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From the editors' desk



In the history of human civilization, there are stories of thinking men. Thinking women rarely appear if we look back. What did women wonder about? Virginia Woolf explored early writings by women in "A Room of One's Own" about a hundred years ago: "Good breeding, fashion, dancing, dressing, play, Are the accomplishments we should desire; To write, or read, or think, or to inquire, Would cloud our beauty and exhaust our time, And interrupt the conquests of our prime,..."

Women's "conquests of prime" were portrayed as domestic desires (home, children, etc.) rather than intellectual pursuits throughout the earliest written history of science, arts, and philosophy. Was it an accurate representation? There was no way to earn money, establish scholarships, and arrange for the next generation of women to escape domestic chores and derive some quiet time to ponder about the Universe. Financial independence is a key to progressive thoughts and intellectual freedom. However, changes did happen. A fraction of liberal men in history prioritized justice and equality. For example, William Herschel facilitated his sister Caroline Herschel's explorations with telescopes; Pierre Curie rejected the Nobel Prize unless shared with his collaborator (and wife) Maria Skłodowska-Curie; in Bengal, India, Ishwar Chandra Vidyasagar pioneered societal perception about women's education. Gradually, women began to learn, think, and move societies. The Universe became comprehensible to them. They started to mentor more women and men... here we are, thinking through our academic foremothers and forefathers, exacting their overlapping and complementary qualities, building logic, sense, and sensibility about this world. But the voices of these daughters are not sufficiently loud even today. CARINAS is an initiative to raise our voices, open the doors of our minds, position ourselves in the forefront, and tell our stories. We will explore various nuances of gender balance in our newsletters through real-life tales and statistics, e.g., women's approach to science, the role of gender in the advisor-advisee equation, deterrents in career path, and most importantly, how to build a better future together. Dear readers, fasten your seat belts and begin this journey with us!

In the first edition of the CARINAS newsletter, we feature three Indian women in Astrophysics who were also mentor and mentee: Prof. Chanda Jog, Prof. Mousumi Das, and Dr. Rubinur Khatun. We have often heard of academic lineages of men. Here, we peep into the minds of women across three academic generations. Further, we include the demographics of our forum along with the recent member activities. Last but not least, our in-house humor columnist Dr. Jestress concludes on a laughing note with the "Freshly Baked News".

My life in science

by CHANDA J. JOG

– Honorary Professor, Department of Physics, Indian Institute of Science (IISc), Bengaluru (FASc, FNA, FNASc, FTWAS, J.C. Bose National Fellow (Former))



I am giving here a few thoughts about my life in research, as asked by Prakriti. I hope some of this may be interesting to you as early-career astronomers.

For as long as I can remember, I have always been fascinated by nature and its mysteries. **I had the great fortune to have parents who supported and encouraged curiosity, independence, and an open attitude to life** in my sister and myself. We stayed outside Mumbai—near the foothills of Sahyadri hills—for four years during my higher secondary school years, when I got interested in star-gazing. That started my deep interest in as-

tronomy, which led me to study it for my Ph.D. at the State University of New York at Stony Brook, USA.

During my school years, my favorite subjects were mathematics, especially geometry, and physics. I remember spending long hours engrossed in the geometry riders my mother assigned me. The thrill of finally figuring out the construction and solving a problem by pure logic (and imagination!) was my first experience in research. It also taught me, as I realized later, the value of persistence as well as confidence and the deep joy that solving a problem can give.

During my time at Stony Brook, apart from the subject itself, **I also learned from the open attitude of teachers who welcomed questions from students.** I also realized that steady hard work is absolutely essential to do good research. At Stony Brook, I met **Aloke Jain (my future husband)**, who was also a student there. Aloke urged me to give my best to research and **supported me at all stages of my career** until his untimely death in 2015 after a prolonged sickness. I would like to mention that

Aloke **contributed a lot to the child-care of our twin daughters**, Abha and Deepa when they were young.

After two years of postdoctoral experience each at Princeton University and the University of Virginia, Charlottesville, I returned to India and joined as a faculty member in the Department of Physics of the Indian Institute of Science (IISc), Bengaluru. Joint Astronomy Program (JAP) based at IISc was a fledgling program. I contributed substantial efforts to the growth of this collaborative program, both as a teacher and as the Convener—the latter for 11 and a half years, in two bouts of seven and four-and-a-half years.

“ *One piece of advice from my experience is: do not wait for someone to notice you or help you. Instead, talk to people about your work and theirs.* ”

— Prof. Chanda J. Jog

I am thankful for the interest and encouragement from Prof. S.M. Chitre and Prof. Govind Swarup during my MSc years. Regarding research, I feel privileged that I could interact and work with Prof. P.M. Solomon, my Ph.D. advisor at Stony Brook; Prof. J.P. Ostriker, my postdoctoral mentor at Princeton; and later, Prof. Françoise Combes, a long-term collaborator in Paris. From these people, I learned a lot about science itself and how to do science. Similarly, working with students, postdoctoral fellows, and other collaborators has been a rewarding and educational experience.

My main area of research has been galactic dynamics. I have explored new ideas and initiated work in areas of gravitationally coupled star-gas instabilities with various applications, including spiral structure, lopsided galaxies, vertical disk dynamics, triggering of starbursts by shock compression of molecular clouds, and the dynamics of interacting galaxies. **Keeping in touch with observations has been crucial in my work, as this allows one to formulate meaningful problems representing realistic systems.** I have enjoyed working with very good PhD students at IISc, with whom I could develop various interesting ideas and work on challenging, new problems. It is a great pleasure to see that they are established scientists now. I feel I have been fortunate to have been able to do science all my life and to contribute to the field. The excitement about science is what still keeps me going.

There has been tremendous growth in the field of galaxies, which is fueled by new high-resolution, multi-wavelength observations that also cover high-redshift galaxies. The field is more exciting than ever with many unsolved problems.

At IISc, and **overall in my career, I did not experience any overt discrimination.** Incidentally, I was the first woman faculty ever to be hired in the Physics department, IISc. **Instead, what I did experience was benign neglect, especially in my early years, when no one took any notice of my work.** I did not have mentors to advise me or show me the ropes. However, in the

latter part of my career, I did get support from some senior colleagues and I am thankful for that. In my turn, I have tried to help and mentor my students and postdoctoral fellows, as well as other young people here as well as in Europe, so they could become a part of the science network. **One piece of advice from my experience is: do not wait for someone to notice you or help you. Instead, talk to people about your work and theirs.** That way, you will not remain isolated. Try to develop a broader perspective of things, beyond your immediate research. This advice is equally applicable to all young scientists, not just women.

I will end by saying: **keep up your enthusiasm and interest in research, as this is what will keep you going even when things get difficult.** I wish you all the best in your future life and career!

N.B. This narrative is based on my article in “Lilavati’s Daughters”, an anthology of the lives of Indian women scientists. Some of you may find the book informative and inspiring.

Conversation with a scientist:

Prof. Mousumi Das, Indian Institute of Astrophysics (IIA)

by MANAMI ROY[‡] & PRAKRITI PALCHOU DHURY[†]

– Postdocs, [‡] The Ohio State University, USA [†] University of Oxford, UK

Like many women about 25 years ago in India, Prof. Mousumi Das, Indian Institute of Astrophysics (IIA), Bengaluru, did not have a smooth ride in academia. She realized later in life that her ambitions as a young girl were not well-shaped despite having a strong acumen in science. Hailing from an educated middle-class family in West Bengal, she received good exposure to science from her childhood. **However, had it not been for her mother, who was a liberal thinker, Mousumi would not have pushed herself persistently in her career.** We had a delightful and candid conversation with Mousumi on life, science, society, and the future.



MD: Before you start the interview, I want to say that I am really happy to be part of CARINAS, and I think it is a wonderful initiative to connect women in Astronomy. There is now a fairly large community of women astronomers. So this platform to express our ideas is very important.

MR & PPC: Thank you so much! We also hope that this initiative will be helpful to the Indian women Astro community. (pause)... So, let’s start with your childhood stories. Tell us about your schooling, inspiration in science, and entry to the field.

MD: I was in the UK until the age of 12 with my parents. We moved to Kolkata and I was admitted to Calcutta Girls’ High School. It was not an easy move. Bengalis have cultural elitism and I was not that young girl who knew *Rabindrasangeet* (laughs). But I had a happy-go-lucky childhood. We were not so serious about academics. Of course, the night sky was the biggest inspiration and in those days Calcutta sky was dust-free. After

school, I was admitted to IIT Kharagpur in Physics. But I did not continue. *Ma* (mother) called and said, “Your name is up on the Presidency College list. Come back.” See, **back then middle-class parents were somewhat conservative about women going to a far-off place to study, even though it’s only 100 km away.** It was a different time. I was also fine with what I was told to do and returned without objection. Presidency College required some adjustment from my side. In 1970-80s Calcutta, the best Physics students, specifically the boys in Presidency were also great philosophers. They debated so much about everything from politics to philosophy. In about a year or so, I fitted in. Took a *jhola* (cloth sling bag) on my side and I was just another physics student (laughs). After my M.Sc., I was considering a Ph.D. in Astrophysics abroad. However, my family found it challenging to accept the idea of me studying far away from home. Then an IISc Ph.D. interview came up. I lied about a university excursion and went to give the interview. When I finally received the news of my acceptance to IISc, I told *Baba* (father) that I intended to visit the institute to get a feel for it. In response, he decided to send *Kaku* (uncle) along with me. *Didi* (elder sister), with a mischievous grin, chimed in, “Don’t bother purchasing a return ticket for yourself, just make sure to get one for *kaku!*” (laughs)...

MR & PPC: How was your Ph.D. life? How was the journey into science? Did you have Ph.D. siblings?

MD: When I joined, Chanda’s (Ph.D. supervisor) family responsibilities kept her somewhat busy. Overall, I had a good time. My Ph.D. sibling was Monica Valluri (now a Professor at the University of Michigan, USA) and we became good friends. Chanda preferred pen-and-paper work. I realized that computation is also needed in this field (galactic dynamics). At that time, the Department of Physics (IISc) had a thriving Condensed Matter group that did computer programming. I went and talked to them to pick up that skill. Both me and Monica took up numerical calculations that way. **In IISc, I learned to be an independent researcher...**how to take an idea forward. Also, Rajaram Nityananda helped me a lot during my Ph.D. days.

MR & PPC: How was the scientific journey after your Ph.D.? Tell us about the challenges as a woman. Did you face any explicit bias?

MD: I got married in the final year of Ph.D. **I feel now that your generation of women plans things better.** Some of us didn’t back then. It was an inopportune moment to start a family but I did. I first became a postdoc at RRI and my first child was already born. I made many strategic mistakes. I was very candid about family life with my colleagues at Raman Research Institute (RRI) and I now think that people did not take me seriously as a professional woman. ...(interrupted)

PPC: ...but when it comes to assessment from the community, your science is a separate space from family life; shouldn’t matter if you are candid about the latter or not.

MD: You wish things were that ideal, Prakriti (laughs). However, a great thing about my family life was that **my**

husband was tremendously supportive of my career. Hence I dared to start applying for a postdoc abroad. In Germany, I was interviewed in the Genzel group in 1999 but they told me that there was no daycare for my child. Then I got a job at Maryland (UMD) in 2000 with Stuart Vogel. An arrangement for child care was made even before I arrived. I started on a very positive note and had a good time in Maryland. **The fact that I was a mother did not come into the way of my profession.** See, IIA still doesn’t have a daycare! There were ups and downs in my US life but at that time working women had better support there than in India. Eventually, I had to return to Bangalore for family needs and I was desperately looking for a position. I was not hired in RRI/IIA. I crossed the (golden) age limit (of 35) for IITs. I went to BITs (Hyderabad) and took a teaching job. That was a turning point since teaching requires discipline and the cultivation of basic physics. Initially, it was a struggle to go back to physics. Finally, in my mid-forties, I came back and got the full research position in IIA. I was very late to get a job, partly due to my foolishness. **I never gave up since I felt that as a scientist I had a lot to contribute.** One person who strongly supported my case was Harish Bhatt, a very good astronomer and an understanding person. I was good but somehow getting a job was a heart-wrenching affair. Maybe I was a bit disorganized...

MR & PPC: How did your scientific interest evolve throughout these years leading to a faculty position? And what are you currently working on?

MD: Yes, I was interested in (galactic) dynamics and that’s why joined Chanda. But what I realized in RRI is that in theory there are so many problems. If you want to understand the subject as a whole, you have to get into observations. In Maryland, Stuart implied that I should go into hardcore N-body simulations or observational data. **If you have done basic theory, it is great to do multi-wavelength observations.** Then you can master so much! When I was in RRI, I did radio (GMRT), in Maryland I learned millimeter, and when I came back to IIA I learned optical mostly from my students. I also worked with Chris (Reynolds) and picked up X-ray.

“ *I think we (in India) don’t look to the West for ideas, but definitely for data. We are known more for our theorists.* ”

– Prof. Mousumi Das

MR & PPC: Can you elaborate on the astrophysical objects you study? It is broadly related to galaxies co-evolving with black holes, we believe.

MD: Yes, I study everything related to galaxies. Galactic structure, how they rotate, the kinematics, the composition (stars, gas, dark matter). I’m also interested in the galaxy environment, i.e., Manami’s subject CGM, although haven’t done much of it. I’m interested in how galaxies grow through interactions or cold gas accretion and generally also in black holes. I look at the big picture of galaxies but I’m not an expert in terms of details. If

you're an expert in black holes, let's say, you understand more about AGN evolution. I lose out on such details. But **I'm more excited about the big picture.** I study low surface brightness galaxies and determine their dark matter content. I use UVIT to examine star formation, tidal tails, and dual AGNs to understand galaxy evolution through mergers. I, along with a Computer Science student doing a Ph.D. in Urbana (UIUC), recently used a million SDSS galaxies, and using imaging techniques, we detected pairs of galaxies. Then, using spectroscopy, we identified which ones were AGNs. We found a sample of 159 dual AGNs primarily coming from major mergers. Another student, Amruta, is doing UV observations of dwarf galaxies. Over the years, I have been very fortunate to have good Ph.D. students. **When they get deep into a topic, I learn from them.** I have done radio studies with Rubinur, optical/UV studies with Jyoti, Amrutha, and Honey, and simulations with Sandeep, Ankit, and Sioree. Sioree is now writing a paper. I'm learning a lot from her draft.

MR & PPC: We will shift gears - you mentioned you felt that certain things were better in the States for you as a working woman. But did the race or country of origin come into your way? Were you ever looked down upon socially or academically?

MD: My postdoc group, the BIMA group was quite progressive. But some people had reservations. During a lunchtime conversation, a fellow American scientist mentioned (not nicely!), "You know, there's an Asian woman who recently started as a postdoc." In response, I couldn't help but smile and said, "Yes, that would be me!" I was an Asian woman and short, not very commanding. So, **I was not taken seriously many times in conferences, especially in Europe.**

MR & PPC: Do you or did you feel any sexism in India and abroad as a faculty?

MD: As a postdoc, I did feel some amount of gender bias in India, but once you're a faculty, once you have reached that stage, people do take you seriously. I think there is gender discrimination against women scientists abroad as well, it's not just in India. In some meetings, I do feel some racism, but it is usually rare and sometimes I think it's because I don't know that many people in the meetings abroad. This is mainly because it's difficult for us in India to frequently travel abroad for meetings, and so we don't always feel that comfortable.

MR & PPC: What do you say to the younger generation? And what do you think of the future in Indian Astronomy/Astrophysics?

MD: Don't forget basic physics. But be aware of data. Be networked and be planned about faculty job applications. In India...well, we are being slow. TMT has not come up. GMRT is the only world-class facility. AstroSat is a good hope. But Astrophysical instrumentation is lagging. **I think we (in India) don't look to the West for ideas, but definitely for data. We are known more for our theorists.** Many years ago Nick Scoville in Caltech told me, "Your country produces very good theorists!" So we should keep that reputation up, but build more world-

class facilities for the scientific community.

The third generation: Story of today's woman

by RUBINUR KHATUN
—Postdoctoral fellow, University of Oslo, Norway

My research journey has been a thrilling exploration into the depths of astrophysics, with a primary focus on active galactic nuclei (AGN) and star formation within galaxy mergers. My investigations extend to the intriguing phenomenon of dual AGN and the impact of AGN feedback on cosmic structures.



Like many others, **my earliest celestial memories were shaped by my parents.** Growing up in a small village, my parents often took me outdoors to gaze at the night sky. They introduced me to the wonders of the cosmos, pointing out familiar constellations such as Orion and Ursa Major.

These stargazing sessions soon evolved into playful challenges to identify stars, like those within Orion's Belt or the Big Dipper. Those moments ignited my curiosity and my lifelong passion for the cosmos.

However, my formal journey into the world of astrophysics began during my master's program at St. Xavier's College, Kolkata, and the Bose Institute, Kolkata. Here, I had the privilege of learning from exceptional educators who imparted the fundamental principles of astronomy, cosmology, and astroparticle physics. It was during this transformative period that I decided to pursue a Ph.D. in astrophysics. My doctoral research unfolded at the Indian Institute of Astrophysics in Bengaluru, India, under the **invaluable guidance of my wonderful supervisor, Dr. Mousumi Das. Dr. Preeti Kharb also played a pivotal role in mentoring me** throughout my research journey, both at the Indian Institute of Astrophysics and the National Centre for Radio Astrophysics. These mentors and institutions provided me with a nurturing environment to delve deep into my scientific pursuits.

I have dedicated my research efforts to understanding the intricate connections between galaxies and the central AGN. My investigations involve observing some of the universe's most captivating galaxies using prominent radio telescopes like the Very Large Array, the Giant Meterwave Radio Telescope, and India's first space observatory, AstroSat. These observations are crucial for detecting dual AGN, studying star formation during the late stages of galaxy mergers, and modeling complex data to unravel the mysteries of peculiar radio galaxies.

Participating in international conferences has been a rewarding facet of my research journey. These gatherings have provided me with a platform to engage with fellow scientists, share my work, and cultivate cross-cultural connections. They offer a unique opportunity to embrace diversity, exchange ideas, and broaden my horizons as a researcher. **Throughout my life, I have been fortunate to have parents who instilled in me the values of fair-**

ness and equality. These principles have guided me both personally and professionally. My travels across diverse cities in India and abroad have revealed that while significant progress has been made, the journey towards true equality remains an ongoing endeavor. Academia has its own set of challenges, including job shortages, intense competition, hierarchical structures, and persistent gender inequality. With the vision of equality firmly in my heart, **I am immensely proud to be a part of CARINAS**, a women’s forum dedicated to supporting and empowering Indian women in STEM fields. This forum would serve as a vital platform for women researchers to share their experiences, offer mentorship, and collectively address the unique challenges faced by women in science. Together, we strive to foster a more inclusive, diverse, and equitable scientific community, working tirelessly to dismantle barriers and uplift one another.

In conclusion, **my journey as a researcher** in astrophysics has been an odyssey of discovery and scientific exploration. It **has illuminated the profound value of equality and underscored the critical importance of advocating for change**—both in our personal lives and within the scientific community.

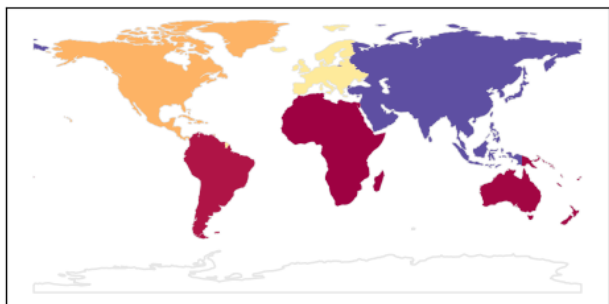
How did we get here?

—and counting our stars

by SANSKRITI

— Postdoctoral fellow, Kavli Institute for Particle Astrophysics & Cosmology, Stanford University, USA

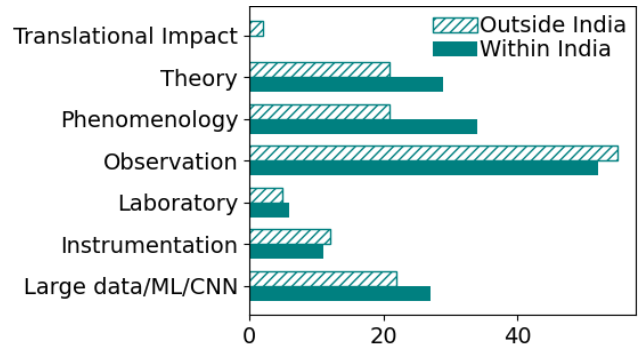
Similar to many astronomical discoveries, the formation of CARINAS was serendipitous. We were concerned about the status of women’s representation and appearance in cosmology & astronomy and its relevance in the context of our cultural/racial identity. For example, the percentage of Indian women **within the IAU membership** is below the global average and significantly below the South American and Southeast Asian countries. In many developed countries, encouraging women to enroll in STEM is an issue. Unlike them, the skewed gender ratio in STEM in India emanates from the problem of retaining women in academia. **≈43% students in STEM graduate courses in India are women.** However, we do not see this percentage percolating to the top. Here at CARINAS, we aim to explore the defects in our “leaky pipeline”.



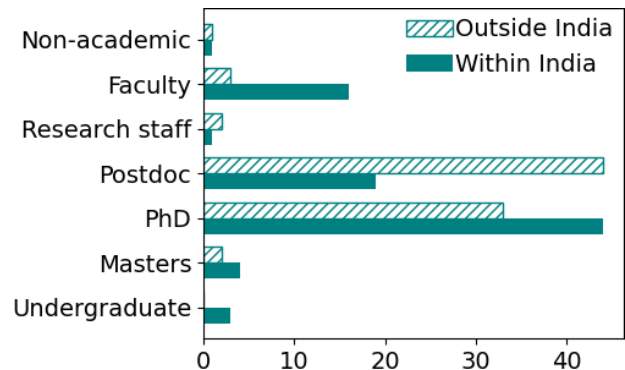
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%of CARINAS

Starting from three founding members (Prakriti Pal

Choudhury, Manami Roy, and Sanskriti Das), we have grown to 224 members in one year, spread across 25 nations on 6 continents. 51% of the members currently reside in India. In the following figures, we summarize research techniques CARINAS’ members specialize in and their career stages within and outside the country. You can find more detailed member statistics on our [website](#).



CARINAS’ members shine across the whole breadth of research techniques. Many members are also active in extensive outreach and teaching (not presented here). The bar chart reflects India’s rich tradition in theory and phenomenology and rising capabilities in observations and data-driven endeavors. The paucity of members doing instrumentation and laboratory science could result from the lack of encouragement or role models for women scientists in these subfields.



As CARINAS is a community focused on early-career scholars, most members are Ph.D. students (44%) or postdoctoral fellows/associates (36%). After their Ph.D. from India, many scholars move abroad to enrich their experiences, resulting in more postdocs outside the country. The deficit of undergraduate or master’s students is partially due to our insufficient reach to younger students. Rectifying it as early as possible is on our agenda.

Where do stars cluster?

Meetings attended by members

by ANWESHA MAHARANA[‡] & YASHI TIWARI[†]

— Ph.D. student, [‡]KU Leuven, Belgium, [†]Indian Institute of Science, Bengaluru, India

CARINAS attended many conferences, workshops, and meetings all around the world. The word art illustrates a list of places visited by some of the members. The most attended conference was the annual meeting of

the Astronomical Society of India, 2023, held at IIT Indore, India. The full list of attendees and the corresponding conference names can be found on our [website](#).



Star formation

Achievement of members

We wholeheartedly congratulate our “new stars”, the CARINAS’ members who have recently earned their doctorate in Astronomy/Astrophysics/Cosmology: **Dr. Ankita Bera** (from Presidency University, Kolkata, India), **Dr. Manami Roy** (from Raman Research Institute, Bengaluru, India), **Dr. Meera Nandakumar** (from Indian Institute of Technology – Benaras Hindu University, India), **Dr. Misba Afrin** (from Jamia Millia Islamia, New Delhi, India), **Dr. Mitali Damle** (from University of Potsdam, Germany), **Dr. Purva Diwanji** (from the University of Alabama, Huntsville, USA), **Dr. Silpa Sasikumar** (from Tata Institute of Fundamental Research, Mumbai, India), **Dr. Srashti Goyal** (first female Ph.D. from International Centre for Theoretical Sciences, Bengaluru, India), and **Dr. Sriyasrithi Acharya** (from Indian Institute of Technology Indore, India). Be it along the “main sequence” or otherwise, we wish you the best for the next stage(s) of your career!

Freshly baked news

Prodigal pet loses way in her space enthusiasm¹

by DR. JESTRESS

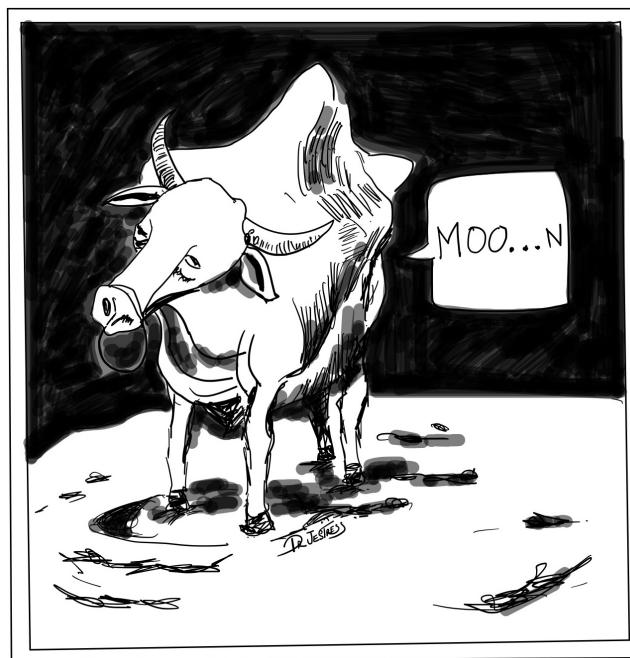
Has your pet gone missing? Chances are it is exploring space! The Lunar South Pole (*aka* LSP as named by space scientists) has become the top travel destination for the wealthiest humans around the globe, but pets are strictly prohibited there. In an unusual turn of events, an Indian cow has landed on LSP. She was caught by cameras onboard multiple lunar rovers and orbiters belong-

ing to space agencies like ISRO and NASA (see attached photograph). Her name is *Radha*.

Radha has been known to the world as adventurous since her heyday. She always had an odd affinity for space activities, as noted first in 2014 by the *New York Times*. However, this time, old *Radha* had no intention to travel so far out and linger, as informed by her loved ones to our special correspondents. “She is fragile, lonely, and feels vexed out there,” they said, “...but she is carrying sufficiently warm coats for lunar nights.” No one has got a clue on how she broke all protocols and got stranded.

As usual, Indians have divided opinions on this issue. A section of the Indians contacted PETA to take action since this may fall under animal rights violation. Vegans and vegetarians are relieved that there is a new way to save these poor animals from meat eaters. The vegetarians seem hesitant to align strongly with the former. Rest do not care so far. However, concerned global citizens have raised intense X (former Twitter) debates on making water-tight space travel regulations for stray pets.

The President of the United States, anxious about which protocol to follow next, called for an urgent meeting with the Prime Minister of India. The UN chief and senior officials also express deep concern about *Radha*’s safety in the unfamiliar terrain.



Editorial board

Prakriti Pal Choudhury, Sanskriti Das, Divita Gupta, Garima Rajguru, and Veena Vadamattom Shaji

Other acknowledgements

The Milky Way photograph used for creating a woman’s silhouette by Prakriti Pal Choudhury is provided by [Sangram Biswas photography](#).

¹This is meant for pure humor. Everything here is fictional. Apologies in advance if any individual/community/nation finds it offensive.