

PROPHETS OF DOOM

"The End: Year 2287" by Arthur Richards, International University Press, pp210, \$ 11.95 (1990).

"End" by Frank Close, Penguin Books, pp242, Pounds 6.99 (1988).

What is the future of humankind? What is going to be the fate of the world? Is the universe eternal? Where are we going? Is the form of life as we know it going to be in existence forever? These are questions which have been asked by human beings since the dawn of civilization. Eschatology has been an integral part of religion and the fate of humanity has troubled philosophers. The two books under review are two diverse attempts to answer these questions.

"The End: Year 2287" is a book which paints a scenario of the end of life which is brought about by the human race. Set in the latter part of the 23rd century, it is a time when the devil's influence on humanity has increased and selfishness, free sex and greed prosper. Then one day the sun does not rise in Japan and there is panic. Over the next few days it becomes obvious that the effect is not localized to Japan but is a global one. Scientists are puzzled and there is much panic and devastation. Thus starts the countdown to the final 13 days which will bring about the end of life. Earthquakes, tidal waves, volcanoes and floods are all part of this disaster scenario. The mountains split open, the moon spills blood and the oceans evaporate! The Earth turns into a molten ball of fire and there are echoes of the Lord's words, "I Am Alpha And Omega... The Beginning And The Ending, The First And The Last."

If all this sounds weird, then that is exactly what it is. The earth is drifting away from the sun and thus all kinds of catastrophes are occurring. The reasons for this are dismissed off in two sentences as the effect of nuclear tests carried out and the extra weight of the millions of tonnes of lunar material brought to the earth! The moral degradation seems to be the real reason for our fall according to the author. The whole book is full of Biblical prophesizing buffered with half-digested pseudo-scientific gibberish. There is mention of the other religions but the author's familiarity with these seems to be minimal (his reference to the portrait of Muhammad being spared by the earth shattering quake !) The U.S Moon Mission Chief Tucker, who presumably has some scientific knowledge doesn't know the difference between a star and a constellation of stars! The whole book is filled with such howlers that it is difficult to take it seriously. It seems that the author wanted to write a Biblical tract on the end of the world and incidentally put in scientific trappings to make it respectable.

Although it seems that the author has let his imagination run, it falters in some places. In the year 2287 it seems highly improbable that the tallest building in the world is still the Sears Tower in Chicago!

There are some important points raised in the book but these are not developed. For example, questions regarding the finiteness of human knowledge, fear of the unknown,

innate attributes of human nature etc. However all these are treated in a perfunctory manner. The references are put in at the end of the sections in the text itself which turns out to be very distracting and there are a number of typos.

The biographical sketch of the author at the end of the book writes about the author correctly predicting in 1960 that 'Singapore a colonial backwater would one day turn into an ultra-modern city'. Correctly predicting the future of a city seems to have encouraged the author to take on this ambitious project of speculating about the future of the earth. It must be said that the author doesn't quite come up to the standard in this one.

Popular Science as a genre has recently witnessed a veritable explosion of books. These books are of fairly uneven quality. On the one hand there are all time classics like Asimov's "The Intelligent Man's Guide to Science" which have inspired many a teenager to take up sciences. On the other extreme are pop popular science like Capra's "The Tao Of Physics" which though immensely popular, attempts to sensationalize science and reduce it to the level of analogies. What makes writing good popular science difficult is the need to simplify esoteric theories rather than trivialize them. This is precisely what distinguishes good from bad popular science writing; while Capra would have us believe that the whole of particle physics is just a reworking of Hindu and Taoist symbols, Stephen Hawking painstakingly and creatively makes accessible abstract concepts in his "A Brief History of Time". Frank Close's new book "END" falls in the category of good writing on Science for the layperson. Close is a reputed young theoretical physicist who has already written an excellent introduction to particle physics, "The Cosmic Onion". Here he is attempting to explore scientifically the fate of the universe and the possibility of a cosmic catastrophe.

The book begins with a description of the solar system and the objects within it which constitute a hazard for us. A lucid account is given of meteorites, comets, asteroids and meteors. The description presupposes no knowledge of astronomy. Several very speculative ideas are also included in this section; the possibility of a companion star of our sun, the existence of a tenth planet, Planet X. Though these ideas are speculative, Close examines them in the light of existing data and discusses the possibility of discovering these objects. This is a good introduction not only to our immediate neighborhood in space but also to the methodology of science; the process of testing theories against empirical evidence and modifying the theory if it doesn't work.

"What were the series of events which led to the extinction of the dinosaurs, the most dominant creatures on earth in their time?" This is one of the great mysteries which confronts palaeontologists when they examine geological data where there is evidence for several such mass extinctions (the wiping out of whole species). There are many theories which claim to explain these sudden (on the geological time scale) and catastrophic events. Close describes a proposal originally due to H.Urey and recently revived by L.Alvarez and his co-workers. The scenario is one of a very big comet hitting the earth and depositing

unbelievably huge quantity of energy on the earth. Oceans vaporize, the atmosphere changes and there are global climactic changes. An "extended darkness at noon owing to the dust in the atmosphere" exists for a long period of time. This catastrophic event leads to large scale disruption of life and could possibly lead to mass extinctions. Close goes through the evidence and concludes that the "verdict is not proven", i.e. there is only circumstantial evidence in support of this theory of cometary impact causing mass extinctions. This is a fascinating chapter which indicates the inherently inter disciplinary nature of the field and reads like a geological whodunit or a paleontological jigsaw puzzle where evidences have to fit together. And as Close cautions, "Many pseudo-scientific 'explanations' fail when one confronts them quantitatively. Apparently nice ideas sometimes just do not fit the scale of the phenomenon".

Imagine sitting inside a salt mine 1 mile underground, with 100 tonnes of perchlorethylene i.e. dry cleaning fluid and waiting for an invisible particle to come from the sun and click a counter. This is precisely what Ray Davis started doing in 1964 to study solar neutrinos. These neutrinos interact very weakly and can in fact pass right through the earth without interacting at all! But they can provide us with an immense amount of information about our nearest stellar neighbour, the sun. They can help us decide which stage of its evolution the sun is at presently. They can also throw some light on how the sun manages to burn for billions of years. Close describes the solar neutrino puzzle in great detail in his chapter on the sun. In fact, one of the most fundamental cosmic conundrums could be related to the neutrinos; is our universe going to collapse in a big crunch or is it going to continue its expansion indefinitely? Experiments currently in progress will decide how massive these neutrinos really are. Since there are huge numbers of them in the universe, they could (if they have sufficient mass) force the universe to collapse due to their gravity. This would undoubtedly be an extraordinary achievement for science and the human intellect if by carrying out experiments on the sun, we could determine the fate of the universe.

Close then takes us on a guided tour through the cosmic void, which is really not a void at all but is instead filled with fascinating objects like spiral galaxies (like our own Milky Way), pulsars, black holes etc. His "travelogue" of the universe is extremely lucid and informative. Not only is there plenty of information, it is also made very accessible. For example, seemingly mundane though important questions like "how is the distance to a star measured" are answered. Going through this journey through space (and hence time) one can't escape from a feeling of insignificance on a cosmic scale on the one hand and a feeling of omniscience on the other.

One of the most fascinating areas of research which has emerged recently is the interaction of particle physics and cosmology. These apparently diverse fields, one dealing with the sub microscopic nature of matter and the other with the study of the whole universe, have a lot to do with each other. A better understanding of one enriches the other. In fact, any acceptable particle physics theory has to pass the test of cosmology that is have verifiable

cosmological consequences. On the other hand cosmological theories ultimately have to be consistent with theories of particle physics which are independently verified in the laboratory. Close examines these theories of the sub microscopic nature of matter and their effect on the evolution of the universe. Apart from the standard theories, he also touches upon very speculative theories about higher dimensional space times (that is ones which have more than the observed four dimensions of space-time) where the extra dimensions curl up! This is a well written section where the author is pedagogical instead of being pedantic.

After considering the various possibilities of a cosmic catastrophe (from a comet hit to the tunnelling of the whole universe!) and concluding that these are highly improbable though not impossible, the author turns to 'what is to be done'? The first thing to come to mind is to extend our habitation to other parts of the universe -- moon, other planets, maybe even other solar systems. Close describes a much more modest proposal due to Gerard O'Neill of establishing space colonies. O'Neill envisages rotating cylinders with complete human support systems to be built from materials obtained from the moon. A technological assessment of this proposal shows that all that is required is a commitment from the society, of the level of say the Apollo project, to make this thing work. There is technologically nothing unfeasible in this. However, the social and psychological issues are far from simple - - who goes and lives in these colonies, what are the effects of extended isolation on communities of people? The social implications of such a proposal need to be studied before we bow down before the technology fetish of building everything that can be built.

A far more radical proposal is due to the famous physicist Freeman Dyson. If human beings are merely collections of billions of molecules, and intelligence is simply an ability to perform certain functions then it could be possible to completely blueprint a human being, store the information in a computer, and reassemble the molecules at will. Now these are all very doubtful assumptions which presuppose answers to many questions which are still being hotly debated amongst experts. But leaving this aside, if these assumptions are valid, do our physical laws allow us in principle this kind of transmutation of life? Dyson thinks that the answer to this is in the affirmative. There is, he claims, nothing in our known physical laws which prohibits this idea. The suggestion that life equivalent to information processing is indeed fascinating. One doesn't need to believe completely in this proposed equivalence of consciousness to double helixes of DNA, but surely to get a better understanding of life, the machinery of molecular biology and computer science can help. One really wishes the author had devoted more space to these ideas. In their present form, they leave the reader dissatisfied and hungry for more information.

"The most dangerous things in the universe may well be humans. If there is a message in this book it is this : '.. we are not omnipotent we are much more vulnerable to external circumstances than we would like to admit". With these sobering words the author concludes. This is first rate popular science and should be read not only by people interested

in science but also anyone who cares to think about the future of the Technological and Scientific Man.

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