Why Study Astronomy?

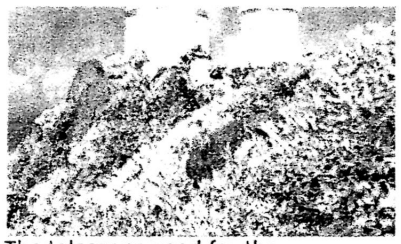
Jayant Narlikar and Thanu Padmanabhan

Astronomers are often asked why anyone should study astronomy and bother about distant stars, planets and the remote galaxies in the sky above. Many people wonder whether such an activity is of any practical value and why we astronomers indulge in it. The question has special relevance this year as we are celebrating 2009 as the International Year of Astronomy (IYA in short). As we wind up this series of articles, we thought it worthwhile to discuss this question.

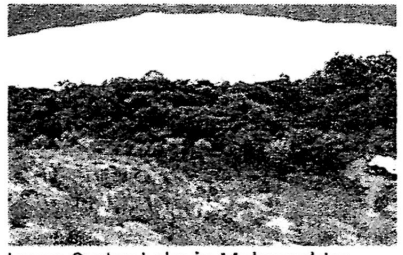
This question, of course, can be answered at different levels. At the deepest level, the motivation to study astronomy is the same as the motivation for any intellectual activity. As, for example, emphasised by CEM Joad in his 'Dialogue on Civilisation', one of the clear signs of any advanced civilisation is that a fraction of people spend their time pursuing activities like arts, literature and the more abstract variety of science. They are supported by the rest of the community in these pursuits which is the hallmark of every advanced human civilisation we have seen. So, at this level, astronomy is practised in order to satisfy our innate curiosity about the cosmos and to understand our place in this universe. It is somewhat less abstract than, say, pure mathematics but the intellectual simulation is the same.

Viewed in this respect, astronomy has given us rich intellectual dividends. The leading astronomer of 16th century, Tycho Brahe, had made meticulous observations of the sky and in particular, the motion of planets. Kepler, who worked as his assistant, codified them in the form of three specific laws for planetary motion. The explanation for these laws, from a theoretical point of view, came from Newton who had the courage to postulate the existence of a universal gravitational force between any two objects. From then on, study of gravity has played a crucial role in understanding the structure of our universe. Later on, Einstein's modification of Newtonian gravity led to the picture of an ever expanding universe which has been the cornerstone of cosmological studies today. It is very gratifying that human mind could unravel so many mysteries about the universe motivated only by sheer curiosity. The fact that common man does appreciate such intellectual endeavours was again demonstrated when Einstein was voted 'Person of the 20th Century' ahead of many other luminaries who might have contributed tremendously in practical matters of the world.

At the next level, one can list several technological offshoots which have come about from the study of pure science and have benefited mankind. More often than not, such utilitarian aspect of a discovery in science was not anticipated at the time it was made. When Faraday discovered his laws of induction, many people wondered what good it is for the common man. Today, most of our electric power infrastructure depends directly on this discovery. Similarly, most of the benefits of space technology which we enjoy today can be directly traced to the better understanding of how gravity works which, in turn, was prompted by purely astronomical considerations. That we can launch satellites around the Earth or can send space crafts to the Moon and the planets like Mars, Mercury or Jupiter all in highly precise trajectories is because of our understanding of Newton's law of gravitation.



The telescope used for the Spacewatch programme



Lonar Crater Lake in Maharashtra

Hence, the benefits we enjoy today from space technology, be it remote sensing of Earth resources, or sending a fax or an e-mail message or watching the World Cup live on TV, all owe their existence to the law of gravitation; and the law of gravitation itself owes its genesis to the data from astronomy.

For those who want a more direct and clear-cut benefits from astronomy, one could provide the following example. We can actually go one level further and argue that astronomy is essential for our continued existence on this planet. We are aware of the history of Jurassic age when huge beasts like dinosaurs used to dominate this planet. What happened to them? What catastrophe took place that wiped them entirely from the face of the Earth?

Speculations are many. But one possibility that is taken very seriously is that the Earth may have been hit by an extra-terrestrial body of appreciable mass and the impact caused a huge turmoil wiping out all, or at least most life forms from the Earth. What could such a body be?

Johannes Kepler

Judged by the crowded streets in a metropolis, the space in which the Earth moves is remarkably empty. The chance of a collision is very very small. But it is not zero. Let us see a few examples of previous impacts. The surface of the Moon is pockmarked with craters, showing evidence that outside bodies have hit it on several occasions. The Earth has also such craters; only many of them are filled with water and appear as lakes. Some impact craters are confused with volcanic ones. Two examples of craters believed to have arisen from impacts are the Meteor Crater in Arizona, USA and the Lonar Crater Lake in the Buldhana district of Maharashtra in India. As the name of the first one suggests, the impacting body in both cases was a huge meteorite.

Meteorites come in all sizes, ranging from less than a millimetre to several metres and the larger ones can be devastating in their impact. For example, the meteorite whose impact caused the 'hole' at Lonar was about 60 metres in diameter, weighing about twenty million tons. The hole so caused has a diameter of around 1,830 metres and a depth of 150 metres. How can we describe the magnitude of this event? Tom Gehrels from the University of Arizona has used a graphic way to describe it: through a comparison with a devastating event that our society endured last century: viz. the energy released in a nuclear bomb. The energy released in the Lonar catastrophe was equivalent to that coming from a 6 megaton H-bomb. For a comparison, the strength of the impact on Lonar was about 500 times the atom bomb dropped on Hiroshima (which was of 13 kiloton capacity).

There are bigger entities than such meteorites going around in the Solar System. In July 1994, Comet Shoemaker Levy had impacted on Jupiter. The event was witnessed by telescopes on the Earth. On the huge planet the impact of a comet had, of course a transient and relatively mild effect.

Tycho Brahe

But what if a comet strikes the Earth? Indeed, such a possibility was raised in 1992 in connection with Comet Swift Tuttle. This comet passed by in 1992. At the time, it was predicted that in its next visit on August 14, 2126, it will come very close to the Earth. Although it cannot be definitely calculated, the probability of its actually hitting the Earth is not negligible. A better estimate can only be made when the comet is sighted again in the 22nd century.

One of us had written a science fiction story in which a comet like this was headed for a collision with the Earth. How did the scientists avert the catastrophe? The solution used in the story involved sending an unmanned spacecraft to rendezvous with the comet; with the provision that close to the comet, it would carry out a nuclear explosion generating shock waves that would divert the comet from its original path. The same solution is now proposed for saving the Earth from an impending impact by a comet or a meteorite, or, what is now considered more of a threat, an asteroid.

Keeping such possibilities in view, astronomers in the USA have initiated a Spacewatch programme, in which a dedicated 1.8 metre telescope is looking for all solar system bodies of such appreciable sizes in our neighbourhood. With their trajectories charted out we can predict if any of them will come dangerously close to the Earth in the future, and take preventive action as needed. This example again tells us that sky-gazing is not a mere idle activity: it can help human survival...

Astrophysicist Jayant Narlikar and theoretical physicist Thanu Padmanabhan contributed to DNA's special series through 2009, designated the International Year of Astronomy.