Shashikumar M. Chitre (1936–2021)

A leading astrophysicist, affable, kind, learned, suave, sophisticated, warm, such are the words which come to mind at the mention of Professor Shashikumar Madhusudan Chitre, who passed away on 11 January this year, aged 84. In his passing Indian astronomy has lost a great gentleman, and many of us have lost a valued colleague, friend and mentor. Chitre's research and teaching spanned more than six decades, and he continued to work until just a few weeks before his death.

Kumar, as he was universally known, left for Cambridge, England in 1957. He then had a B.A. in mathematics and had completed a year's study for an M.A. On the ship to England he met another young student, Jayant Narlikar, who too was on his way to Cambridge. The meeting developed into a lifelong friendship and partnership in science. Kumar did a Tripos in mathematics as a student in Peterhouse, the oldest college of Cambridge University, and had courses by Paul Dirac, Fred Hoyle, Michael Atiyah and other great physicists, astronomers and mathematicians.

For his Ph.D., Kumar worked with Leon Mestel, a renowned astrophysicist, whose students at the time included Donald Lynden-Bell. Kumar was then in Churchill College. At a recent memorial meeting for Kumar, Narlikar recounted how Kumar had once made chicken curry and rice in Churchill, while his own attempt to make puris did not quite succeed because he kept waiting for the oil to boil. The connection that Kumar established with Cambridge so many years ago remained strong all through his life. To continue his scientific collaborations, Kumar visited the Institute of Astronomy at Cambridge for a few months almost every year over the last few decades, to continue his scientific collaborations. He could not go there in 2020 because of the pandemic and yet he continued attending meetings and collaborating remotely. He was looking forward to going to the Institute again as soon as the pandemic abated. This process of getting back to the beginning has been a characteristic of Kumar's life: the evolution of several of his activities over decades has been along nearly closed orbits, some with large eccentricity. He was born in Bombay (now Mumbai), was brought up in the then tranquil and beautiful western suburbs, had his schooling and college in the city, travelled the world, settled in the southern tip of Bombay for some decades, and then returned to the western suburbs where he stayed until the end. He was truly a creature of the city who contributed to its wellbeing in his own way.

After completing his Ph.D. from the University of Cambridge in 1963, Kumar lectured at the University of Leeds during 1963–1966. There he had extensive contact with Thomas Cowling who influenced the course of his research in magnetohydrodynamics and solar physics. After Leeds, Kumar was a Research Fellow at the California Institute of Technology during 1966–67 where he was introduced to relativistic astrophysics and the structure of neutron stars by Kip Thorne. All through the decade he spent abroad, Kumar had the good fortune to learn from, and work with, some of the leading scientists of the 20th century. That was reflected in the broad and yet deep understanding of astrophysics that Kumar had, and the quite different areas of the subject to which he contributed significantly over the years.

Kumar's thesis was on the structure of sunspots. This was followed by some work on stellar convection; he continued to work on the Sun and stars to the very end. After joining TIFR he initiated research there in helioseismology. He was always fascinated by the solar neutrino problem and made all efforts to constrain neutrino fluxes using seismology, including inversions for temperature and chemical abundance profile. He also contributed to the inversion of rotation rate in the solar interior and its temporal variations, and used that to infer the gravitational quadrupole moment as well as higher order moments. During the last several years he was very interested in the study of meridional flow in the solar interior and that work was in progress until his last days. He had several research papers on the Sun and stars over the last few years, including work on convective differential rotation in stars and planets, solar surface dynamos, energy budget for the solar cycle, hydromagnetic turbulence and so forth, attesting to his enduring interest in topics that he was first introduced to sixty years ago. Kumar's research students who worked on these topics were D. M. Kale, H. M. Antia, D. Narasimha and S. K. Pandey. He also had a large circle of collaborators over the years, including Sarbani Basu, D. O. Gough, W. H. Saslaw and Chris Tout.

Another area to which Kumar contributed substantially is gravitational lensing. The TIFR group which worked with him on this area included Narasimha, K. Subramanian and his student Sunita Nair. The group did some pioneering work on this subject including detailed modelling of lens systems. In a paper with Saslaw and Narasimha, Kumar pointed out that a point gravitational lens images a diffuse background source as a 'gravity ring' which could be observed with long baseline radio interferometry. Such rings have now been observed and are known as Einstein rings. The group also discussed microlensing, which they called minilensing.

Kumar's research interests stretched far beyond the Sun, stars and microlensing. As examples, he worked on neutron star matter with his student V. K. Garde, B. Banerjee, V. Canuto and others, with J. V. Narlikar on apparent superluminal motion, effect of interstellar dust on measured values of cosmological parameters and various other topics, on vacuum energy density in cosmology with P. S. Joshi and T. Padmanabhan, and on cosmic inflation with D. Lynden-Bell.

As recognition of his academic work, Kumar was elected Fellow of the three science academies in India and of the Royal Astronomical Society and the Third World Academy of Sciences. He was awarded the *Padmabhushan* in 2012.

After Kumar retired from TIFR in 2001, he had multiple choices before him for a post-retirement position. But he

took a conscious decision to involve himself in teaching, so that he could give back a bit to society from which he knew he had got so much. Therefore, Kumar joined the Physics Department of the University of Mumbai at its Kalina Campus. While there he realized that a deeper connection between the university and an organization like BARC would be of great benefit to students and young researchers in the university. Various arrangements already existed for university students to use BARC facilities and expertise for their research projects, but what Kumar had in mind was an entity to which the two organizations could contribute and which would have the ambience enabling it to rise above the usual limitations. With the then Vice Chancellor Vijay Khole and members of the physics faculty, Kumar approached Anil Kakodkar, who was then the Secretary of the Department of Atomic Energy. Kakodkar, in his own words, agreed to support the setting up of a joint centre, providing the university granted the venture the autonomy required to enable it to rise to the national level.

The result of the effort was the establishment of the MU-DAE Centre for Excellence in Basic Sciences. It has developed into a centre with excellent faculty and students and very good facilities. Kumar was Chair of the Academic Council of the Centre and member of the Governing Board. But his true contribution came through the courses that he tirelessly gave and his mentoring of the young students. He was delivering lectures from his home until a few weeks before he was admitted to hospital for the last time, and his students helped the family through his illness. There really was no gap between the teacher and his students, in spite of the age difference of more than 60 years between them.

Kumar did valuable work for the Tata Trusts, as a Trustee for the J.N. Tata Endowment Fund for Indian students for studies abroad, and as Honorary Executive Director of the Homi Bhabha Fellowships Council. Kumar's connection with the Tata Trusts proved to be very useful for the LIGO-India project. When I was Director of IUCAA, he helped me to formulate and navigate through the Tata Trusts a project for developing human resources for LIGO-India. The large grant obtained enabled many young researchers, faculty and engineers working for the LIGO-India project, and on gravitational wave physics, to travel abroad, and for foreign experts to be invited to India. In a conversation I had with him just a few days before he was admitted to hospital, he enquired, in a rather feeble voice, the status of an extension of the grant I was seeking in these pandemic-affected times.

Kumar mentioned to me on occasion that he had received offers to head various institutes, but he did not cherish such a leadership role. He was content to be a Professor in a premiere institute, to carry out his research through students and small collaborations rather than through large groups, and to conduct the business of science through discussions and committees. It was often an interesting experience to be on a committee with him, for appointments, promotions, reviews and other institutional matters. He was never dominating or intrusive. At the beginning of a meeting he seemed to be in full agreement with people who had called the meeting. Then in a soft manner he began to ask the occasional question or make a comment and soon the case appeared to be wide open, sometimes to the alarm of his hosts. The meeting finally ended with the correct decision having been reached, which often was what the hosts had in mind; in the process the hosts typically obtained very good insight into the issues involved and a lesson in putting forward their case with care and diligence. I have once seen Kumar in a meeting convincing Prof. Govind Swarup to make an about turn, a feat not many have achieved.

While it is straightforward to take stock of the professional work done by a scientist, and the larger contributions made to society, it is difficult to keep count of the small impressions made and influences exerted on individuals, which can go a long way in shaping and improving their lives. I have personally gained much through my interactions with Kumar. Some of my experiences may appear to be inconsequential, but the fact that I remember them over so many years shows they have been important to me, perhaps in ways I may not consciously understand. I first met Kumar with a few of my friends from Ramnarain Ruia College in Mumbai, where I was in the first year of my Master's course, almost exactly 50 years ago. The purpose was to invite him for a talk, but we did not succeed in getting him, because he was to leave for the USA for a longish stay. We pleaded with him for an hour, but he did not budge from his decision. The second time I saw him was a couple of years later, when I was ensconced as a graduate student in TIFR. I saw Kumar exiting, with a group of people, from a small lecture hall in the institute, with a board outside which announced a conference on Lie Groups and Lie Algebras. I was extremely impressed with an astronomer being so involved with abstract mathematics. I much later realized that Kumar had been in a meeting with fellow astronomers, which had taken place in the hall between sessions of the conference. I do not remember whether I ever narrated this story to him.

In his personal life Kumar was inseparable from his wife, Suvarna Chitre, who always travelled with him on his long visits to so many countries and cities over the years. Suvarna taught in schools for children with special needs, which she continued to do until recently. She and Kumar were ever gracious hosts and their hospitality seemed to extend without limit. When my wife and I went to their place in the TIFR colony for the first time, we were quite nervous. But we were soon put to ease in the elegant ambience, and enjoyed the occasion very much in spite of so many senior people being present. While that first experience is still sharp in our minds, many such occasions spread over countries and cities blur together, ending with a visit to their home in Versova, so full of paintings by greats like K. H. Ara as well as by his talented students. Kumar is now gone, leaving behind Suvarna, their two sons Yatin and Yougandh, their families and a host of friends, colleagues and collaborators with fond memories. He will be greatly missed.

AJIT KEMBHAVI

Emeritus Professor,
Inter-University Centre for Astronomy and Astrophysics,
Pune 411 007, India
e-mail: akk@iucaa.in

Edited by S. K. Satheesh, and printed & published by G. Madhavan for Current Science Association, Bengaluru 560 080.
Typeset by WINTECS Typesetters, Bengaluru and Printed at Lotus Printers Pvt Ltd, Bengaluru (Ph: 2320 9909)