Hindu 12.2.78

Scanning the sky from Kavalu

LOCATED amidst sandal wood forests in Kavalur near Jolarpet in Tamil Nadu is India's unique optical telescope, scanning the sky every night. The forest, which has a good chance of being preserved, has a good effect on the atmosphere. Otherwise, rocks would emit the heat and add to the turbulence which would distort the heavenly objects.

Kavalur has also a good number of clear nights—some 2000 hours in a year, almost equalling the availability at Mount Palomar. Kavalur is far away from city lights and yet is easily accessible by road.

The telescope is operated by the Indian Institute of Astrophysics, Bangalore. Indeed, the Institute inherits an impressive heritage. The East India Company established an observatory in Madras in 1782 to aid their navigational effort. The first observation of helium in the sun was reportedly made there in 1868 during the total eclipse of the sun, when a Madras team of astronomers found the characteristic yellow line in the solar spectrum. They also discovered several asteroids and variable stars.

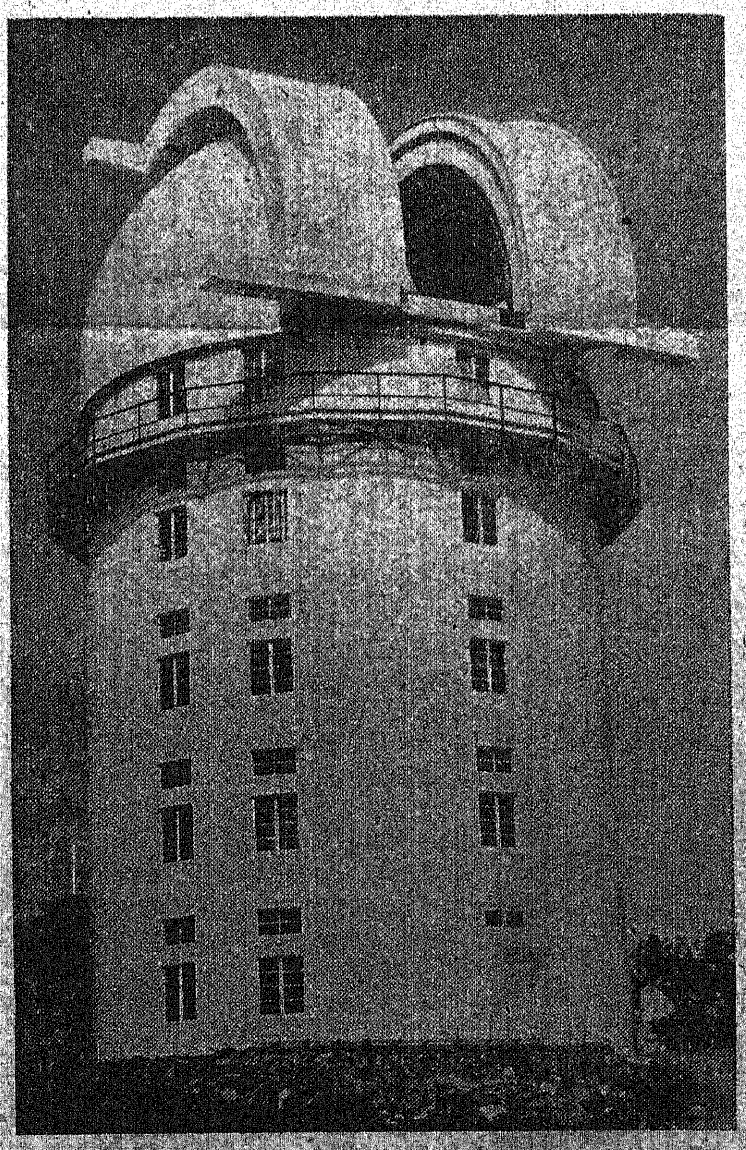
After about a hundred years, the observatory was moved to Kodaikanal where several important studies were done.

It was in 1934 that oxygen was first seen in the solar chromosphere. Kodaikanal still has some vintage equipment, as witness to a bygone era of constant intellectual activity and curiosity. Particularly interesting is an old clock made by one John Shelton in the 18th century. This was used by Captain Cook in his famous South sea voyages. It was later kept by one Captain Pitri who was the first astronomer employed by the East India Company. He donated the clock to the Observatory and it is ticking well even to this day. A similar clock is in the British Museum.

Kodaikanal, with all its vantage points, is rather cloudy and Indian astronomers, after Independence, started looking for a better place. Kavalur was eventually chosen. The pioneering astronomers ventured deep inside the forest, often losing their way. Dr. J. C. Bhattacharya, now Deputy Director of the Institute, said he once had to find his way out by using a toy compass on his key chain!

To-day, Kavalur is a well-laid out campus, with a tower, which has under its dome a 40-inch (102 cm) telescope. This is the diameter of the mirror in the telescope which is an imported piece. But several modern attachments have been added, including an on-line computer which processes the data as and when observed by the astronomers. It has been working successfully ever since it was set up five years ago. The first telescope brought to Kavalur was a 15 inch instrument. They have just completed a 30 inch telescope, fabricated in Bangalore by Indian engineers.

Work has begun on a 90 inch telescope, which will be the biggest in Asia. The raw material for the lens is imported but the mirror will be polished and given a aluminium coating in Bangalore. It is a sophisticated job, when one realises the order of smooth and even surface required. It is equivalent to a surface accuracy of half a millimetre over a one-km diameter surface. Any departure from the ideal surface should be absolutely minimal. The young engineers in the Institute in Bangalore are quite hopeful of churning up the mirror to international standard. The machines that grind, it may be added, are indigenous. The 90 inch telescope is expected in 1980.



A view of the tower and dome of the 102 Cm. main telescope in Kavalur.

Some may wonder whether the days of the smaller telescopes are numbered. Far from it, say the astronomers. While the bigger telescopes are needed for locating giant objects, the smaller ones would be able to give long exposures. Moreover, several attachments strengthen the small telescopes. For e.g., there is photometry that can record the minute fluctuations in the brightness of objects. There is the high-dispersion spectrograph for bright objects. The image intensification devices are now available and with them, a 40-inch instrument can do quite a few things done by the unaided 200 inch Palamar telescope. The 40 inch Palomar telescope. The 40 as faint as the 20th magnitude which is almost dark sky brightness. The instrument can even look at galaxies beyond our own.

The star-studded sky and the milky way act as magnets of attraction for the young people who spend nights gazing at the stars and stellar objects. Due to the rotation of the earth, everything in the sky appears as if moving from east to west. In 12 hours, 'we' cover 180° and it works out to 15 seconds of arc per second.

Catching the light of the stars can be done by photographic plate, where the light falling on it gradually makes it dark resulting in the picture. However, only 1000th of the light really converts the silver grains on the surface. In the more sensitive photo-emissive surfaces, the conversion efficiency is a 100 times more. As a further step, silicon devices are coming and computers are used to make the picture pattern.

After catching the star light, the scientists disperse it through a spectrameter, The star is imaged in different colours in which it is emitting light. A number of absorption lines appear and they are identified with the help of standard lines, produced in the laboratory. The scientists can say what elements correspond to the wavelengths of the lines. Indeed, they can infer much more information about the stars from the absorption lines like pressure, temperature, magnetic fields and even whether a star is coming towards us or going away.

A major achievement of Kavalur is its discovery of the rings of Uranus—a credit of international fame. In 1977, the astronomers were studying the lunar occultation method by which the moon hides an object like a star and special instruments measure the diameter of the star and record the variation in line intensity. Normal photometry is correct to one second whereas in lunar occultation, one should be 1000th of a second accurate. This method gave valuable experience when Uranus occulted a faint star and the light from that star suddenly diminished even before it was expected to be hidden by the planet. At first, Indian and other astronomers thought the sixth satellite around Uranus was found. Three teams in the world looked at the phenomenon independently. It soon appeared that only a ring system like that around Saturn can explain the findings. Kavalur also found the evidence of five narrow rings and gaps between the rings. This momentous discovery (about the solar system) has been hailed by experts all over the world as a rare feat.

Other studies include the chemical elements in the stars, their rotational velocity and its effect on their colours, black holes, quasars and other objects both within and outside our galaxy. The sun, too, has attracted a good deal of research. The ultraviolet and the X-ray output from the upper atmosphere of the sun is being analysed. Another area of interest is the strong magnetic fields, which account for "cooler" spots (by 2000°C), in a hot environment.

Three new projects are emphasised by **Dr. Venu Bapu**, Director of the Institute—an internationally respected astronomer. With the forthcoming 90 inch telescope, the study of the galaxies would be intensified. Secondly, the study of the stellar chromospheres, now being done on the 40 inch instrument, will be expanded. Thirdly, studies will be made to decipher the exact location of spiral arms in galaxies by studying the very young stars in the region.

The enthusiasm of Dr. Bapu is infectious. Several young men and women have joined the Institute and are proud to pursue various studies. With more telescopes and satellites, Dr. Bapu envisages more opportunities for the young to profitably engage themselves in this field. Some of the greatest advances in physics may yet take place, after man understands the behaviour of cosmic phenomena. Small telescopes will play a big role in this task of analysis and understanding even as the bigger telescopes are extending the limits of the visible universe.

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