



Twinkle, twinkle little star

How I wonder what you are!

MOST children would have wondered at amazement at those little, diamond-like objects shining in the night sky. As they grow up only a few retain that sense of wonder and still fewer probe deeper into the mysteries that abound. This is the story of one such boy – M.K. Vainu Bappu – who went on to be fondly remembered as the “father of modern Indian astronomy”.

Manali Kallat Vainu Bappu was born on 10 August 1927 in Hyderabad. His father Manali Kukuzhi Bappu and mother Sunanna both hailed from Kerala.

Vainu Bappu first joined St. Annie's Convent and later the Islamia High School. After high school, he joined the Naizam's College and completed his Bachelor's degree in 1946 and three years later the Master's degree in physics.

From Hyderabad to Harvard

Though Bappu was very good in studies, he had other qualities that made him an all-rounder. He was a gifted speaker, interested in sports, particularly cricket, and literature. But what claimed him as its own was astronomy. As a professional astronomer he used to say, “I learnt astronomy in the lap of my father.”

Yes, astronomy was in his blood. His father worked as an astronomer at the Nizamiah Observatory, Hyderabad. Young Bappu used to accompany his father to the observatory and quickly learnt the ‘ins’ and ‘outs’ of telescopes and other instruments. He published his first paper on astronomy in 1946 in the journal *Current Science*. The topic was variable stars—those fascinating objects in the sky that vary in brightness periodically. Another short paper in the same journal followed in 1948 on the spectrum of night airglow, using a spectrometer he had himself built.

After his MSc degree, he was keen on pursuing higher studies in astronomy. But, at that time there were no institutions in India offering courses in astronomy and he did not have enough resources to go abroad for studies on his own. However, chance played a benevolent hand here. Professor Harlow Shapley, a renowned astronomer from Harvard University, Boston, USA was

M.S.S. MURTHY

Vainu Bappu

Father of Modern Indian Astronomy

visiting Hyderabad. Bappu met him and impressed him so much that the professor promised to do his best to get him admission at Harvard.

In early 1949, Bappu enrolled at the Harvard University with a Government of Hyderabad scholarship. “I will never forget in my life that meeting with Harlow Shapley,” Bappu used to acknowledge later in life. That meeting not only gave a prolific astronomer to India but also to the world. For, Bappu rose to adorn the highest chair of international astronomy—the President of the International Astronomical Union.

Donhoe Comet Medal

Comets have fascinated humanity since humans first noticed them with bright distinctive tails streaking across the night sky. They are small members of our solar system and have a great deal to tell about their origin. Hence, discovering new comets is an important aspect of astronomical research. Within a short time after arrival at Harvard, Bappu discovered one.



Donhoe Comet Medal of the Astronomical Society of the Pacific

As part of his work, Bappu was routinely taking night sky pictures. According to *Harvard Crimson*, a daily newspaper of the University, on 2 July 1949 Bappu exposed a photographic plate to the early morning sky. After developing the plate, he announced, “Now I am going to look for comets” and indeed he spotted one after careful examination. His Professor Bart Bok and colleague Gordon Newkirk confirmed the discovery. From several such plates that Bappu took on successive nights they calculated the orbit of the comet to be so large that it would reappear only after 60,000 years!

It is customary to name comets after their discoverers. The International Astronomical Union officially designated the comet as *Bappu-Bok-Newkirk comet (C/1949N1)*. As the first member of the team, Vainu Bappu was awarded the Donhoe Comet Medal of the Astronomical Society of the Pacific. He is the only Indian after whom a comet has been named. But, bigger discoveries from him were yet to come.



Vainu Bappu (1927-1982)

M. K. Krishna Bappu

Today, astronomy in India has grown leaps and bounds—not just in the optical wavelength but also along the entire electromagnetic spectrum, from infrared to gamma ray.

The Vainu Bappu Observatory in Kavalur (below)



Wilson-Bappu Effect

Bappu completed PhD in 1952, just three years after arriving at Harvard. For his thesis, he carried out spectroscopic studies of a class of stars known as the Wolf-Rayet stars. Immediately, he was offered the prestigious Carnegie Fellowship in astronomy for two years, which gave him an opportunity to work at the largest telescope in USA at that time—a 200-inch Hale Telescope at Mount Palomar. Even here, Bappu was the first Indian to have received this Fellowship. Working with Olin Chaddock Wilson, Bappu came out with an important discovery that etched his name permanently in the annals of astronomy.

While conducting spectroscopic analyses of a class of stars known as late-type stars, they discovered that the width of emission lines of ionized calcium (Ca II K line) in the chromosphere of these stars was proportional to the absolute luminosity of those stars. They studied as many as 185 stars whose luminosities were known and established a calibration curve to demonstrate the relationship. This discovery had a great impact on two areas of research in astronomy; one, it became a convenient tool to determine the distance of those stars; two, it gave an impetus to the study of chromosphere of those stars. Their paper was published in the *Astrophysical Journal* of the American Astronomical Society in 1957 and came to be popularly known as the Wilson-Bappu Effect.

In 1999, the *Journal* was celebrating the one-hundredth year of its publication. To mark that occasion, it brought out a Centennial Issue that featured 53 articles selected from those published over the past one hundred years with the greatest impact on the development of astrophysics and astronomy. The paper by Wilson and Bappu was one of them.

Home Again

After completion of the Fellowship, Bappu had several job offers from Europe and USA, including one from Harvard itself, but he had determined to return to India. He was aware that from Aryabhata in the 5th century to Sawai Jai Singh in the early 18th century India had a glorious past in astronomy. Nevertheless, when he wanted to pursue astronomy, there were no institutions in the country to teach the subject. While the West was making

giant strides in astronomical research by using bigger and bigger telescopes, there were hardly any modern observational facilities in India. Bappu wanted to change all that for posterity. He denied himself all the personal benefits from a job in the West and decided to return home without even the promise a job for his dream of putting India back on the astronomical map of the world.

In the interim period, Prof. K.S.Krishnan, the well-known physicist, arranged for Bappu a fellowship from the National Science Academy, which helped him to carry out some of the work he had brought from Harvard.

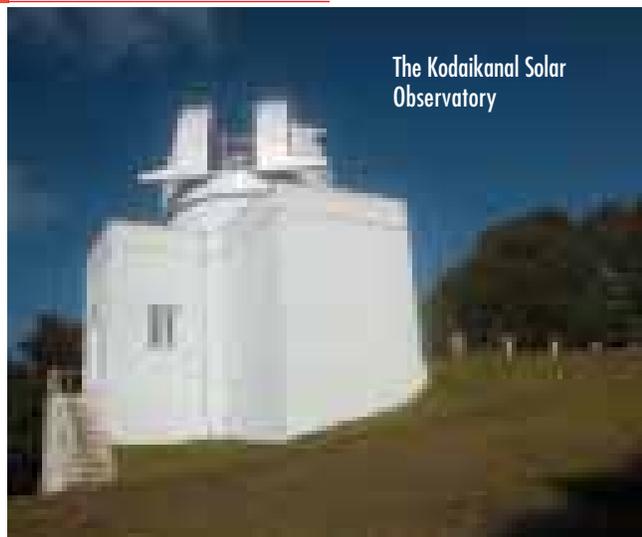
A break came when he was offered the post of Chief Astronomer at the Uttar Pradesh State Observatory, Varanasi. Varanasi was not the best place for an optical observatory, because of the city lights polluting the sky. Bappu shifted the observatory to a more suitable location on Manora Peak, a hilly location near Nainital at the foothills of the Himalayas. In the next few years, he not only equipped the observatory with better instruments but also gathered and trained a group of young astronomers.

As early as in 1945, the Government of India as part of its policy to encourage science and technology constituted a committee under the leadership of the famous astrophysicist Prof. Meghnad Saha to revive astronomical research in the country. The committee recommended steps to improve the existing facilities and to establish a large observatory so that scientists in India could do front-line research in astronomy.

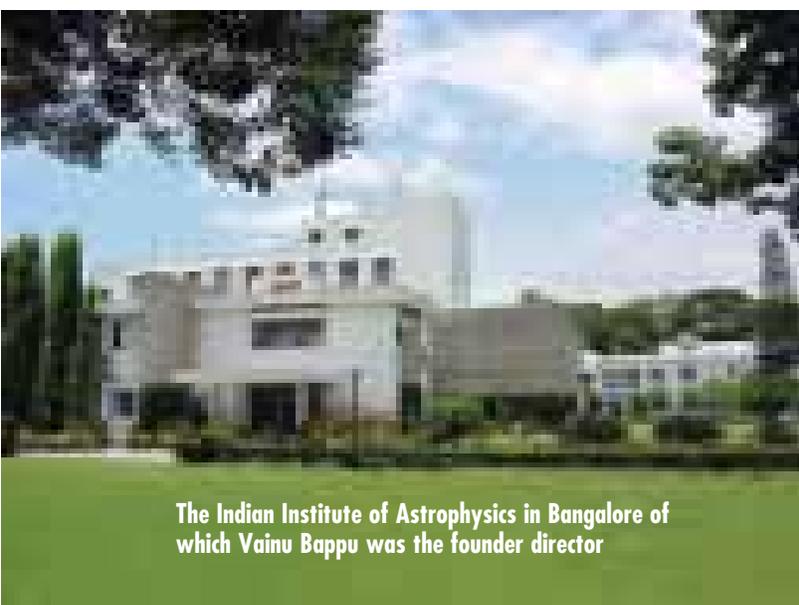
The biggest solar observatory was situated at Kodaikanal. The British originally founded it in 1899. The eminent astronomer Prof. A.K. Das was its Director. The responsibility of carrying out the committee's recommendations fell on Prof. Das. He decided to give priority to those recommendations that could be implemented immediately. He established small observatories at the Universities of Delhi, Agra and Benares to be used for teaching and training graduate students. Then he carried out modernization and expansion of Kodaikanal Observatory and installed a new solar telescope. This enabled Kodaikanal to participate in the International Geophysical Year 1957-58. Prof. Das retired in 1960. Bappu filled his place. He handed over the responsibility of the Nainital Observatory to the batch of young astronomers he had trained and took over the directorship of Kodaikanal. He was just 32 years old.

Kodaikanal was doing excellent work on solar observations. Bappu wanted to extend the activities to stellar observations. But, Kodaikanal was not the best location for a stellar observatory because it is in the path of two monsoons. So he wanted to look for another location where the sky could be clear for a better part of the year. He also wanted the site to be close to the equator in the southern part so that the telescope will have access to almost the entire sky. He combed the entire southern India and finally selected a site amidst the dense sandalwood forest near a village called Kavalur in Tamil Nadu. It was surrounded by hills creating a natural trap for still air. The dense forest-cover reduced ground heating minimizing perturbations to the incoming stellar light.

Bappu immediately started setting up the observatory on a 40-acre forestland near Kavalur. By 1967, a 38-cm telescope, though small from modern standards, was installed and stellar observations started earnestly. Then he persuaded the authorities to purchase a 102-cm telescope from Carl Zeiss, Germany. He had planned everything so thoroughly that accessories like the spectrograph and other instruments were ready by the time the



The Kodaikanal Solar Observatory



The Indian Institute of Astrophysics in Bangalore of which Vainu Bappu was the founder director

German engineers installed the telescope in 1972. In fact, he and his associate A.P. Jayarajan, who was a specialist in optical instrumentation, learnt German language much before the German engineers arrived so that they could know from them all the finer aspects of the telescope for independently carrying out the repair and maintenance in future.

Within months after installation, using the 102 cm telescope astronomers at Kavalur discovered the existence of an atmosphere in the Jovian satellite Ganymede. A few years later, they discovered rings around the planet Uranus.

Bappu was not to rest on laurels. He had bigger dreams. At Palomar, he had worked with a 200-inch telescope for stellar observations. His dream was to set up a large stellar observatory in India, comparable to the best anywhere in the world. The Saha Committee's recommendations for setting up a large observatory provided a good platform for him to launch his dream project. He prepared a project report for a 93-inch (234 cm) reflector telescope for Kavalur. It was expensive and finance was hard to come. And there were other administrative problems to overcome.

Indian Institute of Astrophysics

At that time, Kodaikanal and the Kavalur observatories were under the Department of Meteorology of the Government of India. He had to wait for every financial sanction to come from Delhi. He felt that for healthy growth of astronomy in India, it was necessary to have an autonomous organization with its Director having adequate financial powers. With the support of leading scientists of that time, Bappu was able to convince the government and on 1 April 1971 the Indian Institute of Astrophysics was born with the Kodaikanal and Kavalur observatories as its constituents. Bappu was appointed as the founder Director.

In 1975, the Institute established its headquarters in Bangalore opening up various areas of research in astronomy, astrophysics and related topics. He introduced in-house computer facilities to boost research, encouraged seminars and colloquia for free flow of ideas, and training programs for new recruits. Today, the Indian Institute of Astrophysics (IIA) stands as a testimony to Bappu's vision and liberal thinking and has become the cradle of optical astronomy in the country.

Bappu put up a proposal for a 234-cm telescope to the Governing Council of the Institute. To cut costs he offered to indigenize the project as much as possible. Only the mirror blank would be imported. The rest of the jobs like grinding the block to the shape of a parabolic concave mirror, design and construction of the telescope mount, movement and control all would be carried out locally. The Committee approved the proposal and decided that it would be a national facility available for all astronomers in India.

The mirror blank arrived from Germany in May 1974. It was 2.5 meter in diameter, 50 cm thick and weighed four tonnes! By far, the most demanding task in building such a huge telescope was the fabrication of the mirror. The optical experts at the IIA had experience of grinding only small mirrors. Compared with that, this was a gigantic task. However, after a short training abroad they were able to build a special machine that could handle such a huge blank and started the grinding work towards the end of 1979. Because of the high precision required it was an agonizingly slow task.

Meanwhile, civil construction of the telescope building at Kavalur also began. Fabrication of the telescope mount, the circular track for rotating the telescope to follow the stars, the telescope dome, etc were entrusted to specialist workshops in different parts of the country. When everything was going smooth, tragedy struck. Suddenly, Bappu was no more.

A One Way Journey

During all these institution-building activities, Bappu did not ignore his research interest in astronomy. He continued the study of Wolf-Rayet stars and calcium emission lines in stellar chromosphere and finally became an authority on those subjects. He had more than 90 scientific publications. And he loved chasing solar eclipses wherever they occurred to study solar corona. For his outstanding contribution to astronomy he received many awards, both Indian and foreign. The President of India decorated him with Padma Bhushan in 1981. His highest recognition came when he was elected President of the International Astronomical Union for the years 1979-1982, an honour that made the entire astronomical community in India proud.

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Vainu Bappu Father of Modern Indian Astronomy

(Continued from page 31)

The International Astronomical Union (IAU) holds its General Assembly once in three years at which the President would address the astronomers gathered from around the world. The 18th General Assembly was to be held in Patras, Greece on 23 August 1982. Bappu, as its President was looking forward to address the Assembly. On his way to Patras, he had a stopover at Munich, Germany. There he suffered a severe heart attack and had to undergo emergency by-pass surgery at the Munich Hospital. His wife Yemuna was with him. Just before the operation, he was planning to finish the Kavalur telescope project and getting the IAU to hold its 19th Assembly in India.

But fate had other designs. Two days after the surgery, complications developed and Bappu breathed his last on the afternoon of 19 August 1982. He was just fifty-five. His mortal remains were flown back to Bangalore and according to his wishes the ash was immersed in the river Kaveri. Bappu had traveled to that distant land to become one with those little twinkling stars, which he probed all through his career to understand them.

Condolences and tributes poured in at the IAU General Assembly at Patra, which he was to address. The news was received in India with shock, disbelief and profound sorrow. An eerie gloom filled the skies of Bangalore, Kodaikanal and Kavalur.

But the scientists and technologists at the IIA loved their leader too much to let grief overtake them. They rededicated

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themselves to the realization of Bappu's dream—the 2.34-meter stellar telescope at Kavalur. It was inaugurated and dedicated to the nation on 6 January 1986 by the then Prime Minister Rajiv Gandhi. He named it the Vainu Bappu Telescope and the observatory the Vainu Bappu Observatory.

The IAU, during its 19th General Assembly held at New Delhi, honoured its past President by naming an asteroid after him.

Today, astronomy in India has grown leaps and bounds—not just in the optical wavelength but also along the entire electromagnetic spectrum, from infrared to gamma ray. It owes much to the vision and dedication of one man—M.K. Vainu Bappu.

Bappu was married to Yemuna, a post-graduate in political sciences. A charming, gracious hostess that she was, she took personal interest in the welfare of the staff members of the Institute. The Bappus had no issues. Yemuna lives in Koramangala, close to the IIA, whose staff even now fondly address her "Ammu" and invite her to participate in all the functions of the Institute.

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Science Reporter's

Science Fiction & Science Cartoon Competition

Results!

Science Fiction Competition 2010

Best Entry: *Mirror, Mirror on the Wall!* by Shripad Dharkar

Second Best Entry: *Head Louse Turns Super Bug* by Samiya Fatima

Third Best Entry: *Atrophy* by Pranab Mazumdar

Science Cartoon Competition 2010

Best Entry: *Wake up* by Deepa S. Kumar

Second Best Entry: *Water Crisis* by Rehan

Third Best Entry: *Newton's Way to Catch the Lion* by Prateek Gupta

Fourth Best Entry: *The Natural Time Machine* by Mansi Mandal

The winning entries would be published in the forthcoming issues of **Science Reporter**.

CONGRATULATIONS WINNERS!