

IN the penultimate *shloka* of the *Gita* Sanjay says:

*tac ca samsmrtya-samsmrtya
rupam atyadbhutam hareh
vismayo me mahan rajan
hrsyami ca punah-punah*

Translated into English it means "And as often as I recall that most wondrous form of Hari, great is my astonishment, O

different from Sanjay's.

Of course, in Sanjay's case the "not happened before" refers to the act of witnessing the vision. The cosmic form is supposed to have existed all along but few had been allowed to witness it before. In science *adbhuta* mani-

"That which has not happened before" is what the 'Bhagvad gita' associates with 'adbhuta'. J.B.S.Haldane gave wonder a long lease with the comment, "The universe is not only queerer than we suppose, but queerer than what we can suppose". Today the emotion wonderment belongs most to the scientist who, even as he disenchant a credulous world ready to gawk at 'miracles', is first privy to the awesome revelations of the universe.

JAYANT NARLIKAR, the well-known astrophysicist, discusses the ever unfolding 'adbhuta'.
Drawing by **LALITHA LAJMI**

King, and I thrill with joy again and again."

Sanjay, of course, is referring to the cosmic vision of God as exhibited by Lord Krishna to Arjuna in chapter 11. Significantly he uses the word *adbhuta* as the adjective for the vision, a word that literally means "that which has not happened before." A modern scientist, if he is really fortunate, can experience joy and amazement on seeing the *adbhuta* during his creative life. Such occasions do not occur often, but when they do, his reaction is no

feats itself in two ways — through the discovery of a natural secret that had hitherto remained hidden and through the genesis of a new idea that makes it possible to "create" something profound.

That something profound may be destructive or beneficial. Rutherford did not envisage that his experiment tampering with the atomic nucleus in a laboratory would lead to anything very dramatic. When the secret Manhattan Project finally led to the first explosion of the atomic

bomb in Alamogordo, New Mexico, the project director Robert Oppenheimer (a Sanskrit scholar besides being a leading scientist) resorted to the *Gita* in describing the magnitude of the explosion as "brighter than a thousand suns" — the very description Sanjay had used for the cosmic vision. This time the vision was man-made and, unfortunately, opened the way to the possibility of man destroying all life on this planet.

Of the nine *rasas*, *adbhuta* is the natural one for a scientist to aspire to. The more dramatic the discovery, the greater the joy of being associated with it — the spontaneous joy that is. For, as in the case of the atomic bomb, a more sober, even disquieting reaction may subsequently follow. And some discoveries bring amazement to the scientific community as a whole rather than to individuals.

Let me record two discoveries

in astronomy that fall in this class — discoveries that were made after I began my research career in the early '60s — that of quasars in 1963 and pulsars in 1968.

Quasars appear as bright point-like sources of energy not much different from stars. Indeed, the first two quasars to be discovered had earlier been mistaken for radio stars. However, detailed probes showed them to be considerably more powerful emitters of energy: a typical quasar may be million times as bright as the sun! Where does all this energy come from? The process of nuclear fusion, so well established as the source of energy in the sun proves inadequate to explain this enormous power of a quasar: for the quasar seems to generate it within a spherical volume no greater than a few light hours across.

This concentration of energy suggests that gravitational force

play a crucial role in the energy generation process. A gigantic black hole billion times as massive as the sun would be needed towards this end. But would it be sufficient to explain all the peculiar features of the quasar population, now some 7,000-strong?

If quasars confront us with the gigantic scale of the cosmic processes, the pulsars puzzle us with their remarkably accurate time-keeping. Indeed, the first pulsar to be discovered was beaming radio pulsars at intervals of about 1.34 second so regularly that it was tempting for the scientists to speculate whether they were signals from advanced extra-terrestrials — *the little green men*. Prior to this no cosmic process was known to show a periodicity that was regular to more than 10 billionth part of a second.

Theoreticians explain the pulsar phenomenon in terms of a rapidly spinning neutron star

with a strong magnetic field which together with the pulsar's atmosphere of electrically charged particles produces the radio waves much like a revolving search light. We receive them if we happen to be located in the beam of the search light. To explain the effect the neutron star has to have a density several hundred thousand billion times that of water and its magnetic field a trillion times that on the earth.

I have narrated these two examples to illustrate the extremes of physical conditions that exist in the cosmos. To the earth-born scientist these are the *adbhutas* to wonder at. They are the challenges to our claims to understand the universe.

How does the common man react to *adbhuta*? Literature is full of description of the effects of the unexpected on the public ethos. The reaction to seeing the manifestation of something that

ances of the unusual. Yet scientists have shown that there is nothing *adbhuta* about the Bermuda Triangle nor do they have a single instance of a UFO that calls for the bizarre explanation of extra-terrestrial visitations.

No, the real, genuine *adbhutas* are present in the nature around us and in the cosmos out there. It is extremely unlikely that the store of mysteries present in these would ever be fully exhausted. For, the human brain has its own biological limitations for understanding them. It may be that in a layered structure, we need to reach a certain level of knowledge even to spot the presence of the mystery. Our ascent to the next layer would be achieved when we solve that mystery. As J.B.S.Haldane put it: "The universe is not only queerer than we suppose, but queerer than what we can suppose."

Perhaps that is why, the chal-

remark: "The most incomprehensible thing about the universe is that it is comprehensible"

In the 1930s, the celebrated actress Elizabeth Bergner asked Einstein whether he believed in God. He replied, "One may not ask that of someone who with growing amazement attempts to explore and understand the authoritative order in the universe." When she asked why not, he answered "Because he would probably break down when faced with such a question."

And so the universal form that left such a lasting impression on Sanjay continues to inspire and disturb the scientific mind today with its ever unfolding *adbhuta*.

Next week:

Bhayana by Qurratulain Hyder

Illustration by Navjot

The Marvellous Sentiment

ADBHUTA rasa or the marvellous sentiment includes the depiction of extra-ordinary and fantastic events and objects as also acts of magic and fantasy. It is to be depicted by eyes agape, tears of joy, uttering words of approbation such as 'aha', and by making gifts.

All plays must end with a depiction of *adbhuta* rasa. This means that the denouement of any play must contain unexpected twists and excitedly reach to its climax. Any predictability in the plot or any cliché-ridden handling is bound to reduce the enjoyment by the spectators or worse still make them uninterested in the happenings on stage.

Mandakini Trivedi

NAVARASA UPDATED — 4

has not been seen before can vary from pleasure and wonder, to fear and shock. In this sense the reaction to *adbhuta* may call forth many of the remaining *rasas*.

Yet, in the present age of science the reaction is somehow expected to be more 'balanced'. We would like the scientific temper to step in giving impetus to rationalisation. When you see watches materialise out of nothing, do you stop and try to rationalise what you see? Or do you immediately put it down to 'miracle' till science tells us that there is such a thing as the law of conservation of matter and energy? So if you see the law being violated, your observations must have missed a subtle action. Find it and the law is seen to be true: there is no miracle, no *adbhuta*.

The common man reacts to the Bermuda Triangle or the Unidentified Flying Objects (UFOs), with the belief that these are inst-

enges are difficult but not hopelessly difficult. The *adbhutas* of yesterday are being understood today. For example, the mystery of solar energy was resolved in the 1930s with the improved understanding of nuclear physics. The process of radio emission in extra-terrestrial sources is explained in terms of fast electrons moving across magnetic fields. The theorists certainly don't need to feel smug about their knowledge but they don't have to feel daunted either. They have scored a few successes.

Perhaps and paradoxically, the greatest *adbhuta* is that they have done so. For, why should the laws of science discovered in the tiny laboratories of a minuscule planet by brains that have obvious biological limitations, turn out to be even moderately successful in explaining the vast universe? Albert Einstein expressed his amazement by his (oft-quoted)

