THE TIMES OF INDIA

Cosmic Collisions

Averting Peril from Outer Space

By J.V. NARLIKAR

BACK in 1976 I wrote a science fiction story called, *Dhoomaketu* in Marathi, which was duly published in a Mumbai magazine. The story centred round a comet discovered by an amateur astronomer from Calcutta. While the discoverer was honoured and feted, the comet was being carefully studied by scientists who discovered, to their horror, that the comet was set on a collision course with the Earth. The story had the scientists meeting under the auspices of the United Nations to devise a plan of action to protect the Earth from a catastrophe and the humankind from extinction. The plan of exploding a nuclear device (a PNE, not a bomb!) near the comet so as divert its trajectory, worked and all was well.

The main purpose of the story was not the cometary collision but to highlight the wide gap in the scientific temper in our society that harbours both superstitions (a yagna performed to propitiate the vague and undefined cometary evil) and the scientific approach (of understanding the peril and using modern technology to combat it). However, the scientific theme of that story turns out to have realistic implications today.

Small Telescope

In mid-January, the Arthur C. Clarke Centre for Modern Technologies in Colombo hosted a meeting jointly sponsored by the U.N. and the European Space Agency. The occasion was to inaugurate a small telescope gifted by the Japanese government to Sri Lanka and the theme of the meeting was to discuss what astronomy can be done with small telescopes.

With the Hubble space telescope revolutionising astronomy, and large ground based telescopes like the ten-metre Keck and the eight-metre European one stealing the glamour, one may indeed wonder if there is anything worthwhile left to be done by their smaller brethren in the one to two metre class or less. Far from being made redundant, the small telescopes have assumed new significance today. With advanced instrumentation provided by modern technology they can fill important (and wide) gaps left behind by big telescopes. Survey of large stellar and galactic populations, long term monitoring of celestial objects and events, studies of anomalous phenomena are examples for which the heavily oversubscribed big facilities have neither time nor inclination, but which can be followed up by patient and dedicated studies by the small telescopes.

An example is of the 1.8 metre telescope in Arizona devoted to a long term study of orbits of small objects in the solar systems. At the Sri Lanka meeting Mr Tom Gehrels of the University of Arizona described the vital work to be done by this telescope. To those who think that nine planets with their handful of satellites make up all that is worth knowing in our solar system, this information may come as an eye opener.

The solar system also contains smaller objects such as asteroids, meteorites, minor planets and comets. The comets come from the remote corners of the solar system way beyond Pluto, whereas the asteroids are largely confined to a belt between the orbits of Mars and Jupiter.

"Largely" is the operative word. Perhaps the asteroids are bits and pieces that could not get together to form a planet. But not all the bits and pieces move in the narrow asteroidal belt. Some of them are knocked off track and come closer in, or are flung further out.

It is the former that cause concern. Some of them in the past have come perilously close to the earth and so the possibility of a direct hit by one in the future cannot be ruled out. Likewise we may also wonder and worry as to whether a comet will hit the earth. In the last two to three years this issue has been brought sharply into focus.

In early 1993, a prediction that a comet would hit the earth in the year 2126 was flashed across the world. This comet, called Swift-Tuttle did in fact come in our neighbourhood in 1993 but at a safe distance away from the Earth. The prediction was about what it would do when it came again 133 years later. Subsequent analysis of the comet's trajectory, however seems to make the eventuality of a direct hit rather unlikely.

Safe Spectacle

But in July 1994, we saw a comet hit Jupiter. Comet Shoemaker-Levy's impact on the giant planet had also been predicted by astronomers and it was observed by many telescopes and carefully documented. Watched from a distance of some three quarters of a billion kilometres, the event was indeed spectacular and safe for us to watch.

It may be exciting to watch two cars collide on a movie screen, but it is a far more serious matter when you are in one of them. The Jupiter impact raised the spectre before the earth -dwellers of their planet being at the receiving end of a hit from a heavenly body. Has it happened before? Can it happen again? If so what will be the consequences?

The meteor crater in Arizona bears testimony to an event that occurred some 47,000 years ago. A meteorite weighing no less than several million tonnes must have hit the earth creating a hole in it; the crater is about a kilometre and a quarter in diameter. The Lonar Lake, 1.8 kilometre wide, in the Buldhana district of Maharashtra is another example. A similar impact of a cosmic nature must have wiped out the dinosaurs of the Jurassic Age.

The effect naturally depends on the magnitude of the impacting object and its speed. Mr Gehrels estimates that the energy released by the impact of an asteroid one kilometre across is the equivalent of million nuclear bombs of the kind dropped on Hiroshima. This would not only pulverise the parts of the earth unfortunate enough to be hit directly but would play such havoc with the atmosphere that life itself would become extinct on the planet.

Impact Probability

Although the probability of impact by a one-kilometre-size object is estimated at once in a million years, asteroids of this size, or larger, are common enough (there are about 1,700 of them) to make the danger of such an event a real one.

We cannot therefore afford to leave it all to chance. This is why the Project Spacewatch as it is called, for observing the small objects of the solar system will try to find out what is out there and how is it moving. Thanks to the accuracy of Newton's Law of motion and gravitation and to high speed computers, one can confidently predict the future paths of asteroids with good accuracy. If any particularly big object is heading our way, we should know well in advance. Sceptics who question the usefulness of stargazing may take note of the vital importance of this project.

What can we do to avert the collision? The remedy proposed is none other than that adopted by the scientists in the sci-fi story *Dhoomaketu!* When the asteroid is some distance away we send a spacecraft with a nuclear device whose explosion would deflect the object. It may be tempting to destroy the object itself but that is ill advised. The debris of the explosion would then rain on the earth with equally disastrous consequences.

The project will take two to three decades to complete its initial task of finding objects that may threaten us within the next hundred years. It is urgent enough in the context of survival of life on earth. However, we in India need not get paranoid about it, for a greater threat awaits us individually, from the unruly Indian traffic as we cross the road.