Bull. Astr. Soc. India (2006) **34**, 65–81

The Uttar Pradesh State Observatory – some recollections and some history (1954 – 1982)

S. D. Sinvhal*
91 Vigyan Kunj, I.I.T. Roorkee, Uttaranchal 247667, India

Abstract. An attempt is made to present a picture of pre-historic and initial formative years of the well known Uttar Pradesh State Observatory, Nainital. The development of academic activities along with infrastructure are described. The emphasis on the frontline research work, self-reliance and international interaction was given during the formative years of the observatory. The largest telescope 104-cm of the observatory was installed in 1972 and has produced good scientific results.

Keywords : Optical Astronomy; Historical perspective

1. Pre-history

1.1 Introduction

The idea of starting an astronomical observatory in Uttar Pradesh germinated with Babu Sampurnanandji. He belonged to Benaras (present day Varanasi) and started life as a teacher. Brought up under the influence of the Benaras ethos, he was a strong votary of traditional culture. He was deeply interested in ancient Hindu culture including Sanskrit and Phalit Jyotish (astrology). His interest in phalit coupled with his academic bent of mind got him interested in astronomy.

Babu Sampurnanandji was also an ardent freedom fighter. His jail-mates narrate that while under confinement in jail (as a freedom fighter) Babuji used to entertain them with discussions on astronomy and acquainted them with the night sky. Babuji had a modern outlook too and in this respect he was a curious mixture of diverse influences.

*e-mail:sdsinvhal@hotmail.com

Dr. Avadhesh Narain Singh, D.Sc., another son of Benaras and a mathematician, and Babuji were good friends since their early days. Their friendship was based primarily on identity of interests. The two together wanted to do something academically meaningful for their hometown and, at the same time, for the preservation and propagation of ancient Indian traditions, astronomy included.

After Independence, Babu Sampurnanandji became Education Minister in the first popular government of Uttar Pradesh. Dr. Singh had by then become Professor of Mathematics at the Lucknow University. His fields of specialization were Theory of Functions and History of Hindu Mathematics. He co-authored the "History of Hindu Mathematics (2 Volumes)" which soon became a standard work on the subject. He had deep interest in Time and Time Keeping too. The two of them decided to fulfill their cherished dreams and drew up plans for establishing an astronomical observatory with a Time unit at the Government Sanskrit College, Benaras (GSC) (now Sampurnanand Sanskrit Vishwavidyalaya).

In 1950, Dr. Singh went to Europe to attend the World Congress on the History of Sciences (where he was invited to chair the session on the History of Hindu Mathematics). Drs. Sampurnanand and Singh took this opportunity to put their cherished ideas into concrete shape. Under authorization from the Education Minister, Singh negotiated the purchase of a 25-cm, f/15 Cooke visual refractor (on German mounting), an 8-cm, transient instrument, a couple of mariner's chronometers and other ancillary items, from England. These were decommissioned instruments. Purchase order for these instruments was placed by the GSC on his return from Europe.

About the same time, a Standard Time Installation from Rhode and Schwarz of Munich, consisting of two master quartz clocks providing standard frequency outputs at 100 KHz (with a drift of better than 1 part in 10^8) and two slave clocks providing outputs of 1 khz at 1 Volt, were also to provide the same to Varanasi and the rest of India, thus becoming keepers of national standard time. The total cost of these instruments was about Rs. 150,000.

1.2 Committee of experts

In 1952 the Government of Uttar Pradesh appointed a Committee of experts comprising of Dr. Akbar Ali, Director of Nizamiah Observatory (Chairman), Dr. A.N. Singh, Sri Tribhuvan Upadhayay, Principal, GSC, and others. The committee was: (a) To find out and recommend a site, suitable from the points of view of accessibility and available area for future expansion for the establishment of an astronomical observatory, out of the following alternatives in and around Benares: (i) Paharia (ii) Sarnath (iii) Ramnagar, and (iv) Govt. Sanskrit College. (b) To suggest a plan in respect of a building for the said observatory and installation of various instruments therein; (c) To suggest ways and means of developing the observatory into a full fledged astronomical research center; and (d) To indicate the financial aspects of the proposal.

After the consideration, the committee recommended setting up of the observatory at Sarnath. The Committee also recommended that the observatory be divided into two sections, one the "Telescope Section" to be located at Sarnath and the other the "Time Section" to be situated at the GSC. It was recommended that the immediate program of work with the 25-cm refractor would be confined to micrometric observations of comets and asteroids, observations of occultation and measure of double stars. The suggested work of the Time Section from the stars using the transit instrument, the keeping of time using quartz clocks, and the issue of time signals from Benaras. The Observatory was to "work in close cooperation with the Sanskrit College in matters of teaching and research". It was also "expected that the combined staff of the Observatory will cooperate in the study of problems of ancient Hindu astronomy and Hindu calendar and research work in that subject".

The committee recommended for the observatory, when running in full swing, a total of l7 staff (including 6 scientists), a recurring annual grant of Rs.8,000/- and non-recurring grant of Rs. 4.84 lacs for the next five years.

In accordance with the recommendations of the Experts Committee the site at Sarnath was approved by the Government and a fairly large piece of land, including amount and an old building, was purchased by the GSC.

1.3 The standard time installation

The telescope, quartz clocks and other equipment that were ordered arrived in the early part of l953. The Standard Time Installation was installed in one of the towers of the GSC by engineers of Rhode and Schwartz who also trained one Sri G.N. Sharma, a mechanic, in receiving time signals from time installations like Rugby, Irkutsk, Paris, WWV, etc. and monitoring the time kept by the quartz clocks against these signals. It may be remarked that the scheme to relay standard time could not eventually materialize due to lack of permission from the Government of India who were of the view that the responsibility for keeping standard time rested with the National Physical Laboratory who were the sole keepers of national standards and besides, were better equipped for the purpose. The quartz clocks were, however, later useful as sources of standard frequency and also for monitoring time signals from ATA, New Delhi. The results were published.

1.4 Government Astronomical Observatory

Sometime in l953, an institution named Govt. Astronomical Observatory, Benaras (GAO) was instituted under the overall control of the Director of Education, Uttar Pradesh but still as a part of the Government Sanskrit College. Dr. A.N. Singh who had moved over (on deputation) as Principal, D.S.B. Govt. College, Nainital was appointed Hony.

Director of the Observatory till such time as the Chief Astronomer is appointed. Early in l954 the Government of Uttar Pradesh, on a recommendation from Dr. A.N. Singh, approached the Lucknow University to grant the author of this article, who was then Lecturer in the Department of Mathematics and Astronomy of the University, leave on deputation for two years for appointment as Assistant Astronomer at the GAO (Dr. Singh had known me as his Ph.D. student, and later as a colleague). The deputation was granted.

2. The period l954 - 1960: The Observatory comes into existence as an independent unit. Initial formative years. The start of scientific activity

I took over charge as Assistant Astronomer on 20 April 1954. Simultaneously, the GAO was declared independent of GSC and, from then onwards, was to be controlled directly by the Director of Education, as Head of Department, with an office and establishment separate from that of the GSC. We, however, continued to hold office in part of a room of the GSC. Dr. Singh continued as Honorary Director. In July 1954, during the course of his inspection tour to the Observatory, Dr. Singh unfortunately expired at Varanasi.

Dr. M. K. Vainu Bappu, a young, enthusiastic astronomy Ph.D. from Harvard was appointed Chief Astronomer and he took over charge on l November l954. The two of us studied the Experts Committee report and soon came to the conclusion that confining overselves to the topics mentioned therein would not take us far in making the Observatory a "full fledged" centre of astronomical research for which certain vital conditions needed to be fulfilled. Firstly, that the dust and haze of Sarnath, in fact of any place in the plains of Uttar Pradesh, would be unsuitable for establishing a modern Observatory there. Secondly, that the 25-cm refractor could only be marginally useful as an instrument of research and as such larger telescopes of the reflecting types were necessary. Lastly that supporting facilities like a good library, a well-equipped machine shop and an electronic shop were extremely necessary.

Soon thereafter, the Chief Astronomer submitted a report to the Director of Education along the above lines. Dr. Sampurnanand was also apprised of this point of view. While emotionally attached to the idea of locating the observatory at Varanasi, man of few words and quick decisions that he was, Dr. Sampurnanand did not take long to accord his approval to the proposal in the interest of the future of the observatory. After due permission from the authorities concerned, the Chief Astronomer undertook a survey of the regions around Nainital, Dehradun and Mussoorie, as these places seemed likely to offer better observing conditions than the other areas in the State. A comparative report on Varanasi, Dehradun, Mussoorie, Mukteswar and Nainital was submitted to the Government early l955. It was pointed out in this report that Manora Peak, on the outskirts of Nainital, offered comparatively favourable conditions overall for the operations of an observatory, as compared to the other places, consistent with the requirements of present

day optical astronomy. From the meteorological standpoint, the records showed that the rainfall at Nainital, though substantial over the year, was concentrated within the period mid-June to mid September. Again, the Manora Peak area was well protected from the lights of Nainital town by the intervening hills and also did not have much habitation close by. Thus light and smoke pollution were not expected to present problems.

It may be pertinent here to add due to constraints of time and instruments, no detailed objective observations about the skies and seeing conditions at Manora Peak could be made. The choice of Manora Peak was done on the basis of visual observations, on a few nights, of close double stars and stellar diffraction images, with a 2-inch refractor. On cloudless nights the transparency, on subjective estimates, was good. On bright sunny days the sky colour was deep blue. Another factor in favour of Nainital vis-a-vis Mussoorie was on logistic grounds including the fact that the D.S.B. College at Nainital had a well staffed, equipped Physics Department. Authorities of the Municipal Board, Nainital and the local administration promised all help.

In May, l955 the Government announced their decision to have the observatory permanently located on Manora Peak. Understandably, Varanasi locals opposed the decision, but it was Dr. Sampurnanand (Chief Minister by now) who supported us on academic considerations.

2.1 The observatory moves into Nainital

We moved into Nainital in November l955. Prior to that office accommodation had already been arranged at Devi Lodge, which was basically a residential house with some ground open to the south, west and north. Our immediate concerns, on the hand, were acquiring of forest land on Manora Peak, setting the P.W.D. onto designing and construction of approach road and buildings, arranging of infrastructural facilities like water supply and electricity and, on the other, setting up at Devi Lodge, at the earliest, of whatever equipment we had that could be put to use. Planning for the purchase of larger telescopes and equipment for various support facilities was also in the pipeline. All this took a good part of the next one-year. The Forest Department transferred Manora Peak to the Observatory. The hill has a surface area of about 120 acres (48.6 hectares).

2.2 The start of scientific and developmental activities

2.2.1 *Developmental activities*

A machine shop with some tools and a small lathe was setup. Likewise, some measuring and recording instruments and ancilliary tools for an electronic shop were acquired.

2.2.2 *Total Solar Eclipse of June l955*

While still at Varanasi, an expedition to Ceylon (now Sri Lanka) was undertaken to observe the total solar eclipse of 20 June 1955. Dr. Bappu, myself and Sri Murarilal Sharma, Lecturer in Jyotish at the GSC formed the team of observers. The program was to determine isophotes in the corona and to study various parts of the corona by photographic polarimetry. For this a 10-cm f/38 lens (loaned by the Nizamiah Observatory) and an 8-cm telescope (loaned by Dr. Sampurnanand) were used. The two telescopes were mounted on a common two pier mounting at the observation site in Hingurakgoda. A 15-cm f/4 camera on a tripod was also commissioned. The expedition was clouded out.(So also were the optical experiments of the team from the Solar Observatory, Kodaikanal who were located on the same campus as us). Even otherwise, I am not sure if we could have achieved much because of the shaking in the mounting caused by strong winds. One important lesson we learnt that such expeditions have to be planned out, prepared for and repeatedly at the expedition site, well in advance.

2.2.3 *Mars Observations*

The observatory was one of the chains of observing stations assigned to maintain a photographic patrol of Mars during its l956 close approach. The 25-cm Cooke refractor was readied on a concrete platform and was housed in a roll-off shed. Visual observations were started by the middle of August. A photographic observation through yellow and red filters continued until early October. Clouds and dust storms were detected on Mars on certain nights. These were duly reported to the Bureau Central des telegrams astronomiques of the I.A.U.

2.2.4 *Photoelectric photometry and measurement of spectra*

By this time a photoelectric photometer, designed by Bappu got constructed by The Technical Corporation of Lucknow. It was put on the 25-cm telescope for photoelectric BV photometry of galactic clusters and of variable stars. (These were believed to be among the first photoelectric astronomical observations made anywhere in India, perhaps in Asia). The variable stars included Beta Canis Majoris stars, eclipsing variables and short period Cepheids. In some galactic clusters, a survey of H-gamma absorption line intensities in early type stars was made. A programme of measurement of spectra of Wolf-Rayet and other stars, taken by Bappu at the Mount Wison Observatory, was started on a measuring engine loaned by the Physics Department of the DSB College.

Photoelectric measurements of the magnitude and polarization of the nuclei of Comets Arend-Roland (l956h) and Mrkos (l957d) were made through standard B,V filters and

through narrow-band interference filters. A total of 11 research papers embodying the results of the above studies were published.

2.2.5 *The International Geophysical Year (IGY) and associated projects*

During the International Geophysical Year, 01 Jul l957-31 Dec l958, the Observatory was assigned the following three projects by the Indian National Committee for the IGY: (a)Photography of the Moon with Markowitz Camera; (b)Optical tracking of artificial earth satellites; and (c) Visual observations of aurorae. This programme remained a non-starter as no aurora was ever sighted, which is not unusual in the latitude of Nainital.

2.2.6 *The Markowitz Dual Motion Camera*

The camera was designed to take photographs of the moon against bright background stars. It arrived from the U.S. Naval Observatory (USNO) in the last week of December 1957. It was a collaborative programme in which a number of observatories were participating. After making necessary adjustments on the 25-cm telescope, the camera was fitted on to it in March 1958. The purpose of this project was to estimate accurately the position of the lunar centre, and thence an accurate estimate of the observer's position. The observations were sent to the USNO for reduction and collation. A total of 284 plates were sent.

2.2.7 *Optical tracking of artificial earth satellites*

The project on optical tracking of artificial earth satellites was to be carried out in collaboration with the Smithsonian Astrophysical Observatory (SAO), U.S.A. A special telescope, named the Baker-Nunn Camera, was used. The telescope is an f/l system employing a 79-cm aperture primary and a 51-cm diameter corrector disc, and having a 30 degree x 5 degree curved field of good focus. The B-N Camera and the associated equipment including a Norrman quartz clock recording time to 0.00ls, with an accuracy of 0.0025s, ancillary electronic equipment and a 1/2 ton truck arrived from SAO in April/May, 1958. The B-N station was part of a worldwide network of l2 stations set up and monitored, by SAO. A camera house, to SAO specifications, was expeditiously set up and the camera installed. The first track of an artificial satellite recorded by the B-N Camera at our station was on l2 November 1958. The programme was continued well beyond the IGY.

The scientific programme included, among others, the determination of the shape and size of the earth, intercontinental distances, the nature and extent of the earth's atmosphere and of its magnetic field, and meteorological observations. Since all of the

B-N stations were already connected to the then existing major geodetic datum and their coordinates in these respective datum were known, a comparison of datum geodetic coordinates with these coordinates would enable conversion of geodetic coordinates to this new *universal geodetic datum*.

The project on optical tracking of artificial earth satellites continued. The performance of our station was highly satisfactory. Since accurate time reckoning over the 12 BN stations was vital to the project, SAO occasionally airlifted a portable rubidium clock from Cambridge against which the Norrman clocks were calibrated. This became necessary to obviate inaccuracies caused by propagation-time errors in time signals from WWV, Rugby etc. On one of these checks, the clock at our station was found to have an accumulated error of 240 ± 20 microseconds only, over a five year period. On the basis of monthly statistics provided by SAO, *on many occasions* the success percentage of tracked satellite transits at our station was the highest among the 12 SAO stations. The programme continued till 1976. By then over 45,700 satellite transits, including those of the Indian satellite Aryabhatta, were successfully recorded.

As a result of this activity the position of the B-N Camera at the Observatory was determined to *an accuracy of better than 10 meters on a world-datum* (Longitude:$79^\circ 27' 25.5''$ E; Latitude: $29^\circ 21' 39.0''$ N; Altitude over mean geoid:1927 m). It became among the few locations on earth with coordinates so precisely determined. Subsequently, around 1975 (or so) the Survey of India tied their triangulation network to this benchmark.

For the first few years, an observer from the SAO took part in the activities of the station along with the staff of the observatory. To begin with the CSIR (India) sanctioned two posts of Senior Scientific Assistants and two of Junior Scientific Assistants for the project. After some time these were withdrawn. Perhaps we were not contributing worthwhile science out of this project!

It is pertinent to note that in a project such as this, it is the observations taken over an entire network of station suitable spread over the globe that could yield meaningful results. The observations from a single station would not be equal to the purpose in mind.

From hindsight, the advent of the GPS has now provided a facility far simpler, manageable and universally useful than the B-N Camera, in so far as *position determinations* are concerned. The B-N Camera, on its turn, had already superseded the objectives of the Markowitz Moon Camera.

2.2.8 *Occultation of Regulus by Venus*

An occultation of Regulus by Venus was predicted for 7 July 1959. The event was to be observable from places in south India. A team of 5 persons, including 3 scientists

(Bappu, Sinvhal and A. Bhatnagar) went to Tuticorin to monitor the event. The project was to study the nature of attenuation in the light of Regulus as Venus passed across it, with a view to obtain information about the atmosphere of Venus. A medium dispersion monochromator with the exit slit centered on the K-line was used. Due to guiding errors, no useful observations could be made.

2.2.9 *Instrumentation*

The Observatory acquired its first reflector, a 38-cm f/l5 (on German mounting) from Fecker (USA), towards the end of l959. It was installed at Devi Lodge in early 1960. Another telescope, 15-cm f/l5 reflector on German mounting (Zeiss,Jena) was acquired in l960. In the meantime, major equipment for building up the machine shop and the electronic-shop, and some measuring instruments were also acquired.

2.2.10 *Library*

By 1960 the library had acquired over 1400 books, besides a numbers of journals with complete back numbers. Exchange relations were established with many observatories.

2.2.11 *Important visitors*

During this period Prime Minister Pt. Jawaharlal Nehru, Chief Minister Dr. Sampurnanand and several other dignitaries visited the Observatory. The last two dignitaries visited us at Manora Peak in the summer of l959 when all that we had there was the satellite tracking unit, that was approachable by just a kuchha dirt road, and the foundations of some other buildings had barely been laid! Incidentally, that was the only occasion when Dr. Sampurnanand visited us!

We were visited at Devi Lodge by several scientists notably by Prof. D.S. Kothari, Prof. Vikram Sarabhai, Prof. Bart J. Bok, Prof. Fred Whipple, Prof. Allen Hynek, Dr. Harlan Smith, etc.

2.2.12 *Administrative and other matters*

Around 1957 the name of the Observatory was changed to "Uttar Pradesh State Observatory" (UPSO) and the designation of the Chief Astronomer was changed to "Director".

In 1957, the administration of the Observatory was switched over from the Education Department to the newly established "Department of Indology, Culture and Scientific

Research", with the Secretary of the Department as the Head of Department. In 1958, the name of the department was again changed to "Department of Cultural Affairs and Scientific Research" which nomenclature continued up to 1975, when there was a further change to "Dept. of Science and Technology".

Through Bappu's efforts, Subhas Chandra, Astronomical Assistant proceeded on long leave for studies at Caltech.

Dr. Vainu Bappu resigned with effect from 31 March 1960 to assume directorship of the Solar Observatory, Kodaikanal. Bappu's farewell conducted (as per his desire) in a telescope rotunda that was still under construction, and was without a roof, was an emotional affair.

3. Period 1960-1982

Dr. Bappu was succeeded by the present author who was Director up to May 1982, when he superannuated. However, for the period December 1978 to May 1981 he was on deputation to Kumaun University as Vice-Chancellor. Dr. M.C. Pande officiated during this period.

3.1 Move to Manora Peak

My priority on assuming charge was to expedite moving over to Manora Peak, which required hastening the construction of buildings and roads by the P.W.D. and arranging for infrastructural facilities like water supply and electricity so that the work could progress unhampered. The main building got completed by September 1961. Shifting from Devi Lodge to Manora Peak took almost a month. The Observatory finally moved onto Manora Peak with effect from 20 November 1961. Residences for the Director, Assistant Astronomer, Scientific Officers (2 nos), Scientific Assistants (3 nos), Technicians (5 nos) and class IV staff (14 nos) were readied by February 1962 when they were occupied.

3.2 Opening ceremony

The opening ceremony of the buildings of UPSO on Manora Peak was performed on 16 June 1962 by Prof. Humaun Kabir, Minister for Scientific Research and Cultural Affairs, Govt. of India. Chief Minister Sri C.B. Gupta presided over the function; Dr. Sita Ram, Minister for Cultural Affairs and Scientific Research was present.

3.3 Advisory Committee (ADCOM)

When I assumed directorship of UPSO, we had Sri M.Zaheer, IAS as Joint Secretary-cum Director, who took positive and keen interest in his charge. He was an academically inclined person and, at the same time, he believed in good administration for which he even trained me. He gave me full freedom including, as he put it, "the freedom to make mistakes". I could then shape things my way.

Among the steps he took, that had far reaching influence on the course of UPSO, was the constituting of a high powered Advisory Committee. The Committee, headed by the Minister-in-charge, had four top officials of the government (Chief Secretary, Finance Secretary, Planning Secretary, Science and Technology Secretary) and about eight to ten scientists, nominated on the recommendation of the Director, as members. The Committee was reconstituted every three years. The Committee variously had Drs. K.D. Abhyankar, R.K. Asundi, A. Bhatnagar, P.L. Bhatnagar, V.G. Bhide, Govind Swaroop, Harsha Vardhan, P.K. Katti, K.N. Mathur, N.C. Mathur, A.P. Mitra, S.K. Trehan, M.S. Vardya, and others, as members. The Committee usually met once in a year. A total of 14 meetings were held between 1963-1979.

ADCOM served three important functions. Firstly, it gave the senior members of the administration an opportunity to interact with the scientists, who were leaders in their respective fields, about the quantum and quality of the work we were doing; secondly it gave an opportunity to the scientists to assess the work being done here and to interact with the scientific staff; lastly, it gave the Director an opportunity to place his problems, bottlenecks and needs before the government who, on their turn, had the opportunity to have expert advice thereon. I shall like to emphasize that ADCOM served a positive and useful role in the progress of UPSO.

3.4 UPSO upgraded to be a Department

The Observatory was made a full Department of the State of Uttar Pradesh in 1965 with the status of Director raised from that of Head of Office to Head of Department. This implied more financial and administrative powers and freedom to take many decisions for which earlier one had to approach the Government. The Director now had the powers to send staff on tours within India, to appoint non-gazetted staff and also to make temporary appointments on posts up to those of Scientific Officer. This was again done on the initiative of Sri Zaheer.

3.5 Recognition by Universities

UPSO has been recognized by several universities as a center for carrying out researches leading to their respective Ph.D. degrees. In some cases, where the university rules so

required, it has been made obligatory that in addition to the guide from the observatory, there should also be a co-guide from amongst the staff of the university. Till 1982 a total of 17 theses had been approved for the Ph.D. Degree.

3.6 Reflecting stellar telescopes (15-cm, 38-cm, 52-cm and 56-cm)

As mentioned earlier, a 38-*cm f/15 reflector* was commissioned in 1960 at Devi Lodge. It was reassembled on Manora Peak in a newly constructed telescope house and the dome that housed it earlier, now housed the 15-cm *reflector*. The former was used for photoelectric photometry and the latter for showing visitors through.

A 52-cm *reflector* having f/13 Nasmyth and f/70 Coude foci, order for which was placed with Cox, Hargreaves & Thompson, U. K. in 1959, arrived in 1963. In the absence of a proper telescope house, it was housed in a roll-off shed, and was commissioned for stellar photoelectric spectrophotometry, in 1964. For the same reason it could not be employed for solar work.

The *optics-in-tube for a* 56-cm *reflector* having an f/15 Cassegrain focus, order for which was placed with Cox, Hargreaves & Thompson , U.K. in 1956 arrived in 1960. It was originally planned to mount it on the German mounting of the 25-cm Cook refractor, which did not work out. Drawings for a mounting were prepared at the Observatory, and the heavy cast-iron parts were fabricated at the Govt. Agricultural Workshop, Lucknow. The 56-cm dia. worm wheel for the mounting presented immense problems. Finally, it was cut and ground, on a lathe, in the Observatory workshop. The telescope was commissioned for photoelectric photometry and spectrophotometry in 1968. After a few years the primary developed encrustations that could not be ground away. The primary had to be replaced.

3.7 1-m Sampurnanand telescope

At its first meeting in May 1963 the Advisory Committee agreed to recommend to the government to provide a "big" telescope to UPSO. The government accepted the re commendation in principle and asked the Director to provide the cost estimate and other details. Those were the days of foreign exchange crunch and our best bet was to go in for a telescope from the rupee-trade area. We finally settled upon the 1-m telescope offered by Carl Zeiss, Jena in East Germany, and applied to the government of India for necessary exchange, which was declined. We felt stuck. Providence helped. In the summer of 1965 Sri Raj Bahadur, Minister for Civil Aviation and India Meteorology Department, was on a visit to Nainital. Those days the Solar Observatory, Kodaikanal was part of the India Meteorology Department and as such development of astronomy was his charge. As per the demands of protocol, I called on him and requested that he visit us, which

he did. I believe he was quite satisfied with what he saw. As he was leaving, he was good enough to ask "Can I do anything for you ?". "Yes Sir, a great lot" I said. "What is it ?" I explained to him about our need for a bigger telescope and added that rupee foreign exchange for it had been declined by the government of India. He asked me to come over to Delhi with the letter of refusal, which I did. Within two weeks or so thereof, foreign exchange of Rs. 12.5 lakhs (equivalent of pounds sterling 99,200) was released to us! Hurray, we had got the 1-m!

Order for the 1-m reflector with f/13 Cassaegrain and f/31 Coude foci was placed with Carl Zeiss, Jena. The telescope arrived in 1969, but the telescope house was not ready yet. The 40 crates (or so) had to be stored for a couple of years. Engineers from Zeiss came to install the telescope in the second half of 1971. It was finally handed over to us on 11 Feb. 1972. Testing was done in the following months and observations with the telescope were started after the rains in October 1972. The telescope was formally dedicated by Prof. M.G.K. Menon, Secretary Department of Space, Govt. of India on 7 June 1973 in the presence of the Governor of Uttar Pradesh and Sri Swami Saran, Minister for CA & SR. The telescope has since been the main stay of UPSO. To honor the memory of Dr. Sampurnanand the telescope was christened after him.

3.8 Refractor telescopes

The 38-cm refractor was largely employed for use by visitors and for training school children. A 13-cm refractor on a pier, and capable of motion only in the meridian plane, was set up for airglow studies.

3.9 Solar instrumentation

A Halle 0.15 A pass-band H-alpha filter with associated cameras for making sequential records of solar flares at 0.15s intervals, was operational. A 46-cm coelostat feeding a 25-cm f/66 off-axis telescope was readied for spectral studies.

3.10 Training of staff

We did not have any among our scientific staff who have had formal training in astronomy. To rectify this situation several steps were undertaken.

As reported in last section, Subhash Chandra went to Caltech in 1959. In subsequent years Asstt. Astronomers M.C. Pande (1961), N.B. Sanwal (1962), A. Sanyal (1965) went abroad, on leave, for higher studies respectively to Sternberg Institute (Moscow), Case Institute (Cleveland) and University of Arizona. They all completed their studies for the

Ph.D. degree. Chandra and Sanyal stayed back in the USA while Sanwal returned and joined the Osmania University as a Reader. We did not have *suitable* positions to offer to them. Pande returned to UPSO in 1966 and joined as Astronomer on the first post of that level to be created. He had gone to Moscow on a Russian Govt. scholarship; both he and the Government had entered into an agreement. However, the UP government went short of its commitments to Pande. Several other members of the staff went abroad for brief periods ranging between 2 -16 weeks.

At home, lecture series were arranged. Drs. K.D. Abhynkar, N.B. Sanwal, Alladin (all from Osmania) and Dr. M.S. Vardya from TIFR were invited to give courses.

Technical staffs were sent to sister institutions like Indian Institute of Astrophysics, Physical Research Laboratory, National Physical Laboratory for periods of 2 to 4 weeks for training.

3.11 Developmental activities

As the observatory is situated in a location remote from centres of developed technical activity (like Bangalore, Bombay, Delhi etc.) and for lack of any worthwhile facility in or nearby Nainital, it became necessary and obligatory, on us to develop first rate facilities of machine shop, electronic shop, aluminizing shop, and optics shop. These were set up complete with all necessary machines and testing and measuring gadgets. A surface finishing shop was also set up. As a good will gesture, the Smithsonian Astrophysical Observatory helped us with quite a few equipments for various workshops. To facilitate computations, several digital computers were purchased. A microcomputer lab was also established.

3.12 Research

Stellar research: Studies on eclipsing binary stars, classical cepheids, RR Lyrae stars continued. In addition, new programs on spectral classification of late type stars, Delta scuti stars, Flare stars and galactic clusters were started. The work on eclipsing binaries received mention in the IAU Reports, 1973 (p.652). Covering the work on eclipsing binaries received mention in the IAU Reports, 1973 (p.652). Covering the work in this area the world over the Report states ".the leading contributors to this field in ..India : Sinvhal (Uttar Pradesh);..". Based on these investigations over 120 research papers and 11 Ph.D. theses were contributed.

Solar research: Theoretical studies of dissociative equilibrium and of profiles of diatomic and triatomic molecules in solar atmosphere were carried out. Based on these over 70 research papers and 5 Ph.D. theses were contributed.

Planetary research: Studies of night airglow at Nainital, of comets and of stellar occultations by planets were conducted. Of particular interest were the occultation of BD-5 5863 by Pallas on 2 October 1962 and the study of the rings of Uranus when it occulted star SAO 158687 on 10 March 1977. Based on these investigations about 18 research papers were contributed.

Instrumentation : A total of about 10 papers dealing with instrumental development were written.

3.13 Large telescope

Late in the 1960s it was considered appropriate that by 1995 or so, i.e. approximately 25 years after installation of the 1-m telescope, the observatory should upgrade its observing facilities and go in for a telescope large enough to be able to undertake galactic and extragalactic observational projects. It was expected that by then the observatory would have on its staff scientists interested in those problems. With this in view, the issue was discussed at the meetings of the ADCOM. It was at the 1976 meeting that ADCOM agreed in principle to provide a 4-m telescope on condition that as far as possible the telescope be made in India and that it be developed as a national facility by involving other interested institutions. Scouting for a suitable site was also undertaken. After detailed survey of about a dozen sites, the one at Mallika Devi (Gananath) was considered more suitable than others from the point of view of seeing etc. In 1982 BARC was entrusted with preparing a detailed technical project report for the telescope and its set up.

3.14 Guest Observers, Student Trainees, etc.

- Scientists from institutions like the Osmania University, Physical Research Laboratory, Punjabi University, etc. occasionally requested for telescope time and were accommodated.
- On requests from technical institutions like IIT Kanpur, Roorkee University, Birla Institute of Technology (Pilani), Birla Institute of Technology (Ranchi), etc., their students spent 4-6 weeks during summers for practical training in our different workshops and laboratories.
- For three academic sessions our scientists gave a course in astrophysics to M.Sc. students of the D.S.B. Govt. College, Nainital.
- Facilities and assistance were provided to Rain and cloud Physics Laboratory of the CSIR in collecting rain and hail samples, for their studies on seeding of clouds.
- Likewise, facilities and assistance were provided to IIT Kanpur for their project on line-of sight tropospheric scattering of microwaves.

3.15 Open houses

Open houses were held for the public every month for a couple of days before and after full moon. Visitors were taken round the Observatory for a couple of hours every afternoon on working days. It is estimated that about 8000 visitors were accommodated every month.

3.16 Skies at Nainital

The number of photometric hours on nights, varied largely from year to year. Yet, from what information one has about other observatories, it was not too bad. The seeing, at its best, continued to be excellent. It is a pleasure to look at the star-studded skies at Manora Peak on a dark clear night!

3.17 Service conditions and emoluments of staff

Scientific Staff: The pay scales of scientific staff were low all along as compared to those in other research organizations. This resulted in our not being able to attract/retain well qualified persons, which, in turn, affected the overall performance of the institution. The absence of any merit promotion scheme also was a disincentive. Coupled with all this was the practice and procedure of selection through the Public Service Commission; also, the Commission took inordinately long in completing the process-sometimes as long as 2-3 years.

Technical Staff: Likewise, the pay scales of some of the technical staff were also pretty low. Only in one case- that of the Senior Technician (Workshop) the pay scale could be revised after recommendation by the Chief Minister himself, who was then Chairman of the ADCOM.

3.18 Infrastructural facilities

The infrastructural facilities at the Observatory were, by and large, not in keeping with the reality of its location outside Nainital town (9 km by transport or 3 km on foot) with no public transport. Except for vehicular trips for school going children and a part time dispensary, with an unqualified compounder and bi-weekly visits by a doctor, no other facility was provided as such.

For guest scientists who visited us on academic assignments, there was no guest house. Quite often they had to be accommodated on private hospitality of campus-based staff.

3.19 Visits by astronomers and other dignitaries

In addition to the names mentioned earlier the Observatory was visited by several scientists from time to time, some of whom gave talks.

Sir R.V.d.R. Wolley, Astronomer Royal of England, Prof. Hanbury Brown, Prof. Bart Bok, Prof. M.K.V. Bappu, Prof. B.V. Srikantan, Prof.Govind Swarup and Prof. Yash Pal visited in March 1963. 1979 was UPSO's Silver Jubilee Year. At the invitation of UPSO, The Astronomical Society of India held its third annual session (1979) at Nainital. The session was presided over by the author.

Hon'ble Biswananth Das, Hon'ble Gopal Reddy, Hon'ble Chenna Reddy, Hon'ble G.D. Tapase all Governors of Uttar Pradesh, and Hon'ble C.B. Gupta, Hon'ble H.N. Bahuguna, Hon'ble R.N. Yadav, Hon'ble V.P. Singh Chief Ministers of Uttar Pradesh visited.

3.20 In retrospect

I cannot help remarking, in retrospect, that the recommendations of the Experts Committee set up by the Government in 1952, have been honoured essentially in the breach than in observance. May be, if the Committee were to meet again today, they would themselves be happy at the deviation. Yet again, but for the appealing and inexpensive tenor in which they suggested things, the Observatory may never have come into existence! Is it not correct that most big things, even the luminous stars, take shape out of nebulosity ?

4. References

A good part of this account is based on personal notes. Use has been made of UPSO annual reports, ADCOM presentations and earlier write-ups on UPSO. Finally, I shall like to take this opportunity once again to thank all my colleagues for the unstinted cooperation I was privileged to receive at their hands. Whatever success we achieved is totally to their account.