

Nandivada Rathnasree (1963–2021)

Nandivada Rathnasree will be remembered by astronomy students and enthusiasts from all over India as a person who trod her own path of education and popularization of astronomy.

Rathnasree (daughter of Bhimarao Nandivada and late Shyamala) was a bright student and a scholar with distinction. Soon after her M.Sc. from the University of Hyderabad, she joined the Ph.D. programme of TIFR, Mumbai. She entered an arena with not many women around as Alak Ray, her Ph.D. advisor recalls. She worked on the evolution of massive binaries in the nearby galaxy LMC and went on to extend it to analyse the pulsar population. Rathnasree further studied the enrichment of certain elements like helium in the environs different from that of the Milky Way. The choice of the massive stars in LMC gained importance because the progenitor of supernova 1987A as a blue supergiant demanded a different approach to stellar evolution even in single stars. She submitted her thesis in 1992 and formalities for the award of Ph.D. were carried out two years later.

Rathnasree joined the Department of Physics, University of Vermont (UVM), USA, for a postdoctoral fellowship, working with one of us (J.R.), who had met her initially during a lecture at the 1991 NCRA Winter School in Pune and was impressed by her comments and questions. Again she was almost the only woman in the audience. No UVM postdoc was then available, but a few months later, when Rathnasree wrote to inquire again the post had become available. She arrived with her 5-yr-old son and husband Patrick Das Gupta.

A new programme of single-pulse pulsar polarimetry was under development at UVM using the Arecibo Observatory in Puerto Rico, which was the largest facility till recently. Rathnasree quickly learned the observational and analytical methods of studying radio pulsars. While contributing to the new programme, she found creative ways to extend and develop her earlier work on massive binaries, publishing several papers in the *Astrophysical Journal* and *MNRAS* taking good advantage of the recent supernova 1987A. Rathnasree helped lead a month-long series of observations at Arecibo in October 1992 when Vera Izvekova and Sveta Suleymanova were visiting as guest collaborators from Pushchino Radio Observatory in Russia.

Rathnasree continued her studies of pulsars during her fellowship at the Raman Research Institute in Bengaluru, where she was able to take full advantage of the new Arecibo polarimetric survey. She studied the stability of pulsar radio emission in average profiles and her results were published in the *Astrophysical Journal*. She also collaborated on detailed polarimetric single-pulse analyses of two important pulsars, B0823+26 and B1929+10, using the mode-separation technique that were published in *JAA*. One of the Arecibo observations she helped to make on pulsar B0943+10 managed to catch the pulsar as it shifted between its bright and dim modes, prompting first a *JAA* paper with the Russian colleagues and then a follow-on work by Avinash Deshpande, Svetlana Suleymanova, Rankin and others, that included X-ray observations.



Rathnasree joined the Nehru Planetarium in 1996 and continued the analysis of several recent supernovae, though at a slow pace. Guided by Nirupama Raghavan, the then Director, she carried on the task of popularization of astronomy. The Venus transit of 2004 provided a great opportunity. Realizing the limitation of the decade-old projector (no digital support and visuals), she sought a new digital equipment which was made available only five years later. She started experimenting with it from the preparation of the script to creating the visuals and audio recording, since there was no provision to use the upcoming talents of the digital era to confront the impact on visualizations. The professional video editors were least interested in spending time (and money) to meet the demands of the dome versions of

the visuals – a severe handicap faced by all the other planetariums at that time. Even if they obliged, the financial constraint prevented it from being a reality.

Through a coordinated programme for quantitative estimates of light pollution, Rathnasree was able to distinguish the effects of smog in urban areas, traffic lights in smaller towns and the perfect skies of remote areas. The campaign was initiated through a Yahoo group mail and subsequently she used social media effectively for programmes like ‘Tare sadak par’.

Rathnasree used the All India Radio and Doordarshan effectively, though it demanded lot of time on her side, to educate the masses and Delhi residents in particular, about the observatory of Jai Singh Jantar Mantar. She started with school children; her enthusiasm and the on-site lessons mesmerized the kids to return after several years to help her pursue the goal of bringing it back for practical astronomy. She obtained special permission from the Archaeological Survey of India (ASI) to measure the positions of stars and planets at night. Several events of planetary conjunctions, occultations and other such events were measured with Rama Yantra and Jayaprakash Yantra. Rathnasree was able to judge the accuracy of previous such attempts which were carried out only for the sun and were tainted with errors in measurement with the diffuse shadow. Thus when ASI was planning to replace the graduations with new marble scales, she vehemently opposed it on grounds of losing accuracy of measurements.

For the year of astronomy, 2009, among the many activities there was an occasion to put together the amateurs and professional in a meeting in the Jawaharlal Nehru Planetarium at Bengaluru. Rathnasree followed it up with a second one in Delhi.

The knowledge of astronomy of laypersons was extended beyond the eclipses with the transits of Venus and Mercury in 2003, 2004, 2012, 2013 and 2016. Rathnasree shared her resources with all the science centres, created capsules and posters in Hindi and other regional languages.

Rathnasree was approached by students aspiring to participate in the Olympiads, and for guidance on projects as partial fulfilment of B.Sc. and M.Sc. courses, for example, a quantitative analysis of the obscuration of the eclipsed moon. She shared her time between the planetarium programme

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production and education activities thoughtfully, so that neither of them suffered. As the first chairperson of the Outreach Committee of ASI, she effectively spread astronomy education all over the country. The most recent adventure was associating Mahatma Gandhi with astronomy. The exhibition 'Bapu Khagol Mela' together with daytime activities for school children and night sky watch, went round the country and all those who hosted this event, remember her untiring devotion and enthusiasm. Last year, during the pandemic she switched over to the on-line mode and made an effort to get students to measure the angle between Jupiter and Saturn day after day during the rare event of conjunction in December. She named the naked-eye observations programme as 'The Chandrashekhara Samanta Challenge' and collected observations from all over the country.

Rathnasree served in several science popularization committees. She created groups for on-line discussions on a specific topic to help the planetarians of India.

To what extent she was a victim of gender bias will not be known because her hardships of carrying out research with a young baby were brought to light by others only after her death. As one of us (J.R.) recalls, Rathnasree accomplished so much and was single parenting in a new and unfamiliar environment at UVM. She would come to the office each day after she took her son to school and left office to pick him up after school, often by mid-afternoon. Her time at UVM under these conditions reflects a remarkable resilience and determination. She balanced her activities between home and work. Bhimarao Nan-

divada, Patrick Das Gupta and Ujwal Das Gupta perhaps felt enriched by her passion for work. She did not regret at any stage for having diverted from research to outreach and popularization activities, missing an opportunity to be listed among those in forefront research careers.

Rathnasree's interest in the history of astronomy is a lesser known aspect. Perhaps it was kindled by Nirupama Raghavan who studied the iconography of Nataraja for a match with Orion constellation. After the demise of Raghavan, Rathnasree carried it forward to identify the fire in the hand of the idol as the probable depiction of the 1054 supernova.

One of us (B.S.S.) worked with Rathnasree to understand the manuscript of Kamalakara Bhatta to check if he had known about events like transit. We found specific mention of a 'hole'-like appearance for Venus transit and a 'dot' for the Mercury transit in a text, which provided detailed procedure for calculation of the timings.

A workshop was held to understand astrolabes, after which Rathnasree came up with an unusual idea – to use the planetarium projector as the real sky for verifying the accuracy of the star dials of the astrolabes. It sounded impractical to me since I was aware of the problems associated in working with images for the full-dome screening. Rathnasree wanted an astrolabe to start with and it was difficult to procure from any museum. She used the one I had made for Bengaluru latitude and effectively projected it onto the dome to verify the accuracy of my markings of star positions. The success led her to work with images of old star dials from other places and from the catalogue S. R. Sarma. One of her

dreams was to depict the episode of an astronomer making an astrolabe and marking the supernova on it (just as B.S.S. had shown in the 1604 astrolabe) in a planetarium show.

Always looking for something new, Rathnasree came across the name of Badshah Begum of the 18th century, who was probably the first woman astronomer from India on the records. Rathnasree mentioned it in one of her on-line talks from Kolkata last year and was finalizing the paper for publication. Another of her passions was bringing day-to-day research to the common man, which again was considered as an impossible task with regard to planetariums. Rathnasree wanted to show the planetarium sky in different wavelengths with the help of survey images. She also wanted to show the 'radio' sky, and the distribution of pulsars and X-ray sources... but these remain undone.

To cope up with the loss of communication during the pandemic, Rathnasree created a WhatsApp group for all the planetarians of India, juniors included. She wrote there on 19 February 2021 in the context of in-house show productions in planetariums, '...I will retire by November...I too want to put up a last show – a Swan song as it were.'

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Rinti Banerjee (1972–2021)

Professor Rinti Banerjee (Department of Biosciences and Bioengineering, IIT Bombay) passed away on 8 July 2021, due to post-COVID-19 complications. In losing her the Indian and international scientific community has been robbed most untimely of a stellar scientist and researcher (she was just 49), a well-loved teacher, an accomplished S&T administrator and an affable persona.

Following her MBBS from BJ Medical College Pune in the early 1990s, Banerjee did a Ph.D. in *Biomedical Engineering*



from IIT Bombay and a postdoctoral stint at the University of California, San Francisco, USA, before returning to IIT Bombay to take up a faculty position in the Department of Biosciences and Bioengineering.

Banerjee's medical training inspired her to undertake translational research right from the start, when the term 'translational' was only just being heard in the scientific circles, and she retained that orientation strongly throughout her career. Banerjee wanted her work to ultimately result in