Big Bang theory remains the most widely accepted model for the universe's origins, Narlikar stood apart. He remained a vocal proponent of alternative cosmological models, the Hoyle-Narlikar theory developed with his mentor Sir Fred Hoyle. But it wasn't contrarianism for its own sake—it was, as colleagues point out, a rare scientific courage to question consensus and follow evidence, even if it led away from the mainstream.

"He was a complete maverick," said astrophysicist Somak Raychaudhury, vice-chancellor of Ashoka University and former IUCAA director, adding, "we learned from him not only physics but the importance of independent thinking."

Raychaudhury credits Narlikar with inspiring his own career. "I first encountered his book 'The Structure of the Universe' as a school student—it changed my life. Later, he gave me my first job. What stood out was his unwavering belief that science must not be confined to labs—it had to reach the public."

"He ensured school students had access to IUCAA's premises at a time when no other institute in India was doing that," said Raychaudhury. "He would rather skip ribbon-cutting ceremonies, but never missed a chance to talk about science."

Arvind Paranjpye, who worked under Narlikar at IUCAA from 1991 to 2011, recalled the gentle discipline and constant encouragement that shaped his career. "He encouraged me to build rapport with the press and the public. That training helped me immensely when I moved to Nehru Planetarium in Mumbai," he said. "We've lost not just a scientific mind, but a great friend of communicators."

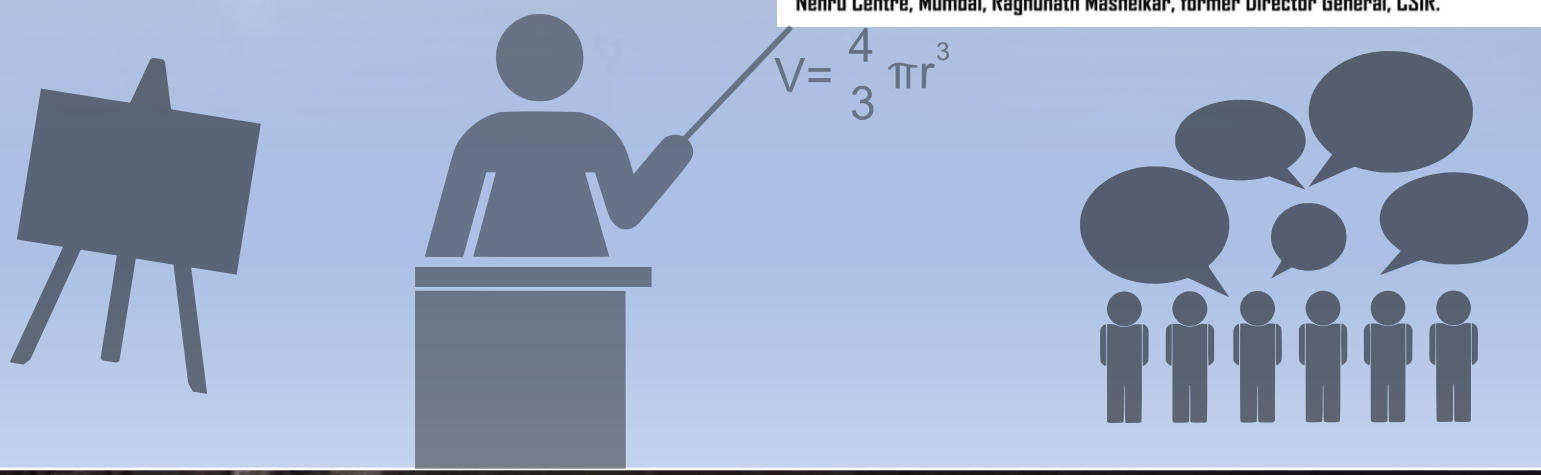
To Dr. Raghunath Mashelkar, former director general of Council of Scientific and Industrial Research (CSIR) and a longtime collaborator, Narlikar was more than a peer. "Jayant was an institution. His passion for fundamental science and science communication was ahead of its time. The UNESCO Kalinga Prize he won is a testament to that. Despite his global stature, he was humble and always approachable," Mashelkar said. He recounted a humorous moment at the Indian Science Congress where he asked to speak before Narlikar—knowing well that once Narlikar took the stage, nobody would remember what came before.

Narlikar's ability to communicate complex scientific concepts with clarity won him a wide readership. He wrote extensively in English and Marathi, for both adults and children. "Even three years ago, he sat on stage with me in front of 500 kids, answering their questions. He brought joy and curiosity into science," said Raychaudhury.

His humility extended beyond science. In 2010, when the Maharashtra Sahitya Parishad offered him ₹1 lakh from a special literary fund for participating in events, he returned the money, suggesting it be used for rural initiatives instead.

Image Courtesy: IUCAA

'Dogma fighter' who brought universe closer to India. by Gayatri Vajpeyee, Hindustan Times [Contributed by R. Srianand, Director, IUCAA, Somak Raychaudhury, Vice-Chancellor, Ashoka University, Arvind Paranjpye, Director, Nehru Planetarium, Nehru Centre, Mumbai, Raghunath Mashelkar, former Director General, CSIR.





Indian Express, Pune May 21, 2025 Pg.01

The North Star in Indian astrophysics, he was ahead of his time — and space

Working with legendary Fred Hoyle to setting up IUCAA, Jayant Narlikar nurtured, inspired next generation

JAYANT NARLIKAR
1938-2025

AMITABH SINHA
NEW DELHI, MAY 20

BIG BANG is an exploding myth, read the sign outside his room. It was also a sort of theme song for the person inside.

For Jayant Narlikar, the established theory about how the universe came into being, through a Big Bang about 13.8 billion years ago, was never really a settled issue.

Narlikar, who had contributed immensely to the development of an alternative model of the universe along with his mentor Fred Hoyle, passed away Tuesday morning in Pune. He was 87. Ailing for some time, he had had a fall two weeks ago and had to be operated upon last week.

One of the most celebrated

INSIDE

M R SRINIVASAN, VETERAN NUCLEAR SCIENTIST, DIES AT 95 PAGE 7

Indian scientists, Narlikar, then a young researcher at Cambridge University in the UK, had attracted global recognition for his

CONTINUED ON PAGE 2

'Narlikar an ideal teacher who turned difficult ideas simple'

ANURADHA MASCARENHAS
PUNE, MAY 20

JAYANT NARLIKAR, one of the best-known names of Indian science, was not just a pioneering scientist, but also an institution-builder, educationist, a science populariser, and science fiction writer. He also groomed generations of new astrophysicists in a country that had little contribution in the field at the global level before him.

Narlikar, who passed away early Tuesday morning aged 87,

Prof Jayant Narlikar with his wife Dr Mangala Narlikar. *Pavan Khengarle*

happened to be one of the most recognisable and loved figures in Pune, not the least among school children who he actively

CONTINUED ON PAGE 2

WWW.INDIANEXPRESS.COM
THE INDIAN EXPRESS, WEDNESDAY, MAY 21, 2025

North Star in Indian astrophysics, ahead of his time

work on what is known as the steady-state theory of the universe, developed by Hoyle, in collaboration with Hermann Bondi and Thomas Gold.

The Big Bang theory suggests that the universe has a definite beginning, and a possible end. In contrast, the steady state theory, which was the mainstream theory in the 1950s and 1960s, maintains that the universe has always been the way it is, without any beginning or an end. The idea has become less popular over time, with mounting evidence that supports the Big Bang theory.

But Narlikar remained unconvinced. Acknowledging that he was in a small minority, he argued in his autobiography 'A Tale of Four Cities' that there was still enough evidence to "re-examine the situation". "It is not that Narlikar was blind to the new evidence coming out in support of Big Bang. He was a scientist of the first order. It is just that he strongly believed in his work. So, every new piece of evidence for Big Bang used to be taken as a fresh challenge by him, a new opportunity to test his ideas. And his responses, or criticism, of the new evidence used to be as scientifically rigorous as it can get," said Somak Raychaudhuri, a former director of Pune-based Inter-University Centre for Astronomy and Astrophysics (IUCAA), which Narlikar was instrumental in setting up, and where he had an office room until a couple of years ago.

"In many ways, Narlikar was like Hoyle. They had amazing ideas on several matters related to science. Many of these were very unconventional ideas, but backed by rigorous mathematics and data," said Raychaudhuri, now vice-chancellor of Ashoka University.

The Hoyle-Narlikar theory, as it came to be known, on the steady state universe was just one such idea. In the process of formulating their model, the two also came up with an alternative theory of gravity, by modifying Einstein's general relativity. Then there was their work on cosmological red-shifts, the fact that light coming from far-away objects appears shifted towards longer wavelengths, corresponding to the red end of the visible spectrum. Narlikar questioned the accepted understanding that the red-shifting was caused mainly by the relative motion of the source.

"Their big ideas have become out of fashion these days, but much of the underlying mathematical structures, and the methods that they developed have withstood the test of time," Raychaudhury said.

And even, bigger ideas, including a possible alternative to Big Bang, are not completely discarded, said Ajit Kembhavi, one of the students of Narlikar, and another former director of IUCAA.

"Science is based on evidence. As new data emerge, theories evolve. Nothing is permanent. For example, there is some emerging evidence that may support newer versions of the steady-state theory. Similarly, there are many examples of anomalous red-shifts, that appear inconsistent with conventional explanations of why this happens. The scientist, Halton Arp, has been a great expert at finding these. Some of the data coming in from the James Webb Space Telescope seem to be clashing with our established theories. This is the way science advances. Alternative ideas are a must, as long as they aligned with basic scientific principles. Jayant (Narlikar) was like that," Kembhavi said.

In his autobiography, Narlikar himself wrote that some of his ideas were probably too ahead of their time. "One moral that I have learnt from my (and more so from Fred Hoyle's) scientific career is that to have the maximum impact of your ideas, you must be only slightly ahead of time: if you are ahead of time by several years (as we were on this occasion), your ideas are dismissed as outlandish and then forgotten," he wrote.

He was referring to three of his papers published in 1966, including the one on gravity, which, he said was considered "provocative" in the scientific community.

But the talks related to these papers, two years ahead of their publication, had attracted a lot of media attention, and Narlikar was interviewed by many in the UK. It got him a lot of fame back home, with even Indira Gandhi, not a Prime Minister then, sending him a congratulatory note, in which she noted that had her father been alive (Jawaharlal Nehru had passed away a fortnight earlier), he would have been thrilled by his achievements.

The international acclaim that the 26-year-old Narlikar was getting was noted by the Indian government too. Former union minister Jairam Ramesh posted a clipping Tuesday from the Yojana magazine of the erstwhile Planning Commission, an issue of July 1964, which discussed whether India should get Jayant back to the country.

Narlikar did, eventually, return to India after a few years, where he trained several generations of astrophysicists and built institutions like IUCAA.

He delved into science fiction, writing short and long stories in Marathi and English, many of which became part of the school curriculum. He pursued science popularisation, and campaigned against superstition and pseudo-science. He would specifically get himself photographed eating during eclipses to make a point. He used to organise special science sessions for schoolchildren at IUCAA and would spend hours answering their questions.

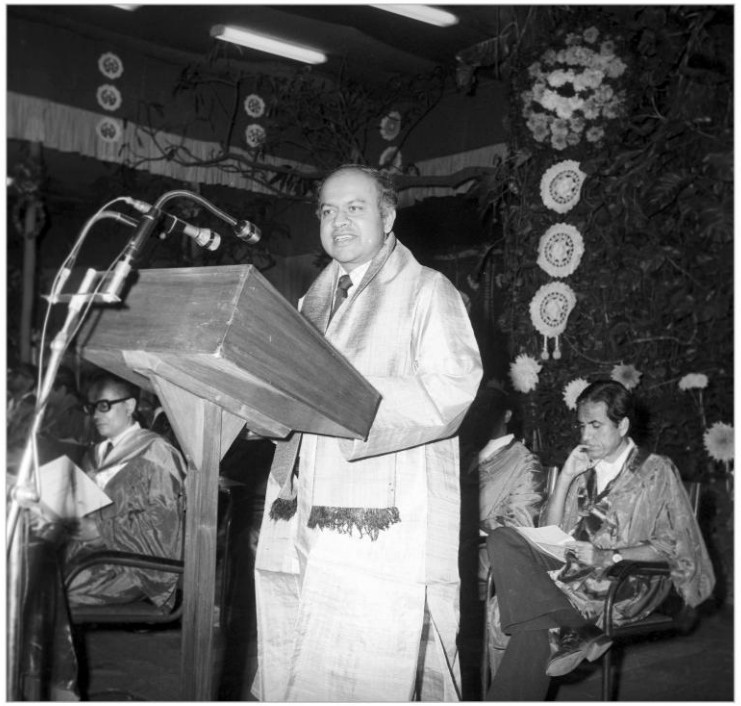
"One of his enduring legacies would be the large number of students he guided and mentored. Look at all the big names in astrophysics in India. Thanu Padmanabhan (who died in 2021), Sanjeev Dhurandhar, Ajit Kembhavi, Naresh Dadhich – all have been trained by Narlikar, and they, in turn, have trained many more. The astrophysics scene in India is quite vibrant," said Tarun Souradeep, astrophysicist and director of Bengaluru-based Raman Research Institute, himself a student of Narlikar.

"Narlikar was a very good listener and very open to new ideas. It did not matter where the idea was coming from. He would often tell students, look it is amazing how that model works so well, now let us examine why our own does not work equally well in this situation. He would ask us to question established theories. Narlikar's students excelled in very different fields within astrophysics. He never forced his own ideas on them," Souradeep said.

Image Courtesy: IUCAA

The North Star in Indian astrophysics, he was ahead of his time - and space. by Amitabh Sinha, Indian Express [Contributions from: Somak Raychaudhury; Ajit Kembhavi, Emeritus Professor and former Director, IUCAA; Tarun Souradeep, Director, Raman Research Institute, Bengaluru]

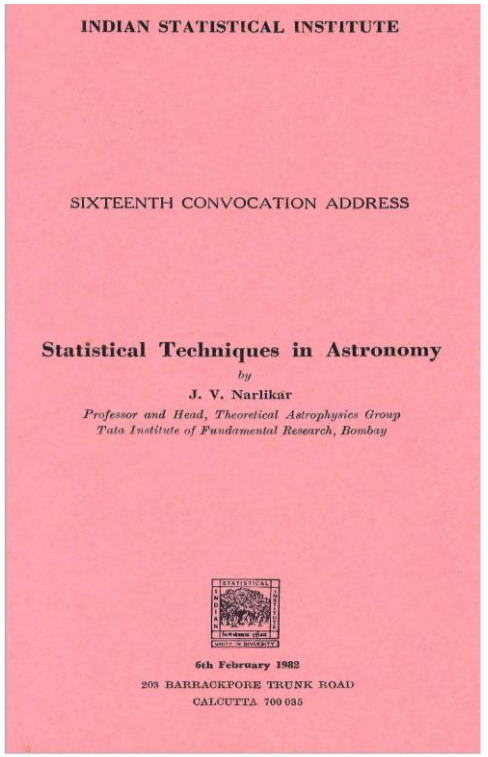
Professor Narlikar at ISI Kolkata



Professor Narlikar delivering convocation address, 1982



Professor Narlikar during convocation at ISI Kolkata, 1982



INDIAN STATISTICAL INSTITUTE

SIXTEENTH CONVOCATION ADDRESS

Statistical Techniques in Astronomy

by

J. V. Narlikar

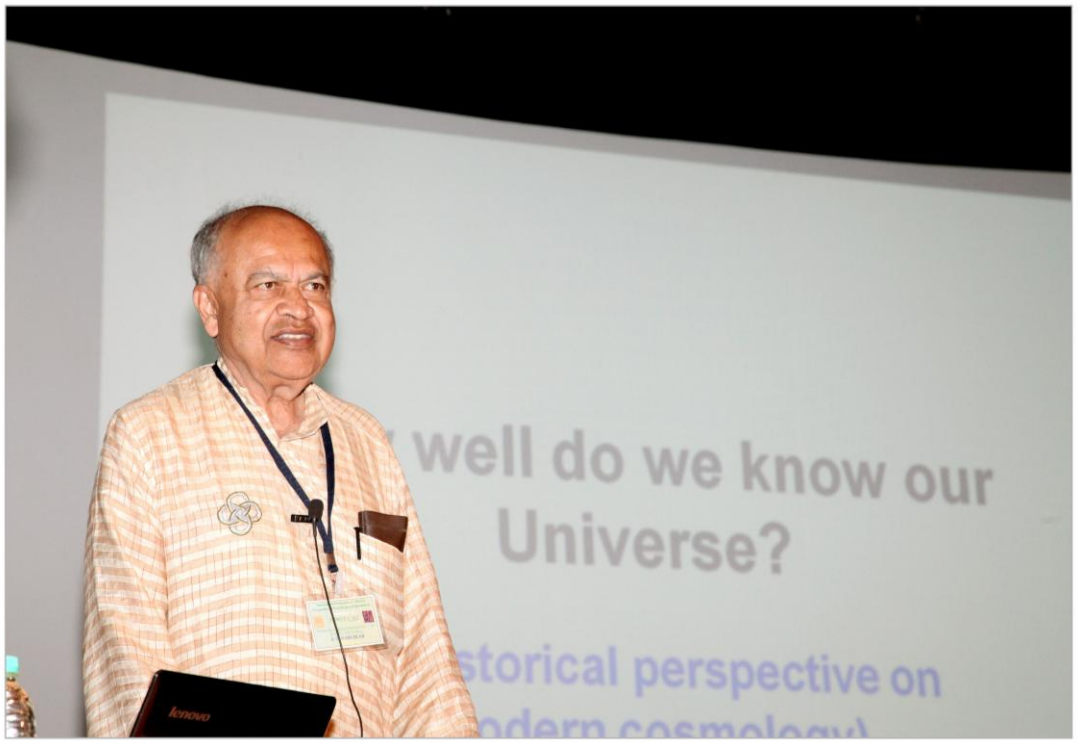
Professor and Head, Theoretical Astrophysics Group
Tata Institute of Fundamental Research, Bombay

6th February 1982

203 BARRACKPORE TRUNK ROAD
CALCUTTA 700 035

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Professor Narlikar at ISI Kolkata

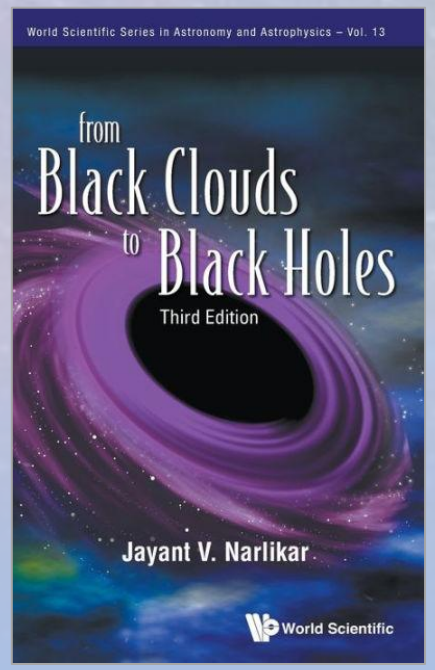


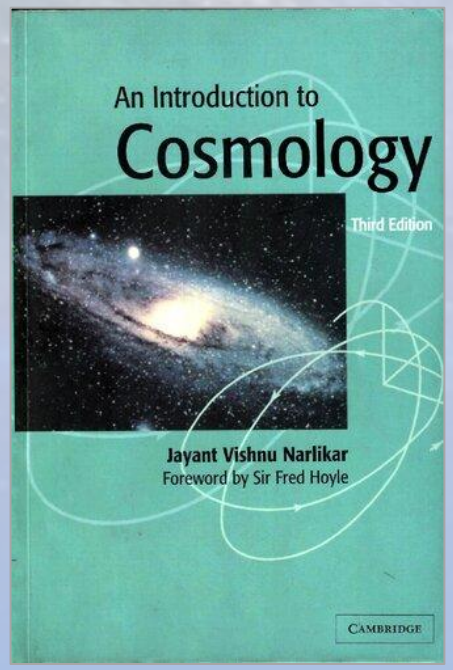
J V Narlikar at Platinum Jubilee Auditorium on 10.02.2012

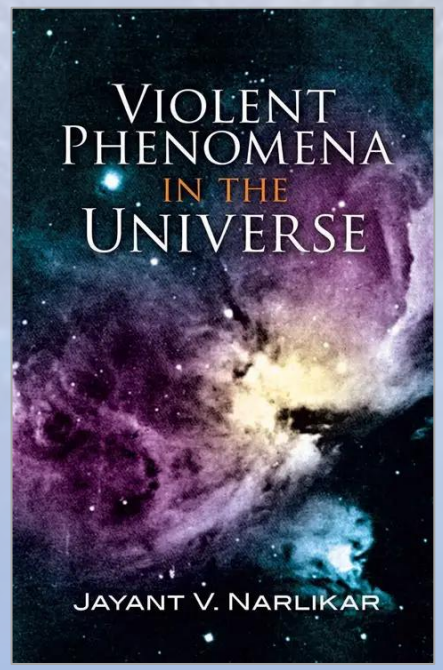


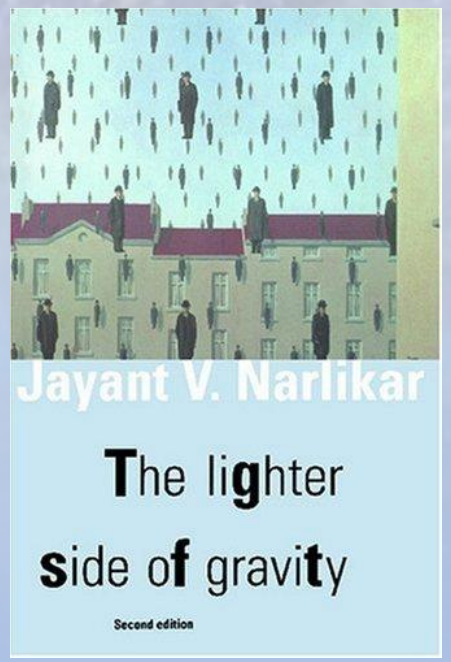
Professor Narlikar was delivering a Lecture at PJA

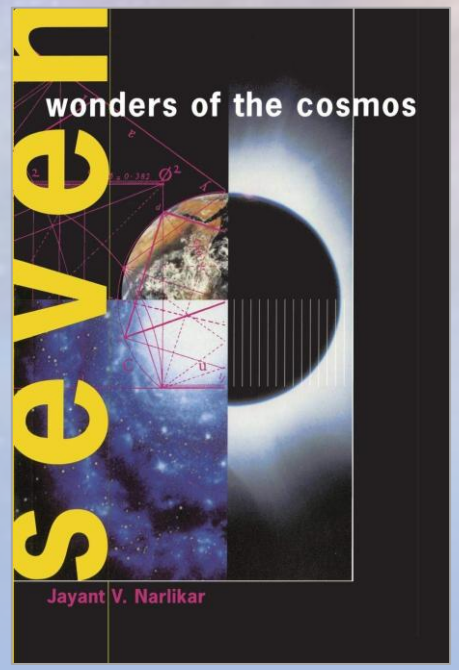
A Few Notable Publications of Professor Narlikar





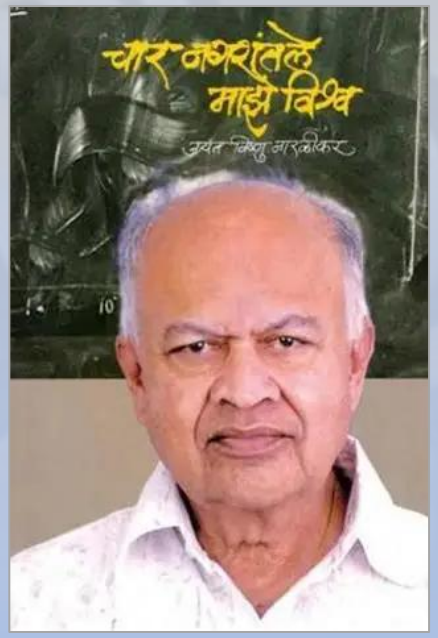


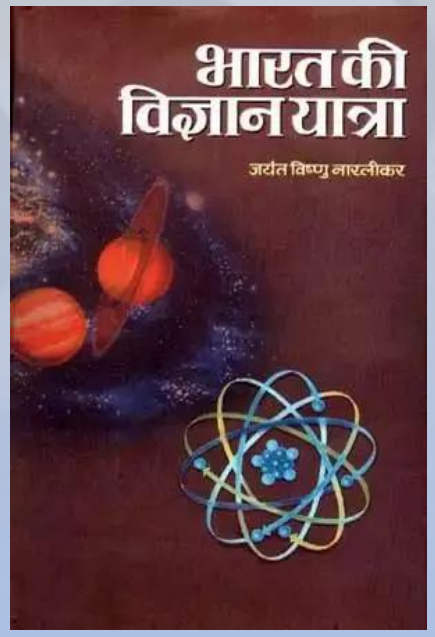


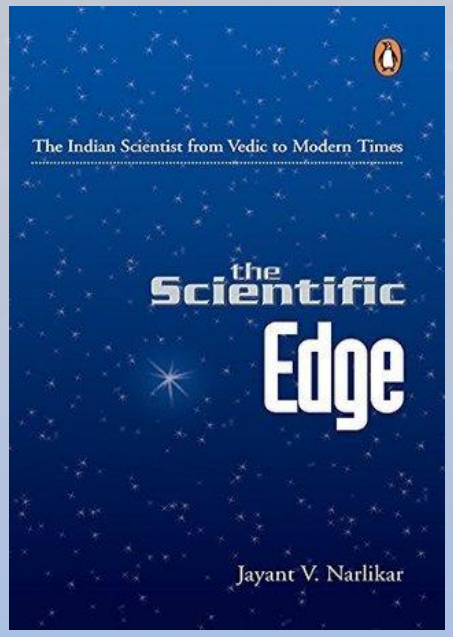


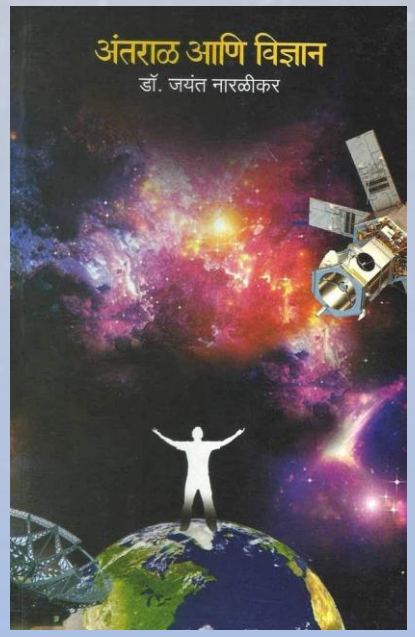
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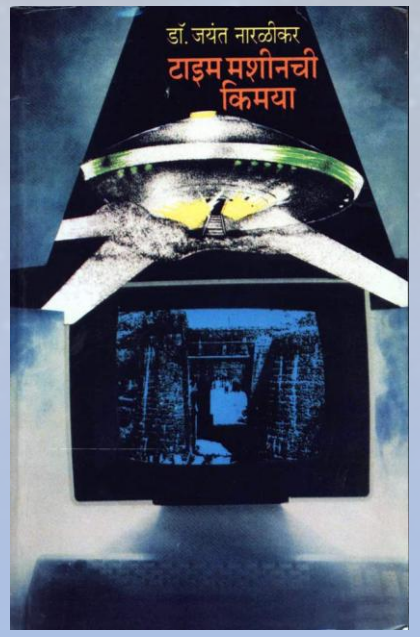
A Few Notable Publications of Professor Narlikar











Several Cosmological & Astrophysical Observations

Cosmic Microwave Background Observations

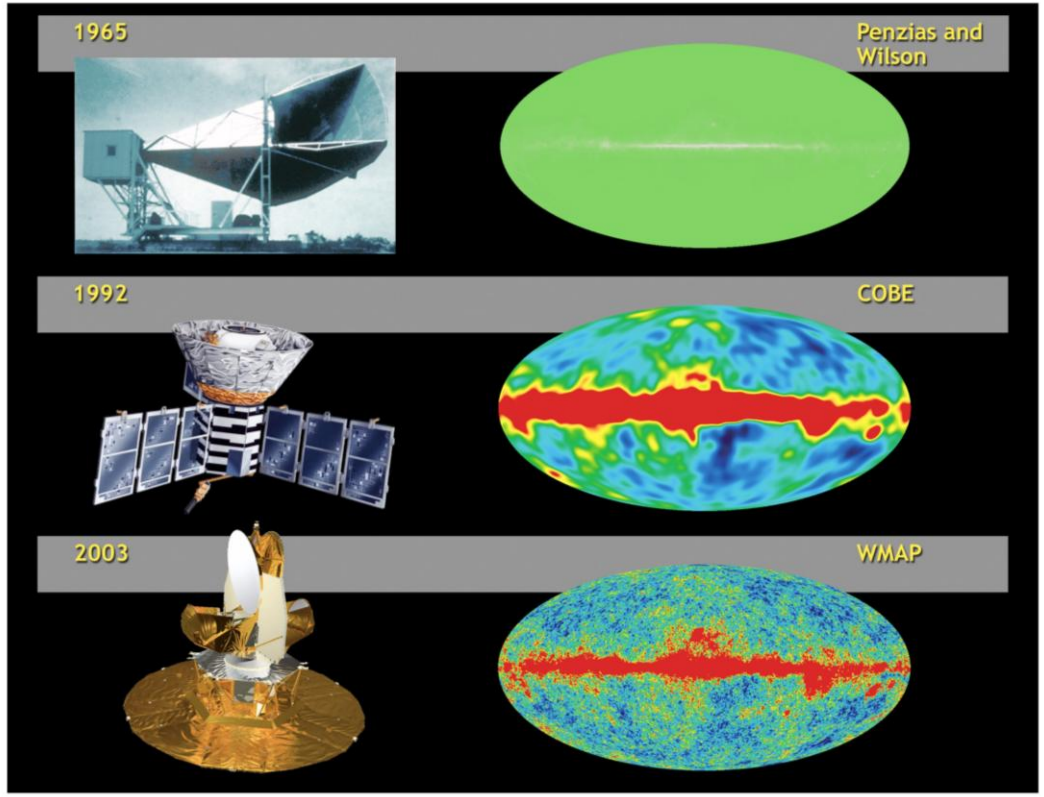


Image Courtesy: Fig. credit: https://wmap.gsfc.nasa.gov/media/081031/index.html

The study of the Cosmic Microwave Background (CMB) has progressed through several landmark experiments that shaped our understanding of the Universe. In 1965, Penzias and Wilson discovered the CMB as faint microwave noise, confirming the Big Bang theory. The COBE satellite (1992) made the first detailed measurements, detecting tiny anisotropies, minute temperature fluctuations, that represented the seeds of galaxies and cosmic structures. The WMAP mission (2003) provided much higher-resolution maps, enabling precise estimates of the Universe's age, composition, and geometry. These observations established the era of precision cosmology, paving the way for later missions like Planck, which further refined our picture of the early Universe.

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Several Cosmological & Astrophysical Observations

Gravitational Wave Experiments

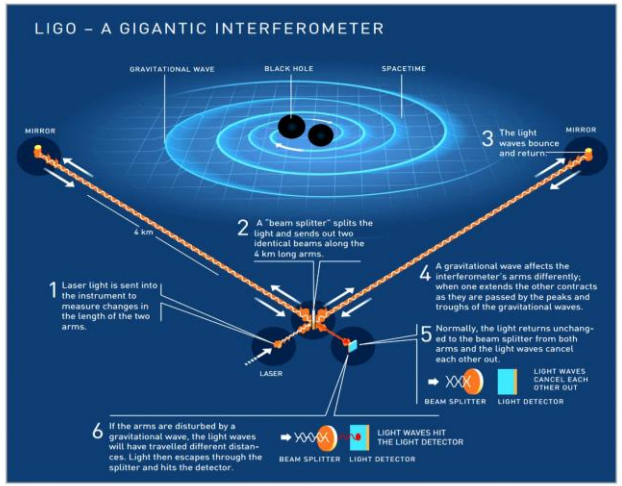


Image Courtesy: https://scx2.b-cdn.net/gfx/news/2017/59d36b0fccc97.jpg

Gravitational-wave detectors such as the Laser Interferometer Gravitational-Wave Observatory (LIGO) can sense high-frequency ripples in spacetime, from 10 Hz to 5 kHz, enabling the detection of mergers involving black holes, neutron stars, and black hole–neutron star systems. Since 2015, these instruments have achieved groundbreaking milestones, including the first detection of a binary black hole merger (GW150914) and the landmark multi-messenger observation of a binary neutron star merger (GW170817). The global LIGO–Virgo network enhances sky localization and polarization measurements, while KAGRA contributes advanced capabilities with cryogenic mirrors and an underground site for superior noise reduction and sensitivity.

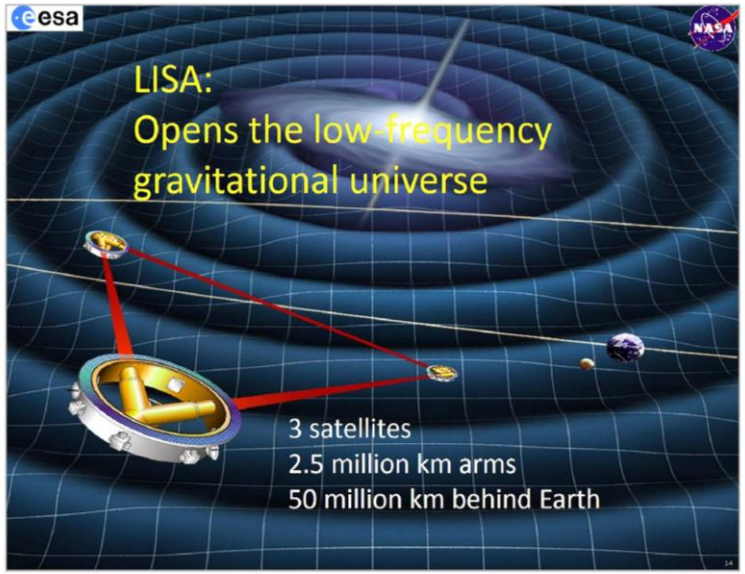


Image Courtesy: : https://www.eoportal.org/satellite-missions/lisa-observatory

The Laser Interferometer Space Antenna (LISA) will fly in space as a vast triangular constellation with arms 2.5 million kilometers long, tuned to the low-frequency universe from 0.1 mHz to 1 Hz. It is designed to capture the cosmic symphony of supermassive black hole mergers, the faint whispers of extreme mass-ratio inspirals, and the diffuse hum of the stochastic gravitational-wave background.

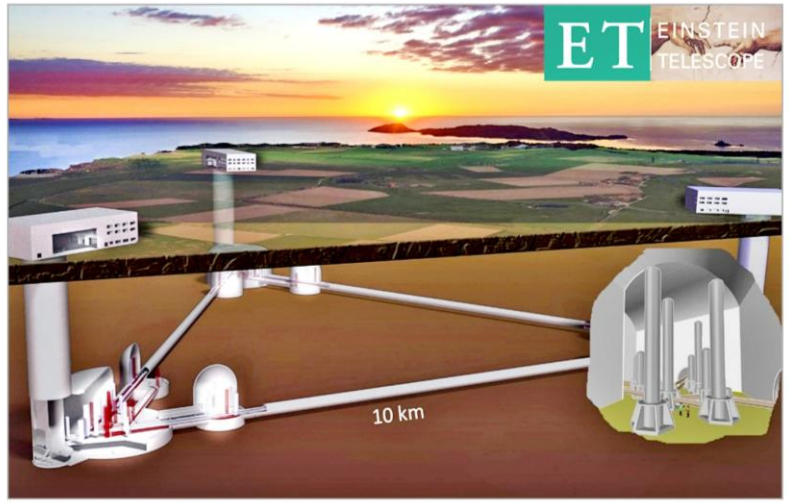


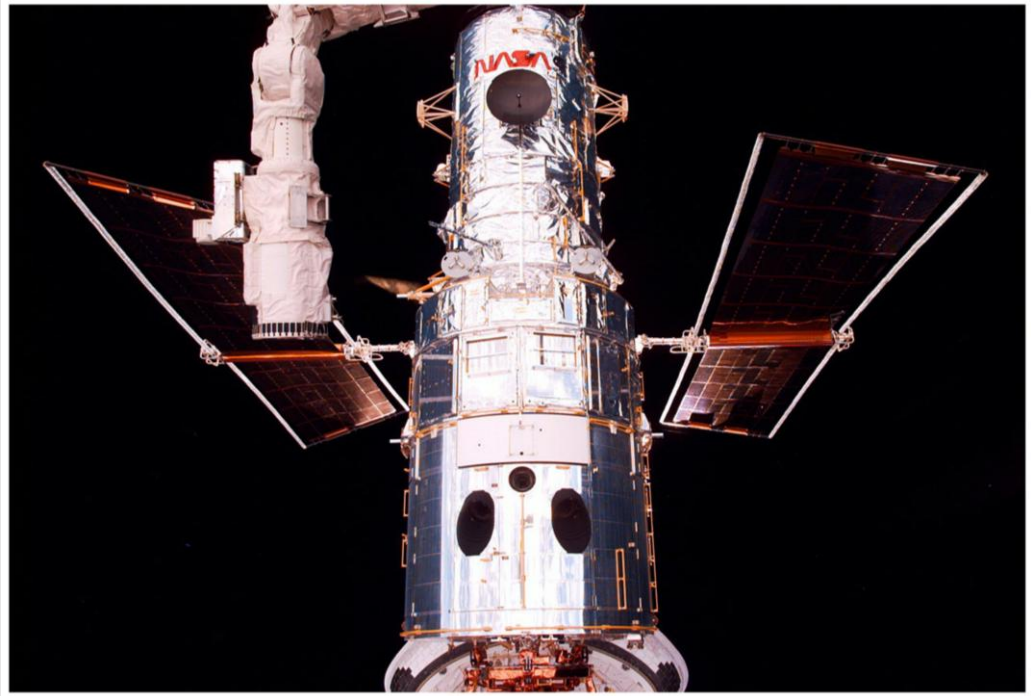
Image Courtesy: https://www.ingv.it/en/press-and-urp/Press/Press-releases/4887-the-Einstein-Telescope-enters-the-European-roadmap-of-large-research-infrastructures

The Einstein Telescope will be an underground triangular observatory with 10 km arms, extending gravitational-wave astronomy from 1 Hz up to 10 kHz with unprecedented low-frequency sensitivity. It aims to push the boundaries of general relativity, unveil the inner physics of neutron stars, and listen to echoes from the early universe.

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Several Cosmological & Astrophysical Observations

Large Scale Structure and Radio Experiments



The Hubble Space Telescope (HST), launched in 1990, is an operational space observatory orbiting about 540 km above Earth. Designed to observe in ultraviolet, visible, and near-infrared light, it has revolutionized astronomy by capturing detailed images of galaxies, nebulae, exoplanets, and the distant Universe. HST carries a 2.4 m primary mirror and several instruments, including cameras and spectrographs, which have provided critical data on cosmic expansion and dark energy. Even after more than three decades, it remains one of the most productive scientific missions in history.



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Several Cosmological & Astrophysical Observations

Large Scale Structure and Radio Experiments

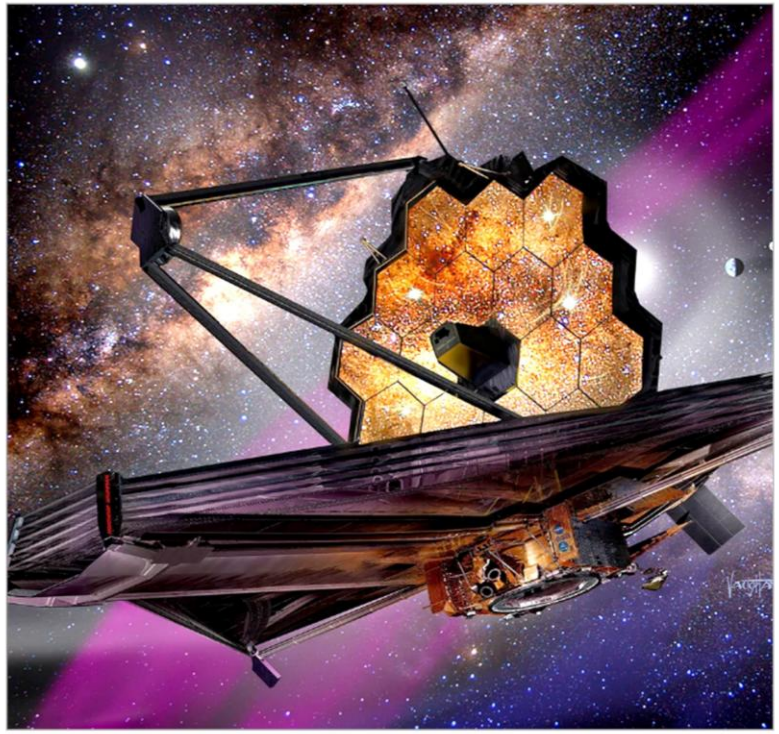


Image Courtesy: https://science.nasa.gov/mission/webb/spacecraftoverview/

The **James Webb Space Telescope** (JWST), launched in December 2021, is a fully operational infrared observatory positioned at the second Lagrange point (L2), about 1.5 million km from Earth. It is designed to study the Universe's earliest galaxies, star and planet formation, and the atmospheres of exoplanets to search for signs of habitability. JWST carries a 6.5 m segmented gold-coated mirror and four main scientific instruments, enabling highly sensitive observations in the near- and mid-infrared. It represents a major advancement over Hubble, offering unprecedented resolution and depth in cosmic exploration. Unlike Hubble, which is limited mainly to optical and near-infrared, JWST's powerful infrared capabilities allow it to peer through cosmic dust and observe much earlier epochs of the Universe.

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Several Cosmological & Astrophysical Observations

Large Scale Structure and Radio Experiments



The **Giant Metrewave Radio Telescope (GMRT)**, built by NCRA about 80 km north of Pune, is one of the world's premier facilities for exploring the Universe at metre wavelengths. Its 30 steerable dishes, each 45 m in diameter and spread across 25 km, are designed to probe fundamental questions in astrophysics, such as galaxy formation, pulsars, and the large-scale structure of the cosmos. Metre wavelengths were specifically chosen because of their scientific importance and the relatively low radio interference in India. The carefully selected site ensures low noise, strong infrastructure, and access to both northern and southern skies.

Fig. credit: https://www.gmrt.ncra.tifr.res.in/

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Several Cosmological & Astrophysical Observations

Large Scale Structure and Radio Experiments

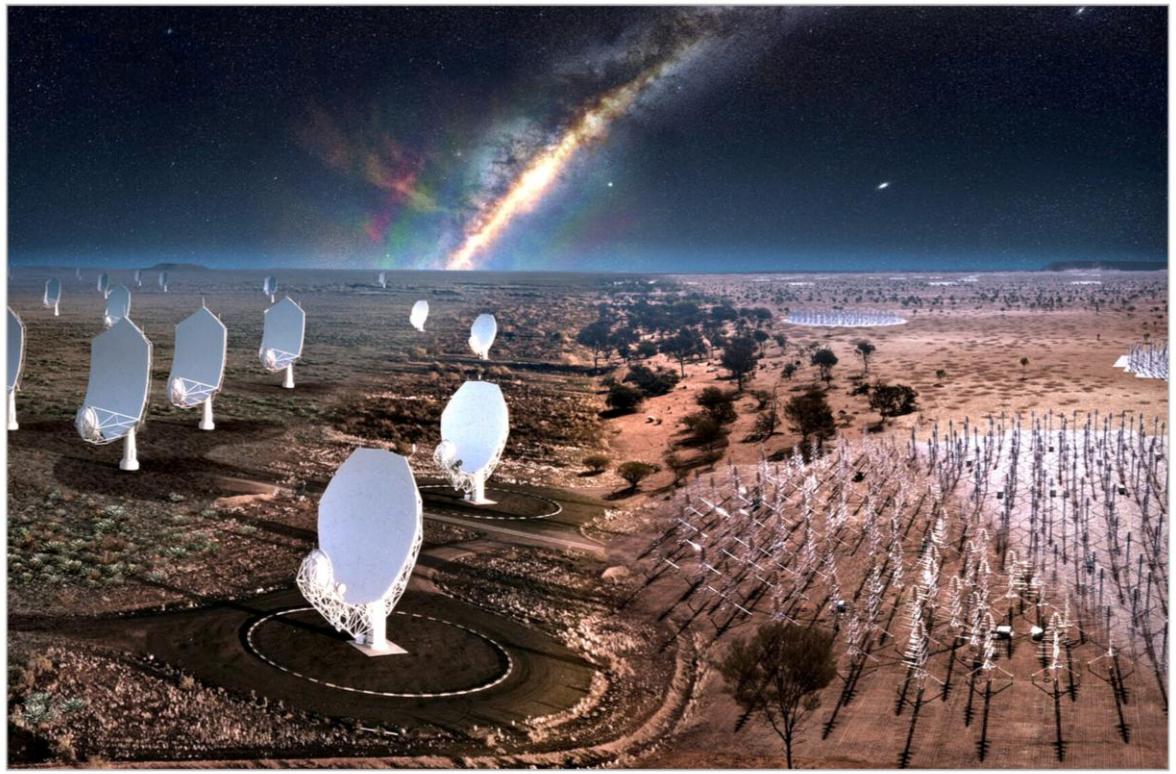


Image Courtesy: https://www.skao.int/en

The **Square Kilometre Array (SKA)** is an international mega-science project to build the world's largest radio telescope, with a total collecting area of about one square kilometre. Spread across sites in South Africa and Australia, it will operate over a wide range of radio frequencies with unprecedented sensitivity and resolution. The SKA's primary goal is to address fundamental questions about the origin and evolution of the Universe, including the formation of the first stars and galaxies, the role of cosmic magnetism, and the search for extraterrestrial life. Its scale and advanced technology make it one of the most ambitious scientific projects ever undertaken.

This exhibition celebrates the enduring legacy of Professor Jayant Vishnu Narlikar as a scientist, educator, and science communicator. His life and work remind us that science is not only the pursuit of knowledge but also an invitation to nurture curiosity, embrace rational thought, and expand the horizons of human imagination.

Curated By: Samiran Das (Library) & Avik Kr. Das (PCMMM&A)

Coordinated By: Monali Mitra Paladhi (Deputy Librarian)

Supporting Team: Keya Das, Naba Kr. Biswas, Sanchari Ghosh, Dipankana Banerjee

Collaborator: PAMU, ISI Kolkata

A Special Thanks to: Partha Pratim Halder, Repro-Photo Unit