MAN'S PLACE IN THE UNIVERSE.

By E. Walter Maunder, F.R.A.S.

In the *Fortnightly Review* for September, 1903, Dr. Alfred Russel Wallace replies to the critics of his paper on "Man's Place in the Universe." The critics had attacked each and every astronomical point of his position, and now, in his reply, Dr. Wallace withdraws most of his astronomical arguments, whilst re-asserting the conclusions which he had drawn from them. His reply, therefore, though in form a defence of his original position, is in substance an unconditional surrender of it.

It may be well to quote here Dr. Wallace's summary and conclusion of his first paper:—

> "We can hardly suppose any longer that *three* such remarkable coincidences of position and consequent physical conditions should occur in the case of the one planet, on which organic life *has* been developed, without any causal connection with that development. The three startling facts—that we *are* in the centre of a cluster of suns, and that that cluster *is* situated not only precisely in the *plane* of the Galaxy, but also *centrally* in that plane, can hardly now be looked upon as chance coincidences without any significance in relation to the culminating fact that the planet so situated *has* developed humanity.
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> "Of course the relation here pointed out *may* be a true relation of cause and effect, and yet have arisen as the result of one in a thousand million chances occurring during almost infinite time. But, on the other hand, those thinkers may be right, who, holding that the universe is a manifestation of Mind, and that the orderly development of Living Souls supplies an adequate reason why such an universe should have been called into existence, believe that we ourselves are its sole and sufficient result, and that nowhere else than near the central position in the universe which we occupy, could that result have been attained."

Now if we assume that these words imply what their sense may be taken to indicate, we infer that Dr. Wallace means that:—

(1) The Galaxy with its appendages and included systems, to all intents and purposes makes up the entire material universe.

(2) The earth in its character of a satellite of the sun is situated *centrally* in the *plane* of the Galactic ring, and the physical conditions necessary to life are only possible in such a central position.

On the first point Dr. Wallace's withdrawal from his former position is sufficiently definite. He writes:—

> "Is the evidence at our command for or against the infinite extension of the stellar universe? This is the real question, the only question we are able to discuss rationally. As to proof or disproof, either is impossible as regards what exists, or what does not exist in infinite space. And even as regards the probability of any particular form of existence being infinite, we have, and can have, no evidence, and without evidence it is irrational to hold any definite opinion."

With this position astronomers cannot quarrel; it is indeed the very point for which Dr. Wallace's critics were contending. But it cuts away the ground from the arguments of his first paper; he then claimed to have demonstrated that which he now admits to be incapable of proof. It is true that in the next sentence he re-asserts his claim to have brought forward "sufficient evidence" of the limitation of our stellar universe, but before the end of the next paragraph he seems to have come to the conclusion that since his position cannot be demonstrated, it ought not to be challenged, and he refers to objections as "the opinions or prejudices of those who ask for proofs of what cannot be proved." Dr. Wallace makes several quotations to show that astronomers of repute have arrived at the conclusion that the stellar universe is limited in extent, and complains that directly he, an outsider, ventures to set forth the same view, he is found fault with.

There has been no dead set made upon Dr. Wallace because he is an outsider. Some three years before the appearance of his first paper in the *Fortnightly Review* there was an interesting discussion in Knowledge on the question "Is the stellar universe finite?" which I concluded by the following words:—

> "The general question 'Is the Stellar Universe finite?' becomes at once not a physical but a metaphysical enquiry, and hence leaves the domain of astronomy, and except as a purely mental exercise I see no value in it. How easily even the keenest and most trained minds may go astray on the subject may be learned from Prof. Newcomb's paper in the March number of the *Windsor Magazine*.* He writes 'it can be shown mathematically that an infinitely extended system of stars would fill the heavens with a blaze of light like that of the noonday sun.' There is a tacit assumption here that the stars are on the average uniformly distributed in space, an assumption which for nearly a century astronomers have known to be untrue."†

A similar statement by Prof. Newcomb occurring in a paper in the *Popular Science Monthly* appears to have been the basis of Dr. Wallace's original paper, but that it was a mistake, and that Prof. Newcomb did not alter his views merely in order to disagree from Dr. Wallace, may readily be seen by referring to the same paper when it was corrected and republished in book form in 1901.

Dr. Wallace yet more unreservedly withdraws his suggestion that the suns on the confines of the Milky Way are "becoming dissipated into outer space," and that "the outer margins of the stellar universe are therefore unstable," so that it "follows that the outer portions of the universe, at all events, and for an unknown extent inward, will be entirely unfitted to ensure that *continuity of uniform conditions* which is the first essential for the development of life." He now admits "that there is probably no justification for this idea, and that the facts that suggested it are *apparent* only." He also withdraws the "similar unfounded notion . . . of a variation of gravity near the boundary of the universe." But these two "unfounded notions" were his sole arguments to prove that "the continuity of uniform conditions which is the first essential for the development of life" is not possible in the case of satellites of such suns as lie within or on the confines of the ring of the Galaxy. There is left, therefore, not even a suggestion of a reason for supposing any star within the reach of our telescopes to be less stable in the conditions due to its position than is the case with our sun.

These ample concessions having been made, it would be a superfluous task to show again that Dr. Wallace had no solid grounds for asserting the centrality of our sun in his particular sense of the word. He complains that his critics misrepresent him on this point, and ascribe to him a precision of meaning which he did not intend. He prefers now to speak of the position of the sun as "nearly central." Frankly, I think his critics allowed his expressions to pass as being less stringent than they were. But a turn of expression may pass for little; it is the argument that counts. And the argument demanded that the sun should be shown to be very materially nearer the centre of the universe than any other star whatsoever. There are no facts known to astronomers which would warrant them in asserting that our sun is better placed in this sense than are hundreds of members of that hypothetical globular cluster of which he speaks.

* March, 1900. † Knowledge, 1900, May, p. 109.

Dr. Wallace brings forward some new points which are not, however, germane to the question. Several writers in objecting to his statement that if the stellar universe were infinite in extent the entire sky would be a blaze of starlight, made the very sufficient answer that the same line of argument if applied to the dark stars would lead to an opposite conclusion. The reply was amply sufficient for its purpose, but Dr. Wallace tries to answer it as if it had been brought forward, not as a mere *argumentum ad hoc*, but as an actual theory of the universe, and urges that if the dark stars were so numerous we should frequently observe occultations of the lucid stars. A very little calculation shows that even if the dark bodies were a thousand times more numerous than the bright, the chances are millions to one against any diminution of the light of a lucid star arising from this cause ever having been observed.

Another point is that though the sun is moving with prodigious speed, yet that the action of gravity would prevent it wandering far from its present position. Why should it? It has had no such action upon Arcturus, and other "runaway" stars. Then Dr. Wallace raises the question of "star-drift"; that is to say, of groups of stars moving with a common proper motion. In what way this helps his argument does not appear. The reference to the five stars of Ursa Major is a particularly unfortunate one, since this group, extending over nearly twenty degrees of arc, is obviously moving as a system in a plane which is nearly at right angles to that of the Milky Way. The latter plane, therefore, is not the only one of high importance within the limits of the visible sidereal system.

It is disappointing that Dr. Wallace takes no notice of an exceedingly suggestive point raised by Prof. H. H. Turner. We speak roughly of the Galaxy as forming a ring. The researches during the last half-century of Heis, Boeddicker, Backhouse, Stratonoff, Easton, and others, have shown us that it is about as unlike a simple annulus as any object could possibly be. It is an object of the greatest complexity, formed of long irregular branching streams, interlacing and crossing one another, and some of them reaching out far towards its poles, of close agglomerations side by side with broad lacunæ. But, most striking of all, there are two portions—if portions they be and not separate and external galaxies—which stand out by themselves and away from the main body—the two Magellanic Clouds. If they are truly part of the Galaxy, then we are no longer in a position to assert that we are in its medial plane or near the centre of that plane. If they are external galaxies, then our Galaxy is not the sole one known to us; the visible universe evidently extends much beyond it.

But if we *did* hold a "nearly central" position, Dr. Wallace's question, "What advantages have we derived from it?" would still be wholly unpractical, and to complain there are "hardly any suggestions of enlightenment in astronomical literature, but, rather, what seem to me now to be unnecessary difficulties thrown in the way of the enquirer," is much as if a man took a candle in order to read the time of night from a sundial, and complained that the literature on dialling gave no guidance how to proceed in such circumstances.

Practically, Dr. Wallace's position in his second paper amounts to this. He has withdrawn as untenable the propositions upon which his original thesis was based; but in effect he claims the right to maintain his former conclusions until his critics have demonstrated propositions, the opposite of all those he has advanced.

To sum up. We have no sufficient evidence to show whether the stellar universe has an indefinite extension or not; or, if it be bounded, whether we have yet penetrated to the boundary. Supposing such a boundary, we have not the slightest reason to suspect any star that we can see of being in an unstable condition owing to its nearness to it. We do not know whether the Galaxy includes in its structure the whole of the objects which we see, or whether any considerable number lie beyond it and are of a different formation. We do know, and it has long been known, that our sun is near the medial plane of the Galaxy, and probably not more than twice as far from one side of it as from the other. But we do not know that it is nearer the centre of the Galaxy than hundreds of other stars, nor have we the slightest reason to suppose that the systems attendant upon them are less fitted to be the home of intelligent life than our own.