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‘Man’s Place in the Universe.’

To the Editors of *Knowledge.* Sirs,—Some further remarks on the question recently mooted between Dr. Wallace, on the one side, and Mr. Maunder and Dr. Turner, on the other, may be of interest to the readers of *Knowledge.* First, all the astronomical arguments in favour of a finite universe seem to me to turn on the assumption that the ether is infinite. Admittedly it is only by the light of very distant objects that we learn their existence; and for the transmission of this light, ether is necessary. Our knowledge is, therefore, confined within the limits of the ether, whether it be finite or infinite. But how can we draw any conclusion as to the finiteness or infiniteness of the universe if all that we can know of it is limited to the finite sphere of the ether? With an infinite and perfectly transparent ether, a limited number of shining bodies would be suggestive of a limited universe of matter; but if the ether itself be finite, we would, in drawing this conclusion, act like an islander who imagined that his island was the only bit of solid land in creation, because, when looking round on every side, he could see nothing but water. His universe would be limited by the curvature of the water as ours (on this assumption) is by the finiteness of the ether. But Dr. Wallace fails to see this. He speaks of bodies wandering outside the limits of the ether, but assumes that they would be cold and dead, &c. Why? If ether is necessary to convey heat to them, it is equally necessary to convey it away. They would, therefore, simply retain their heat without change. That they would be dark I admit, but light is not necessary to animal life. Then, if *our* ether be finite—if it be like a vast attenuated nebula—why may there not be other great nebulæ of ether in external space, some of them, perhaps, much larger and better supplied with stars than our own? A finite ether practically excludes us from knowing anything beyond its limits, and for that very reason it allows scope for all kinds of conjecture as to what is really beyond them. Dr. Wallace does not suppose it to be a vacuum. There are bodies in it which once belonged to our universe; and why should there not also be bodies in it that never formed part of our universe—never entered our ether? There are, at all events, no grounds for dogmatising on this subject. (But I do not think any observation has shown such appearances and disappearances of stars as would arise from their entering or leaving the ether.)

We are, according to Dr. Wallace, in the centre of the universe. He infers this from our position in relation to the visible stars. I need hardly say that when our knowledge of the visible stars is carried further, our present ideas as to their distribution may be largely modified, and even as it is I doubt if any astronomer could go within 1000 light-years (if I am to use that ill-selected unit) of the centre of the star-system as at present known. But so far as we know, while heat, light, and some other influences are dependent on the ether, gravitation is not, and whatever the distance may be its transmission is instantaneous. Hence if there are bodies outside of the ether, as Dr. Wallace supposes, these bodies are as influential in determining the centre of the universe as the bodies which are situated within the limits of the ether. No doubt the distance of these outlying bodies must be very great, but their number and mass may also be very great, and some of them may not be more distant than some of those within the ether but near its confines. A finite material world in an infinite ether is a hypothesis which finds some support in the facts of astronomy. A finite ether with matter (perhaps infinite) beyond it, is also to a certain extent a feasible hypothesis; but a finite ether and a finite material world having distinct and independent limits

seems to me to be the worst hypothesis of the three, and is, moreover, one that does not assist us in fixing the centre of this finite universe of matter.

I therefore reject the astronomical basis of Dr. Wallace's theory, leaving it to others to deal with the conditions of animal life and mental development. I confess, however, that I have sufficient faith in the principle of evolution to think that man might accommodate himself to the conditions of life on almost any of the planets, provided that the change were sufficiently gradual, and a sufficient time were allowed to elapse. But some arguments used by Mr. Maunder and Prof. Turner seem to me also unsatisfactory. The first of these is the argument drawn from the number of dark bodies in space in answer to the proofs of finiteness deduced from the faintness of the general illumination of the sky. What would be the consequence if the dark bodies were on the average as numerous and as large as the bright ones, while the sun were adopted as an average specimen of the latter? Simply that the average illumination of the entire sky would be half that of the sun. The dark bodies would be as often behind the bright ones as before them. Now compare this with the fact. The highest estimate that I have seen of the total light of the full moon is 1/300000 of that of the sun, the discs of the two bodies being about equal. Suppose that the dark bodies were 150,000 times as numerous as the bright ones, instead of being equal in number. Then the whole sky ought to be as bright as the illuminated portion of the moon. Everyone knows that this is not so. But it is said that the stars, though infinite, may only extend to infinity in particular directions, *e.g.*, in that of the Galaxy. Be it so. Where in the very brightest portion of the Galaxy will we find a portion equal in angular magnitude to the moon which affords us the same quantity of light? In the very brightest spot, the light probably does not amount to 1/100 part of that of the moon (when full), thus raising the proportion to fifteen millions to one. Dark bodies may explain why the sky-light is not infinite—which in fact it could not be even if all bodies were bright, and their number infinite—but the extremely small amount of sky-light which actually exists is a startling fact, and one difficult to reconcile with the theory of an infinite material universe.

Again, I think too much stress has been laid by Dr. Wallace's opponents on the motion of the solar system in space. In the first place, the proof of this motion rests on

the assumption that if we take a sufficient number of stars their real motions in all directions will be equal, and that, therefore, the apparent preponderances which we observe in particular directions result from the real motion of the sun. But there is no impossibility in a systematic motion of the majority of the stars used in these researches which might reconcile the observed facts with a motionless sun. And, in the second place, if the sun is not in the exact centre of gravity of the universe, we might expect him to be moving in an orbit around this centre of gravity, and our observations on his actual motion are not sufficiently numerous or accurate to enable us to affirm that he is moving in a right line rather than in such an orbit. Indeed, the positions assigned to the apex of the sun's way appear to show a steady change as we use stars with diminishing proper motion which are presumably at increasing distances, and though other explanations of this circumstance may be given, one admissible hypothesis is that the different directions thus computed represent the tangent to the sun's orbit at different dates, and thus establish its curvature. To anyone, however, who realises the vast dimensions of the known universe, and the manner in which science is constantly opening out great new vistas into the unknown, a hypothesis like that of Dr. Wallace will appear to be exceedingly improbable, and I do not think the basis of observation on which it rests is sufficiently extensive and solid to justify its acceptance by the votaries of science.

I may remark that is, as I have suggested, the ether absorbs light, we have an explanation of many of the difficulties which arise in connection with this question. But apart from this hypothesis, meteors in space—cosmic dust—may absorb a sensible proportion of the light of luminous bodies, this proportion increasing with the distance. We could not discover this fact within the limits of the solar system, because the planets shine by reflected light, and the meteors or cosmic dust which intervened would reflect the light also, and being nearer to us than the planet would, in fact, increase its light, provided that their reflecting power were the same. The effect of their interposing between us and a self-luminous body would be quite different, and if they exist throughout all space, the greater the distance the more of the light they would (on the average) intercept. If sufficiently remote, the star would thus, for all practical purposes, be blotted out.

I may add that on the assumption of a finite ether forming an oasis in a desert universe, which seems to be Dr. Wallace's idea, not only is it unlikely that the centre of the universe would fall within the ether, but even if it chanced to do so, the ether would probably have a proper motion of its own which would soon carry it away from this centre. Further, assuming that life and intelligence could only be developed within the limits of this ether, and (as Dr. Wallace suggests) that the development would therefore be carried farthest in the case of the bodies that had been longest in it, I would expect to find these bodies not in the centre, but near the confines, at the opposite side from that at which they had originally entered it.

W. H. S. Monck.

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