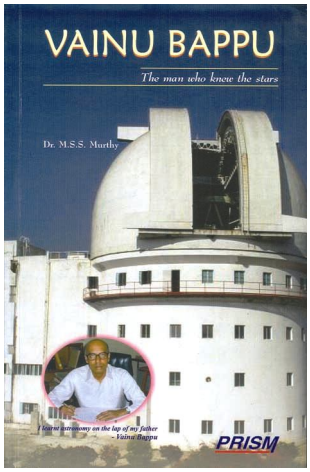


**Vainu Bappu: The Man Who Knew the Stars.** M. S. S. Murthy. Prism Books Pvt Ltd, 1865, 32nd Cross, 10th Main, BSK II, Bengaluru 560 070. 2011. 164 pp. Price: Rs 125. ISBN 978-81-7286-721-8.

Manali Kallat Vainu Bappu (19 August 1927–10 August 1982) can truly be called the modernizer of optical astronomy in India. He came of age at a time when India had just gained independence. Idealism and nationalism permeated the whole atmosphere and foreign training was seen as an aid towards institution-building back home. Bappu was the first full-time director of Uttar Pradesh State Observatory, Naini Tal, where he served from 1954 till 1960. He then took over as Director of the Solar Physics Observatory, Kodaikanal, under India Meteorological Department (IMD). In 1968, he set up an additional stellar observational facility at Kavalur in Javadi Hills, Tamil Nadu, and finally overcoming stiff opposition from the parent department, succeeded in 1971 in converting the Kodaikanal Observatory into an autonomous Indian Institute of Astrophysics (IIA). Interestingly, once the creation of IIA as an autonomous institute became unavoidable, IMD yielded with good grace and suggested that the new institute carry a befitting name; the suggestion of the present name came from IMD[1].

Bappu's personal scientific work and institutional initiatives were recognized nationally and internationally in his own lifetime. He was awarded the Shanti Swarup Bhatnagar Prize in 1970, elected the first president of the newly constituted Astronomical Society of India in 1973–74, and awarded Padma Bhushan in 1981. The world astronomical community bestowed on him the highest honour possible. It elected him as President of the International Astronomical Union in 1979 for a three-year term. He was the first incumbent from outside the Western world. Bappu's untimely death prevented him from presiding over its 1982 General Assembly. He passed away as his heart condition had aggravated and bypass surgery in Munich was of no avail.

Like all eminent persons, Bappu was fond of talking about his work and life. After his death, a number of biographical memoirs were written for various scientific journals. They were largely based on personal knowledge and on Bappu's own statements. Anyone attempting to write a biography must first of all familiarize himself with all that is already in print. Next the prospective biographer should speak to those who knew the subject themselves or about him. Following this the biographer should go to the primary sources to authenticate known information, separate facts from legends and gather more information. Finally, the life and work of the subject should be sought to be placed in a larger context. M. S. S. Murthy (a retired scientist from Bhabha Atomic Research Centre) has attempted to write a 'formal biography' of Bappu, but regrettably has not been up to the task.

This book is poorly researched and badly arranged. There are unnecessary digressions and factual errors. Limitations of perception have led the author to create an imaginary screen play. There is frequent misuse of inverted commas. Choice of words and phrases is thoughtless and copy-editing sloppy. There are a number of photographs, but they are the size of a postage stamp. There is no index. A bibliography has been inserted at the end, but there are no references even when direct quotes are used. The author has heavily depended on official reports, which by definition cannot be a source of much biographical information. A string search on the internet reveals that the book abounds in copy-and-paste jobs.

The author has got the Foreword written by M. G. K. Menon, who was the chairman of the IIA governing council during Bappu's directorship and even later. Curiously, the author does not list in his bibliography Bappu's obituary co-authored by Menon, even though quotes, such as 'I learnt astronomy in the lap of my father' and 'Whatever you do, do with deliberation', seem to have first appeared in it[2].

There is a totally unnecessary and unreliable chapter on ancient Indian astronomy, where the author makes the irresponsible statement that Aryabhata asserted that the Earth goes around the Sun (p. 49). If an index of all the names mentioned in the book were prepared, one would get the impression that the book was a world astronomy encyclopedia. In most cases, no context is provided. In some cases, even the initials are not provided. Inexcusably there are wrong spellings. Descriptions are largely superficial. Meghnad Saha 'of Kolkata' is lauded for clearing 'the confusion in interpreting the stellar spectral lines' (p. 39). V. Radhakrishnan whose relationship with Bappu was marked by mutual respect is introduced merely as the editor of the *Journal of Astronomy and Astrophysics* and quoted on Bappu on a trivial and well-known matter, namely the calculation of the orbit of the comet co-discovered by Bappu (p. 21).

Bappu would surely have looked askance at the author's description of stellar spectroscopy as 'the horoscope of stars' (p. 32). Once the well-known astrologer B. V. Raman made his appearance in the Kodaikanal campus and expressed a wish to see Bappu. A terrified Bappu hid himself in the solar telescope tunnel and did not come out till Raman had given up and departed.

An abiding influence on Vainu Bappu was his father, who was an observer at the Nizamiah Observatory. As it turned out, Bappu professionally came to be known by his father's name rather than his own. Traditionally, his name would

A view of the Kadaikanal Observatory. Library building is in the front. To its left can be seen the dome of the solar tunnel telescope. In the extreme left is the historic building where Evershed Effect was discovered in 1909 (photo: R. C. Kapoor).

have been M. K. Vainu, but the convent school where he enrolled wanted him to have a last name. It was then that his father's personal name was added to his own[3]. Bappu joined Nizam College, Hyderabad in 1942 after high school and remained there till 1948. He obtained his B Sc in 1946 and M Sc in physics in 1949, both from Madras University. He was Burnett scholar in physics 1944–1946, and fellow of Nizam College 1946–1948. His Master's was a research degree for which he carried out experimental studies of amethyst quartz under the supervision of J. C. Kamesvara Rav, physics professor at Nizam College, Hyderabad[4]. Bappu obtained a Hyderabad government scholarship 1949–1951, which he utilized to obtain his Ph D from Harvard University. He completed his doctoral work by August 1951 and received the degree in 1952. From 1 September 1951, he worked for a year at Mount Wilson Observatory as a fellow of the Carnegie Institution of Washington receiving a grant of US$ 3000 (ref. 4).

In January and June 1946, he published two papers in *Current Science*[5]. As a senior student, he came into contact with C. V. Raman and even made research use of the astronomical facility at the Raman Research Institute, Bangalore[6]. Bappu published these results from Harvard in 1950 in the *Astrophysical Journal*[7], no doubt to strengthen his Carnegie application. The Raman contact would stand Bappu in good stead on return.

The Science Congress held at Delhi in January 1947 under the presidentship of Jawaharlal Nehru indirectly came to mould Bappu's career. One of the delegates was the Harvard astronomer Harlow Shapley, who was attending in his capacity as the President of the American Association for the Advancement of Science. After the Congress, Shapley came to visit Osmania University. Perhaps too timid to telephone him for an appointment, young Bappu gathered intelligence on Shapley's routine, waited for him outside the hotel and introduced himself when Shapley stepped out for a walk. The encounter led to Bappu going to Harvard for his Ph D. Three decades later, in 1979, a well-placed Bappu got a chance to do a Shapley. At the time Bappu was temporarily staying in the IIA guest house. One morning when he came out to go out for his regular morning walk, he was greeted by a young man who requested Bappu for employment. Reminded of how he himself had met Shapley, Bappu acceded to his request[8]. The author says (p. 15) that 'Shapley's secretary would not let Bappu meet the professor without appointment', but 'Bappu insisted that he is a student and should meet the professor', who then 'agreed to meet him'. A visiting American astronomer being accompanied by a personal secretary is a figment of the author's imagination.

An actively star forming galaxy (NGC 4449) as seen in a VBT study. (Vainu Bappu Telescope: Silver Jubilee, 2011, IIA.)

Bappu began his graduate studies at Harvard College Observatory in February 1949. Five months later, in July 1949, he and his collaborators announced the discovery and orbit of comet Bappu–Bok–Newkirk. Displaying monumental illiteracy, Hyderabad bureaucratic circles viewed the discovery as a violation of the terms of scholarship conditions, because Bappu was sent to observe eclipsing variables and not discover comets[9]. The book's assertion that 'the Government of Hyderabad, which had given the scholarship to Bappu to do research in astronomy at Harvard, felt he was wasting his precious time discovering comets!' (p. 22) is wrong. The bureaucracy made a distinction between binaries and comets and not between astronomy and comets.

During his stay at Mt Wilson, Bappu collaborated with Olin Chaddock Wilson on what is now known as the (empirical) Wilson–Bappu effect (the discovery paper was published in 1957). Where Bappu stood in the eyes of his Harvard professors in 1951 can be seen from the letters they wrote to Ira Sprague Bowen, Director of Mount Wilson and Palomar Observatories, in support of Bappu's Carnegie application[10]. At the time of his arrival in Harvard, Bappu 'had had no real experience in speaking English and not very much background in astronomy'. 'He picked up the language with amazing speed' and came to have 'complete control of the spoken language'. While most graduate students passed all three preliminary examinations for admission to candidacy to Ph D in their second year, Bappu cleared them after the first year itself and that too with excellent grades. 'This establishes his excellence as a scholar.'

'[a] rather sensitive but socially well developed individual', Bappu had 'a great deal of ambition and a great deal of respect for his elders and for individuals in general'. Harvard would have been happy to hire him as an instructor, but Bappu was very keen to go to Mt Wilson 'to extend his experience over as wide a field as possible before he returns to India'. Shapley was convinced that Bappu 'is definitely on his way to being the leading observing astronomer in India', while the department chairman Fred L. Whipple was certain 'that Vainu Bappu represents our first opportunity to send back a man who may be able to make real strides towards developing astronomical observatories in India'.

His first task on return to India in December 1952 was to find regular appointment of his liking. The scholarship entailed a condition that he would serve the University on return. Osmania University offered him a lecturer's position in the physics department, which was not acceptable to him. He would have accepted a similar position in astronomy, but none was available. The book blandly says that the Observatory Director Akbar Ali came to his rescue (p. 55). This is not correct. While Ali would no doubt have been sympathetic to Bappu's cause, he had no administrative authority in the matter. According to Bappu, rescue came from Raman. It was Bappu's good luck that Raman's student S. Bhagvantam was the Vice-Chancellor of Osmania University. Bappu asked Raman to intercede with Bhagvantam on his behalf. At the end of Raman's visit to the University when Bhagvantam was accompanying him to the airport, Raman asked him to sit with the driver and Bappu at the back with him. Once Bappu had explained his situation, Raman asked

Bhagvantam to let Bappu go (ref. 1). Things moved fast after that. In July 1953, Bappu joined Nizamiah Observatory as a guest investigator[11], and in January 1954 obtained a senior research fellowship of the National Institute of Science (now Indian National Science Academy). Uncertainty in Bappu's career came to an end in November 1954 with his appointment as chief astronomer of the newly founded Uttar Pradesh State Observatory, then located at Varanasi and later (November 1955) shifted to Naini Tal.

It is a little known fact that India's entry into space age began at Naini Tal with Bappu's old Harvard connection helping transcend Cold-War constraints. Naini Tal was chosen as one of the 12 world stations for tracking American as well as Soviet satellites with the help of a Wilson–Bappu camera supplied by USA[12]. The programme, which was part of the International Geophysical Year (IGY), was headed by Whipple, now the Director of Smithsonian Astrophysical Observatory. The installation of the camera at Naini Tal was carried out by Samuel Whidden, who had been Bappu's classmate at Harvard[13]. Incidentally, it was as a part of the IGY programme that Kodaikanal purchased in 1958 a large solar tunnel telescope, which has remained the mainstay of the observatory. It was installed by the then Director A. K. Das, but made operational by Bappu immediately on arrival. It will however be rash to say with the book that observational facilities at Kodaikanal were modernized by Bappu on arrival in 1960 (p. 145).

In 1965, land was acquired in Kavalur and a 1m telescope ordered from Carl Zeiss, Jena, East Germany. Regular commencement of observations began in 1968 with a 38 cm aperture reflector built in the Observatory's optical and mechanical workshops and attached to an old mounting. The Zeiss telescope was received in March 1969 and commissioned in 1972. In the meantime, on 1 April 1971, the autonomous IIA came into being.

It was a relatively easy matter to create the Kavalur field station as part of the existing set-up. But creating an autonomous institute with headquarters in Bangalore faced political and bureaucratic hurdles. A member of the Parliament from the Dravid Munetra Kazhgam (DMK), which came to power in Tamil Nadu (TN) in 1969, wanted to know on the floor of the House, if it was a fact that because of this new development the Central Government was shifting its institutions from TN to Karnataka. The then Minister of Civil Aviation and Tourism under whose charge IMD fell, instead of explaining the circumstances and emphasizing the creation of a new facility in TN itself, flatly denied the move resulting in a delay of probably two years.

The bureaucratic hurdle, however, was the more serious. Bappu got a fairly big-sized plot of land allotted for the proposed institute from the Bangalore Development Authority in Koramangala locality, contiguous with St John's Medical College. Because of the non-payment of dues in time by the IMD, the allotment was cancelled and the land was transferred to the College. Bappu eventually managed to acquire a smaller plot, which now houses the Institute.

Bappu's swansong was the 2.3 m aperture telescope designed and built within the country. A blank of Zerodur glass was purchased from a West German firm and painstakingly transformed into a smooth paraboloid mirror, while the mechanical parts designed by Tata Consulting Engineers, Mumbai, were fabricated by the Pune-based Walchandnagar Industries[14]. While the 2.3 m telescope has been a scientific and engineering success, it did not become a trendsetter. The mirror of 1.2 m infrared telescope of Gurushikhar Observatory was figured at IIA, but later, the exercise was declared to be not a complete success and the mirror was secretly sent to England for reworking. No more optical telescopes were made in India. The case of radio telescopes has been different. Given the competence of Indian electrical and electronics industries, it has been a relatively easy task to make them in the country. In any case, the concept of national science does not quite fit into the globalization era mindset.

The book is completely off the mark when it says that Bappu 'had in front of his eyes the examples of the Bhabha Atomic Research Centre, Mumbai and the Indian Space Research Organization' (p. 72). If anything, Tata Institute of Fundamental Research (TIFR) would have been his role model. During my last major conversation with Bappu, while driving with him from Bangalore to Kodaikanal in April 1982, I asked him why he did not join TIFR. He did say something, which however was not an answer. The impression I got was that from very early days, he had set his eyes on Kodaikanal, which was well-known throughout South India as an astronomical centre and a vast estate. He did say that Bhabha invited him to, give a lecture and asked M. G. K. Menon to take notes. Menon as the Chairman of the Institute's governing body was a great source of strength to Bappu. But ironically he was not the first choice. Bappu wanted Satish Dhawan, who at time was going to California Institute of Technology and was therefore not available[15].

Bappu would have been happier if he did not have to carry the historical baggage of IMD. In 1972, Udaipur Solar Observatory was established by Arvind Bhatnagar under the aegis of Vedhshala (Sanskrit for observatory), Ahmedabad. Earlier, Bhatnagar had obtained his Ph D for work in Kodaikanal under the supervision of Bappu, who also arranged a Carnegie fellowship for him. In December 1981, the Udaipur Observatory was taken over by the Department of Space and subordinated to Physical Research Laboratory, Ahmedabad. Interestingly, the Observatory was first offered to Bappu who, however, declined on two counts. It would have been difficult to operate it from a great distance. Furthermore, since Bhatnagar was at a fairly junior level in Kodaikanal, his absorption into IIA would have upset the hierarchy.

On Bappu's death, his deputy Jagdish Chandra Bhattacharyya was given the charge, although inordinate delay in his confirmation weakened his authority. Ever a loyalist, he set out to complete the unfinished task, more like an American Vice-President completing the term of a deceased President. In November 1985, when the 10-day General Assembly of the International Astronomical Union was being held in New Delhi, Menon brought the news that Prime Minister Rajiv Gandhi, along with his children, would like to visit Kavalur to observe Halley's comet. The opportunity provided by the visit on 6 January 1986, was taken to get the Prime Minister to release an official brochure[11], formally inaugurate the telescope and name it, as well as the Observatory after Vainu Bappu. The first light from the telescope was received in October 1985. The book is in error when it says that Rajiv Gandhi 'used' a room in the 2.3 m building 'for one night' (p. 7). A moment's reflection would show that this was not even

possible. A newly constructed building, which is barely ready, cannot possibly have a guest room for anybody, leave alone worthy of a prime minister.

The early years of the autonomous Institute were quite stressful for Bappu, because of the intransigence displayed by some members of the Governing Council. Much to Bappu's embarrassment, a Council member from a University remarked to the effect that Bappu had a budget of 40 lakh rupees and an output of 40 research papers, meaning that each paper cost a lakh of rupees.

In 1975, the Institute's total budget was 58 lakh rupees. In four decades it has gone up to about 52 crores, a 900% increase. There is great virtue in adversity while easy money tests the mettle of the recipients. The Bappu era came to an end soon after Bhattacharyya's retirement. Bappu's bust for which subscription came from Bappu's friends, students and admirers in India and abroad and which was formally unveiled by M. G. K. Menon in the presence of Yemuna Bappu, Bappu's wife, was detached from its substantial base and shifted to an inconspicuous location inside the library.

The Institute now has a number of field stations, including a remotely controlled 2 m telescope at Hanle, Ladakh. It would be instructive to commission a scientometric study of astronomical output during the last six decades, not only from the IIA, but from other centres also, to see how trends have changed over time; how observational astronomy fares vis-à-vis theoretical studies; what percentage of observational papers are based on data taken with Indian facilities, and what is the nature of collaboration within India and overseas.

There is no gainsaying the fact that Bappu's legacy survives. He transformed modern astronomy into a vibrant collective research area. Not only was he a source of inspiration to his students and colleagues, but also served as a role model for those from other optical astronomical centres. He had consciously modelled himself after a 19th century English gentleman. There was nothing petty or crude about him. There were cleverer people around him, but he would deal with them only according to the standards he had set for himself; his angriest outburst was 'these sons of bachelors'[16].

If the author had written the biography in Bappu's lifetime and shown the manuscript to him, he would have in all likelihood beamed a charming smile at the prospective author and told him: 'I say, why don't you drop the idea'.

1. This and subsequent statements are based on personal conversations with Bappu during 1974–1982. I quote from memory and have made no effort to seek corroboration from official records or elsewhere.
2. Kochhar, R. K. and Menon, M. G. K., *Bull. Astron. Soc. India*, 1982, **10**, 275–289.
3. This was narrated to me by Bappu while he was signing a bundle of certificates to be awarded at the first staff club function. While narrating this story, he automatically began writing his name as M. K. Vainu Bappu than the usual M. K. V. Bappu. Based on personal conversations with Bappu during 1974–1982.
4. Bappu, M. K. V., *Indian J. Phys.*, 1951, **1**, 1–14. Interestingly, this and other papers were obviously sent when Bappu was in USA, but they carry his college affiliation.
5. Bappu, M. K. V., *Curr. Sci.*, 1946, **15**, 18–19; 190–191.
6. Raman Research Institute owned three telescopes: with a 5-in Bausch and Lomb lens, 4½ – in Watson lens, and 4-in Zeiss lens (personal letter from S. Ramaseshan to R. Kochhar; 16 April 1993).
7. Bappu, M. K. V., *Astrophys. J.*, 1950, **111**, 201–202.
8. The beneficiary who retired recently corroborates the narration.
9. Kapoor, R. C., *Curr. Sci.*, 2013, **105**, 116–121 discusses the question at length.
10. Huntington Library Archives, Ira Sprague Bowen Inventory, Box 18.277 A. This valuable primary source does not seem to have been tapped before.
11. Ali, A., *Mon. Not. R. Astron. Soc.*, 1954, **114**, 338.
12. Kochhar, R., *Curr. Sci.*, 2008, **94**, 813–816.
13. Muir-Harmony, T., *Globalizing Polar Science: Reconsidering the International Polar and Geophysical Years* (eds Launius, R., Fleming, J. and DeVorkin, D.), Palgrave Macmillan, New York, 2010, p. 289.
14. Kochhar, R. K., Indian Institute of Astrophysics [an official brochure]; reprinted and revised many times, 1986.
15. Satish Dhawan, Personal conversation, 1986.
16. Kochhar, R. K., *The Week*, 9–15 February 1986, pp. 22–24.

ACKNOWLEDGEMENTS. I thank Catherine Wehrey, Dibner Reader Services Assistant at The Huntington Library, San Marino, California, USA, for providing me with a complete copy of Bappu's application for a Carnegie fellowship. The author was at Indian Institute of Astrophysics, Bangalore during 1974–1999.

RAJESH KOCCHAR

*Mathematics Department,*
*Panjab University,*
*Chandigarh 160 014, India, and*
*Indian Institute of Science Education and Research,*
*Mohali 140 306, India*
*e-mail: rkochhar2000@yahoo.com*

**Annual Review of Genetics, 2013.** Bonnie L. Bassler *et al*. (eds). Annual Reviews, 4139 El Camino Way, Palo Alto, CA 94303-0139 USA. vol. 47. 646 pp. Price: US$ 92.00.

The last five years have seen a remarkable development in high throughput technologies such as DNA sequencing and gene disruption methods that are now being used by vast majority of geneticists for addressing many genetic questions. This volume of the *Annual Review of Genetics* (*ARG*) has many articles that review the progress of genetics using these new technologies. Similar to previous volumes of *ARG*, this one has covered several areas of genetics, including population genetics, epigenetics, bacterial genetics and molecular genetics, giving a gist of overall developments in the field, during the past few years.

In spite of their implication in cancer, ageing and a number of rare genetic diseases, the sources of genome instability have not yet been studied in detail. The high frequency of externally caused DNA damage can be one of the main sources of genome instability. In this issue, Anguilera and Muse review the causes of genome instability as well as how it results in hyper-recombination, genome rearrangements, and chromosomal fragments and loss. In the related subject of genetic mutations, Nakamura *et al*. review the effect of radiation on human heredity. According to them, environmental contamination resulting from massive releases of radionuclides has caused concern over the resulting health risks from exposures to low doses of radiation.