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GUEST EDITORIAL

Can anyone own the sky?

Vigyan Samagam, the ongoing exhibition of science megaprojects, is travelling across cities and bringing the attention of the nation to the significant role played by India in building the engines that will drive discovery in science in the coming decades. Futuristic telescopes are key components of *Vigyan Samagam*.

The skies above have been there for all humankind all over the Earth to spark the creation of imaginative stories, and to perhaps make us the intelligent humans we have evolved to be. It's the experience of visions and phenomena beyond the ordinary, in the sky above as well as here on Earth, that continue to evolve the stories of our cosmic history and science.

I learnt the art of adding to the imaginations when, in 1983, I joined the Radio Astronomy Group of TIFR that specialized in looking at the skies with radio wavelength eyes – radio telescopes. Pramesh Rao – a member of the group at Ooty – was surveying the radio sky and had just noticed something out there that had the most unusual appearance. Professional astronomy first seeks an explanation for phenomena in terms of the known, and ventures into paradigm shifts when all else fails. Govind Swarup – then head of the group – took Pramesh and I for a walk down the Muthorai hillside in Ooty where the Ooty Radio Telescope is sited, and proposed a most outlandish story for the discovery: that gravitational field of a galaxy in space between us and a distant quasar acted as a gravitational lens and distorted the appearance of a conjectured norm into the perceived oddity. A quirky story indeed for a quirky celestial body!

Science does not stop at proffering such explanations; it progresses by seeking objective verification. Govind recognized that substantiation of the theory required imaging the appearance of the celestial object in the optical – which was possible with the Anglo-Australian Telescope located in the continent of Australia – and imaging the object at multiple radio wavelengths and with sharper vision – which was possible with the Very Large Array in the US. The skies were open: Govind, Pramesh and I at Ooty in India could send off requests to these top-notch international telescopes, gain observing time in open competition, have the images across the electromagnetic spectrum shipped across oceans, and endorse the inge-

nious hypothesis thus establishing the discovery as one of the earliest examples of gravitational lensing.

Mature individuals, organizations and nations are recognizing the value of what is called 'open skies' policy. The philosophy is that the builders of telescopes contribute to the building activity if they see gains in engagement in the construction itself, and once the telescope is built it is open for competitive bids for observing time and the contributors to the building may showcase the finest science outcomes as scientific returns on their investment.

Nations have built powerful telescopes that demonstrate their inherent engineering excellence. The investments have been deemed worthwhile when these telescopes produce remarkable advances in the knowledge of mankind, and breathtaking images of the cosmos that awaken the intelligence in all of humanity. To the creative builders of the remarkable machines it has mattered less who in the world did the imaging and advancement. Walking into the foyer of the Array Operations Centre at Socorro, New Mexico, a visitor is greeted by an entire wall of framed cover pictures of *Science* and *Nature* that are adorned with stunning images made by the powerful telescopes built by the National Radio Astronomy Observatories of the US. The nationalities of the authors of the corresponding publications are of secondary importance.

It is the policy of making the engines of discovery open to the best minds of the world – on merit – that have resulted in the remarkable scientific breakthroughs and given the best scientific returns on the investment. Equally important, the discoveries by the high profile telescopes advertise the technical excellence of the builder nations; it is the technological advancements driven by the need to push the capabilities of the observatories that enable discoveries.

For decades my colleagues and I have benefited from this 'open skies' policy that has been followed by most nations that have historically built the most powerful telescopes, thus enabling us to use the best telescopes in the world for the science we do. During my formative years, fellow Ph D students in India gained the best education and training because they had open access to the best facilities for the science goals they pursued, which

then gained them good placements worldwide for post-doctoral research. Later, the policy enabled them to continue pursuing competitive science on taking up tenured positions in India.

Professional telescopes have been getting to be increasingly expensive, and the technologically advanced and gargantuan facilities that enable exploration at the frontiers of our knowledge are no longer considered affordable by single nations. Significant spending has naturally attracted oversight by financial managers, who may seek qualitatively different returns on these investments compared to science managers, who may have grown through the ranks that engage in professional astronomy.

As nations, including India, move forward into the era of science megaprojects, it is sad to see a movement by managements and funding agencies of the participating nations to assume a role of being protectors of their national interests, by seeking guaranteed access for their astronomer community in perpetuity, and seeking to close access to astronomers outside the funding nations. India is poised to be a participant in the giant optical Thirty Meter Telescope (TMT) and also the Square Kilometre Array (SKA) international radio telescope. Management boards of the megaprojects of tomorrow are seeking to limit access to astronomers from exclusively within the collaborations, and India is becoming a partner to the new world where participation in the grand exploration of our origins is poised to be an exclusive privilege of select communities.

Protectionism always has its supporters; most notably the section that has lost its competitive edge – for whatever reason – and seeks security in guaranteed access to research facilities. Responsible management of course needs to be sensitive to the concerns of sections that seek pro-rata guaranteed access in perpetuity, in facilities funded by their nations. However, the goal needs to always be towards a world where free spirited research expands our horizons, with all players provided a fair opportunity to participate in this quest to the fullest of their potential.

Guaranteed time is often deemed necessary for an astronomy community that is disadvantaged. First, the argument is relevant only if the astronomy community has been actively discriminated against and, therefore, disadvantaged. Second, any provision of guaranteed time, which is provided in the cause of enabling a bridging of an existing gap, needs to take the form of a ramping down provision and not provided in perpetuity.

If India along with other countries that collaborate on astronomy mega-projects were to go down a path away from the open skies policy, it would be naïve to imagine that countries – like the US, who have historically kept their NSF-funded ground- and space-based observatories open to India-based astronomers – would continue to do so. Additionally, I would not be surprised if even archival repositories across the electromagnetic spectrum, which

are so much used by Indian astronomers today, might become inaccessible. The Indian astronomy community would, of course, have pro-rata access to the grand observatories for which they have paid subscriptions, and would be directed to be logging their efforts in the defined key science projects that is their exclusive privilege.

While this might provide a psychological and occupational security to the astronomy community, can we quantify the loss to the intelligence of the community as a consequence of the loss in means to engage in investigative astronomy with a free spirit? Do we want to straightjacket the astronomy community to be limited in their visions and experiences of the cosmos, and directed by funding to pursue predetermined programmes? Is the astronomy community of the country – as a whole – comfortable with a future in which they are directed and limited to doing science exclusively with the megaprojects that the country enters into, and be excluded from use of the vast range of instruments and data across the electromagnetic spectrum that might be theirs in a world that embraces an open skies policy?

Most funding agencies do want to see a ‘return on their investment’. I suspect the real return that governmental agencies seek is to the economy, via contracts that flow to local industry located in the participating countries, via advanced and enabling technology that might transfer into local industry, and via opportunities enabled for industry to showcase their capacity and talent in international projects with high visibility. This may be satisfied by participation in the design phase; with guaranteed participation in the construction phase.

Once the telescopes are built, could the benefactors and promoters of the megaprojects, and the nations that fund the building and operations, take delight in the discoveries that emerge? Discoveries that emerge from individuals and natural collectives of astronomers across nations, who are simply pursuing their passions? The way forward in fundamental research often comes from inner whisperings rather than external directions. It comes from inner dedication to a vision that is seen by the inner eye, rather than from a scientific community that is top-down dedicated to an externally defined vision. It has been said that truth is a pathless land.

Could India take a courageous stand and prescribe and champion the open skies policy, joining many in the world that believe in this approach, accepting that the open skies policy serves best the interests of the builders and of science?

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