

## Virtues of studying astronomy

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As an astronomer, I am frequently asked: What is the use of studying distant stars and galaxies, most of which we cannot even observe without the use of telescopes? In what way, if any, does the knowledge gained from this pursuit help us in our daily life? In a way, the questioner is implying that we astronomers are pretty useless fellows!

But reality is otherwise as I will try to prove now. There are many ways in which astronomy is not only useful for human existence, but is vital to it. We know, for example, that since time immemorial, astronomy has been used by civilisations to make calendars, create a time-table for agriculture and religious festivals, and navigate on the high seas.

But historical reasons apart, there were later developments in astronomy that have resulted in very useful social applications of science and technology today.

In the 16th century, Tycho Brahe, an eminent astronomer, had set up a high-quality observatory to record the positions of stars and planets as accurately as possible in those pre-telescope days. Tycho wanted to prove Copernicus wrong by demonstrating that the earth is stationary and it is the sun that moves around it. He needed an assistant to reduce the data mathematically so as to arrive at such a basic law of nature. Johannes Kepler joined him in that capacity and stuck on to the job despite the rather insulting behaviour of his master. For, Kepler realised that the astronomical data amassed by Tycho was indeed very valuable.

As it happened, Tycho died soon after Kepler joined him. His successors were not interested in the data. So Kepler took them in his possession and began his analysis. After several years, he arrived at three basic laws of planetary motion describing how planets (including the earth) move around the sun. These laws formed the basic premise on which Isaac Newton was able to base his law of gravitation decades later. Indeed, it is fair to say that without Kepler's laws, Newton would not have been able to formulate his law of gravitation.

Three centuries later space technologists were able to navigate their spaceships and satellites because they had Newton's law of gravitation. Today, we savour the benefits of space technology in various ways. Remote sensing, spreading education to remote areas, modes of telecommunication in the form of telephone and fax, broadcasting television programmes from one continent to another; all these are possible because of space technology. But space technology would not have been possible without Newton's law and that would not have been possible without Kepler's laws. And, Kepler's laws would not

have been known without the basic astronomical data collected by Tycho Brahe. So, in the last analysis, it is astronomy that we have to thank for the IT-benefits that we enjoy today.

Astronomy is helping basic sciences in many ways, and that can result in practical benefits for us. Why does the sun shine? This basic question was answered by astronomy and that brought to light the fact that the sun shines because energy is being created in a thermonuclear reactor in its core. Can man emulate the sun by producing energy by nuclear fusion? Astronomy holds out hope by pointing out that what has been done in the sun can be repeated with suitable modification on the earth. A fusion reactor needs heavy water as fuel, which can be tapped from the sea in abundance. So, man can hope of solving his energy problem by emulating the sun and this route to energy may well become available by the middle of this century.

Finally, let us look at a possible danger that may threaten the earth. It is well known that a large number of small bodies are moving around in the solar system apart from the eight planets. These include meteorites, asteroids, comets and meteors, and one of them may strike the earth. Though collision is a rare occurrence, when it occurs, it can be devastating. It is believed that dinosaurs were annihilated along with most other life forms when such a collision occurred. This is where astronomy may come to our rescue. By charting the paths of all major bodies in the solar system under the sky-watch programme, astronomers will be in a position to alert us if there is a possibility of such a collision. A typical asteroidal collision can release destructive energy several million times the amount released by the Hiroshima atom bomb.

Will an early warning help? Yes, if we are warned several months in advance, we can devise a nuclear explosion in the vicinity of the approaching object and give it a gentle push away from its path. Thus, it may pass by harmlessly missing us by a short distance. Does it sound like science fiction? Well, in 1994, a comet struck Jupiter and, a few years later, the possibility of another comet hitting earth in 2126 was voiced. So, astronomers are not all that useless!

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