THE INDIVIDUAL AND THE UNIVERSE

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FOR a number of years, cosmology has been a favourite science with the British public, and, with the development of radio astronomy and the recent launching of earth-satellites, the choice of a cosmologist to give the recent Reith Lectures was not surprising. Professor A. C. B. Lovell, who is well-known for the part he played in the development of the great Jodrell Bank radio telescope, took as his title 'The individual and the universe', and in his lectures he found three points of contact between cosmology and religion, each of which calls for comment.

The first occurred in his introductory lecture, which was devoted to the transition from the medieval geocentric and ordered cosmos to the infinite universe of the late seventeenth century. 'In the three centuries since Galileo and Newton we have moved far, but the vital break with tradition belongs to their age, not ours.'[1] Now Professor Lovell shows that he appreciates that the revolution sparked off by the publication in 1543 of Copernicus's *De Revolutionibus* rapidly involved not only physical science as a whole, but also philosophy, religion, and in fact many of the features of man's world picture. But it is on the religious aspect that he dwells. 'The story', he says, 'is mainly one of persecution of the astronomers on religious grounds', and in this way he produces a thoroughly distorted and unsatisfactory picture, for which he was rightly censured by Mr Arthur Koestler in a long letter to *The Listener* the following week.

What led Professor Lovell to take this attitude? I think the answer is to be found in his reading of de Santillana's *The Crime of Galileo*,[2] an emotional and compelling book which he reviewed at length (and with disastrous inaccuracy) early last year.[3] Professor Lovell's first lecture reflects in detail the influence of de Santillana, who is of course specifically concerned with the

1 Unless otherwise indicated, all quotations are from the lectures.

2 Discussed in my 'Galileo reconsidered', *The Dublin Review*, Autumn 1958. Some of the philosophical and physical issues raised by Copernicanism are briefly considered in Chapter III of this book.

3 *The New Statesman*, 22 February 1958.

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religious controversy that centred round Galileo and who therefore emphasizes only one aspect of an extremely complex situation. But it seems that Lovell was not convinced with Koestler's arguments, for later, when reviewing *The Sleepwalkers*,[4] he spoke of Koestler's 'protracted feat of mental agility', and was in turn rebuked for 'arrogant contempt for the humanities'.[5]

In his second lecture, on the origins of the solar system, Professor Lovell raised the question of the uniqueness of man. 'Modern cosmogony', he tells us, 'can accept a situation in which most of the stars in the milky way have planetary systems similar to our own', so that 'the question of the evolution of some forms of living material elsewhere in the universe is therefore removed from the astronomical to the biological domain'. He concluded 'the biologist must introduce inconceivable chances against evolution elsewhere if we are to preserve our uniqueness'. Now this is not a new issue: the probability of life existing elsewhere in the universe was acknowledged by, for example, many eighteenth-century astronomers. But surely the problem for theology would come not from Martian apes but from Martians with rational souls, and our uniqueness is not necessarily threatened by the existence of 'some forms of living material elsewhere in the universe'.

Professor Lovell devoted the later lectures to the 'ultimate cosmological problem' of the origin of the universe. The question of creation interests the theologian as well as the cosmologist, and the present situation in cosmology is unusually exciting. Broadly speaking, cosmological theories fall into two groups: the 'evolutionary' and the 'steady-state'. The evolutionary theories are associated above all with the Abbé Georges Lemaître. According to him, the universe originated in a small and dense 'primeval atom'. This expanded until the size of the universe was about a thousand million light years, after which followed a nearly-static condition. 'Then the conditions of near equilibrium were again upset, the forces of cosmical repulsion began to win over those of gravitational attraction, and the universe was launched on the career of expansion which after nine thousand million years brought it to the state which we witness today.'

Professor Lovell observes that 'at the present time there are no

4 *The Sunday Times*, 25 January 1959.
5 Letter to *The Sunday Times*, 8 February 1959.

known features of the observable universe which are incompatible with Lemaître's evolutionary cosmology', and he also says that evolutionary theories 'are regarded with the most favour by the majority of contemporary astronomers'. This is worth emphasizing, for the rival theories are largely the work of British cosmologists, and in this country the impression is often given that only eccentrics cling to the evolutionary position.

The exponents of the steady-state theories, on the other hand, hold that 'the creation of matter is taking place continuously, and that although stars and galaxies evolve from this basic material the universe, when considered as a large-scale structure, is in a steady-state'.

The opposing theories make different predictions of the past and future state of the universe. They agree that the galaxies we now see are moving out into space in different directions; but whereas on the evolutionary theories this means that in the future fewer galaxies will be visible from earth, on the steady-state theories fresh galaxies are being formed to take the place of those that are disappearing from sight, so that the overall picture will remain essentially unchanged. Similarly, the evolutionary theories predict that in the past *more* galaxies were to be seen, whereas, as before, the steady-state theories forecast no essential change from what we now see.

To decide between the two theories by observational evidence, then, we need to look far enough into the future or into the past. This seems a forlorn hope indeed; but in fact, because of the finite speed of light and radio waves on the one hand and the development of radio astronomy on the other, a decision is not only possible but likely, and quite soon. Because of the finite speed of light we see the stars as they *were* at some time in the past—the sun as it was eight minutes ago, the next nearest star as it was four years ago, some of the star systems which can be photographed in large optical telescopes as they were two thousand million years ago. The large optical telescopes, then, show us parts of the universe as it existed a very long time ago; a very long time, but unfortunately not quite long enough for the forecasts made by the rival theories to be significantly different.

This is a tantalizing situation for the cosmologist. Fortunately there are two ways round the difficulty, both of them made possible by very recent developments. One is to transport optical

telescopes outside the earth's atmosphere which does so much to hamper observations; the other is to use radio telescopes to detect not the light waves but the radio waves which come to us from outer space.

The study of these radio waves has proved immensely interesting. As Professor Lovell has written elsewhere, 'intense efforts have been made to find some relationship between the radio sources and objects that are visible in the ordinary telescopes. Although several thousands of the radio sources have now been positioned—and in some cases the size and shape measured—the linkages that have been established with the common stars remain very few, and the general paradox of the existence of the radio sources remains.'[6] But one very remarkable identification was made when the 200-inch telescope on Palomar, the largest in the world, was used to search for a visible object corresponding to a radio source in a position measured with the radio telescope at Cambridge. 'They found there a remarkable event in which two great extra-galactic nebulae seem to have collided with one another.' The collision is at the limit of clear vision of the Palomar telescope, but the radio waves could be detected even if the nebulae were ten times as far away; and it is now thought that many of the radio sources are due to the collision of galaxies too far away in space, and therefore also in time, for the optical telescopes to penetrate. If this is so then the radio telescopes will soon provide us with measurements for which the evolutionary and steady-state theories give significantly-different predictions.

Professor Lovell began his modestly-written conclusion by saying that, for all but materialist astronomers, 'a settlement of this cosmological issue might mean an affirmation or rejection of deeply embedded philosophical and theological beliefs'. We must ask whether such serious theological issues are in fact at stake. Surely not, and for three reasons. First, if one theory is falsified by new observations, this does not establish a rival theory unless this rival theory is logically the only possible alternative, which is hardly ever the case; and in saying this one does not have to go to the length of regarding *all* scientific theories as permanently in danger of falsification by new evidence, for cosmological theories are rightly notorious for the flimsiness of their observational foundations, as the correspondence in *The Listener* showed.

6 *Progress*, Autumn 1957.

Secondly, crucial experiments do not always succeed in undermining theories according to plan. New evidence (which in any case involves theory in its interpretation) may lead to a modification of the theory with which it conflicts, or it may simply be explained away. One is reminded of the seventeenth-century Antonio Rocco who said: 'In the first place, I will go on denying that it so happens; and if the contrary were proved to me by convincing experiments, I would look for other reasons why it might happen.'[7] Professor Lovell himself recognizes that all may not go according to plan when he says 'the optimism with which I believe we are on the verge of producing the necessary observational data is tempered with a deep apprehension, born of bitter experience, that the decisive experiment nearly always extends one's horizon into regions of new doubts and difficulties'.

Thirdly, although he is not altogether clear on this point, Professor Lovell seems to feel that a theist must reject the steady-state theories because the continuous creation it proposes happens under our very noses and so a complete explanation at the scientific level may be possible; whereas the primeval atom of the evolutionary theory is inaccessible to science and so leaves a place for the Creator. We seem to be offered, in the words of Dixon, 'the notion of God who made the world, and then, being weary, went into retirement'.[8] Such a notion is very unsatisfactory. The theist is not opposed to a scientific theory which offers a complete explanation at a scientific level. For the theist God must operate *as well as* natural causes, but at a quite different level.

There remains the particular theological question of whether it has been revealed that creation had a beginning in time. If this is so, as many theologians teach, then it would be difficult for a Catholic to accept a steady-state theory as true and final. But, then, who would claim that it is?

7 Quoted from de Santillana's edition of Galileo's *Dialogue on the Great World Systems*, p. 159.

8 In *The Human Situation*. Quoted by Lord Brabazon of Tara in a letter to *The Listener*, 25 December 1958.