Rolling super-eyes heavenwards

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If you are building a supertelescope, choose your site where the instrument can function efficiently, which means minimising light pollution

When Galileo Galilei first turned his homemade telescope towards the heavens little did he realise that he was initiating a revolution. From a telescope whose main lens had a diameter no more than three-four centimetres, today's astronomers have at their disposal telescopes with main mirrors having diameters of 8-10 metres. Not only that, the window of vision of the cosmos has widened beyond the traditional optical one, with telescopes using radio waves, infrared, ultraviolet, microwaves, X-rays and gamma rays coming on the line. These "different kinds of light" detect objects that our eyes are not sensitive to. Barring radio waves most other waves tend to get absorbed in the atmosphere. So telescopes using them need to be placed in high orbits around the Earth, well above the absorbing layers of the atmosphere.

For example, in the 1970s, the satellite-launching technology had become sophisticated enough to launch X-ray telescopes. These early X-ray observations led to the discovery of black holes as the invisible members of binary stars. In such a two-star system only one is visible; the existence and dimensions of the companion can be deduced from the data on the visible component.

Not satisfied with the progress achieved to date, the younger generation of astronomers is going in for optical telescopes in the 20-40 metre class. A telescope whose main mirror has a diameter of 30 metres, say, is able to gather light nearly 15 times an eight-metre telescope can. And more light collection means that one can see objects farther away. Since bigger telescopes can spot and record fainter objects, there is a chance of picking objects missed by smaller telescopes. At the same time, we should recognise the "small and beautiful" also. It is the small telescopes that have discovered planets around stars other than the Sun. Likewise, the discoverers of comets have usually been amateur astronomers with their handy roof-top telescopes.

But, deplorably, often these contributions by small telescopes are forgotten in the search for glamour associated with large telescopes. Supermassive black holes, very far away quasars, the exploration of the epoch known as the dark ages, strange dark matter, stranger even the dark energy... these topics where facts are difficult to isolate from speculations dominate the menu card of the modern young astronomer.

Currently, there are three possible large optical telescope baskets in which astronomers can place their eggs. The days when a country proudly displayed its best telescope somewhere on its soil are gone. Perhaps, the last such example was the two-and-a-half-metre Isaac Newton Telescope (INT) which was established in the 1960s on the premises of the Royal Greenwich Observatory (RGO), which had already been shifted from the original site in Greenwich to the spacious surroundings of Herstmonceux Castle in Sussex, to avoid light pollution from the urban lighting of London. The growing brightness of the night sky, however, continued to threaten optical observatories. This light pollution coupled with the well known cloudy British weather meant that the telescope would be used less frequently and less efficiently than it deserved. In fact, many astronomers had earlier recommended placing the INT in a better site, perhaps in the Spanish territory of Las Palmas. But, out of misplaced national pride the telescope was kept in the RGO. The usage (or lack of it), however, finally led to a rethink and ultimate shifting of the INT to Las Palmas.

So, the moral is: if you are building a supertelescope, choose a site where the instrument can function efficiently. As mentioned before, this means minimising light pollution, as many dry and clear skies as possible and good seeing. The twinkling star may make a good nursery rhyme, but the astronomer would like to avoid it. Twinkling comes from disturbances in the atmosphere through which the starlight has to travel before entering the telescope. Air currents, strong wind, etc, shake the light beam and lead to a fuzzy image. So one chooses a location where such atmospheric disturbances are minimal. A prime location from this point of view is above the Earth's atmosphere. The Hubble Space Telescope, circling the Earth at a height of 569 km, enjoys this luxury. But to maintain and service a telescope at this height is very expensive and in most cases a site with as good a record of performance as possible is chosen on the terra firma.

A second issue affecting the modern supertelescope is "who pays for it?" No single nation, howsoever well off, wants to pay fully for the facility for the simple reason that it is prohibitively expensive. So scientists from different nations get together to form a consortium in which each country pays a part of the cost, usually 10 per cent or above. Out of the three supertelescopes on the drawing board, India is planning to join the Thirty Metre Telescope (TMT) project. If a partner in this consortium pays 10 per cent, the observers from that country will get 10 per cent of the total available observing time.

There are encouraging signs with the Government of India indicating support for this participation. Even more encouraging is the circumstance that Indian labs and industry will collaborate and make specified components of the telescope. No doubt this will provide our industry experience to work at the cutting edge of technology. One important part of this picture is the need for creating users for the telescope. Given that we are promised 20 nights, say, for observing, do we have proposals that will require that length of usage? In short, we have to create young astronomers with deep research interests. We may need as many as 50 to 100 and that is a stiff human resources challenge indeed for our universities and research institutes.

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