The National Centre for Radio Astrophysics (NCRA)

Located inside the beautiful wooded campus of the Pune University, NCRA is a national centre set up by the Tata Institute of Fundamental Research in the area of radio astronomy – the study of the universe through naturally produced radio waves reaching us from a variety of celestial sources. With the help of powerful and ingenious radio telescopes developed over the last few decades, radio astronomers have discovered many remarkable objects and phenomena in the universe such as radio galaxies, quasars, pulsars, celestial masers, complex molecules in interstellar space and the cosmic microwave background, believed to be the relic radiation from the hot big-bang origin of the universe. These have provided deeper insights into the physical processes occurring in the universe. In India, research in this field has been pursued since 1963 with the formation of a radio astronomy group in TIFR which has contributed significantly to the study of many of these phenomena.

The first major and international-class observational facility for radio astronomy set up in India by the TIFR group was a large radio telescope near Ooty in the picturesque Nilgiri Hills of Tamilnadu. The Ooty Radio Telescope (ORT) has a parabolic cylindrical reflector about 500m long and 30m wide. The unique design of the telescope – with its long axis made parallel to the earth's rotation axis by locating it in the north-south direction, on a hill with a natural slope of about 11°, the same as the geographical latitude of Ooty – makes it possible to track celestial radio sources for about 10 hours a day by a mechanical rotation of the reflector. In the north-south direction the telescope beam can be steered electrically by introducing appropriate phase shifts between the 1056 dipoles along the focal line of the reflector. ORT became operational in 1970 and continues to be one of the most sensitive radio telescopes in the world at its operating frequency of 327 MHz. Observations made over this period with the Ooty Radio Telescope by a large number of scientists and students from TIFR and other institutions have led to fundamental contributions in several areas of radio astronomy, such as the solar wind, the interstellar medium, pulsars, powerful radio galaxies and quasars and the cosmological evolution of the universe.

In the late 80s most of the radio astronomers of TIFR moved to Pune to set up a much more

versatile radio telescope at a site about 80 km north of Pune. This giant metrewave radio telescope (GMRT), is the world's most powerful aperture synthesis radio telescope in the frequency range of about 50 to 1500 MHz. GMRT has been designed and fabricated entirely indigenously. It consists of 30 giant parabolic dish antennas each 45m in diameter constructed using a novel and highly cost-effective design. While twelve of these dishes are located in a central compact configuration in an area of about 1km × 1km, the remaining dishes are spread out along the three arms of an approximate 'Y'-shaped configuration in which the length of each arm is about 14 km. A computer controlled servo drive system enables all the antennas to be steered from a central control room to point towards any part of the sky (at declinations north of about –55°S). By correlating the signals received from every possible pair of antennas forming an interferometer, one can synthesise a radio image of a source with an angular resolution equivalent to that achievable with a single antenna with a diameter of 25 km. To optimise its scientific performance, GMRT is equipped with state-of-the-art electronic receiver systems and backend instrumentation, which includes low-noise RF amplifiers, fibre-optic communications, a high speed digital correlator system, etc.

Expected to become fully operational by the end of 1998, GMRT will provide a world class facility for frontline research in a variety of astrophysical problems ranging from our nearby solar system to the most distant observable parts of the universe. The ability of the telescope to observe at a number of frequencies in the metre-wavelength part of the radio spectrum will be particularly well suited for the detection and study of rapidly rotating neutron stars (also known as 'pulsars'), for the detection of protogalaxies or proto clusters in the early universe through observation of the redshifted radio line emitted by atomic hydrogen at 1420 MHz, and for the detection of non-thermal radiation from the population of 'old' relativistic electrons in a variety of galactic and extragalactic radio sources.

With such world-class facilities and a highly qualified staff of international repute, NCRA provides a stimulating environment for front line research in a number of areas in radio astronomy. The Graduate Studies Programme of NCRA, leading to the PhD degree awarded by Pune University, offers an excellent opportunity to motivated students to work with these facilities. The minimum required qualification to become a research scholar in this programme is a good MSc degree in physics, but students with a BE/BTech degree in engineering and a strong foundation in physics are also eligible to apply.

The Centre also has a short-term summer programme for science and engineering students known as the visiting students research programme (VSRP) in which selected pre-final year students spend about six weeks at NCRA to work on specific research projects and those performing well are preselected to join as research scholars after completion of their degree.

NCRA also offers post-doctoral fellowships and visiting positions in the Centre for work in astronomy and astrophysics, radio astronomy, instrumentation, image processing applications and development of astronomical software. Exceptionally motivated candidates are also considered for regular staff positions.

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I M O – 1998: A Brief Report

Introduction: The Indian team performed magnificently in the recently concluded 39th International Mathematical Olympiad at China–Taipei to finish with three gold and three silver medals. Going by the total marks obtained by the team, India was placed 7th among the 76 countries which took part, the best ever achieved by India since it's first participation in 1989.

The Team: The team of six students was selected during the four-week IMO – Training Camp held in Homi Bhabha Centre for Science Education, Mumbai from May 7 to June 4, 1998 and consisted of:

Chetan Balwe, 103, Dnyandeep, Swanand Society, Sahakarnagar 2, Pune 411 009
Abhinav Kumar, 9A, Hulang Road, Kadma, Jamshedpur 831 005
Soham Mazumdar, Quarter No. A-30, Satellite Colony, Dhurwa, Ranchi 834 004
Hariharan Narayanan, B-54, I I T Bombay, Mumbai 400 076
Rishi Raj, E-2, Sector II, HEC Dhurwa, Ranchi 834 004
N V Tejaswi, 212, 2E Cross, Girinagar I Phase, Bangalore 560 085

With the exception of Rishi Raj all the other five students have finished their 12th standard (or its equivalent) while Rishi is now studying in 12th standard. While Chetan, Soham, Hariharan and Rishi are from the INMO – 96 batch, Abhinav and Tejaswi are from the INMO – 97 batch. For the first time in the ten years of Indian participation in the IMO the team had no representatives from the Junior batch (i.e., from the INMO – 98 batch). In that sense we had a very experienced team who had gone through two/three years of our training programme which may have played a significant role in the performance at the IMO – 98.