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The "Double Drift" Theory of Star Motions.

I HAVE been greatly interested in Mr. Eddington's account in NATURE of July 11 (p. 248) of Prof. J. C. Kapteyn's investigations of this subject. Although I do not quite follow his argument for the existence of two overlapping systems of stars (more dramatically termed "two Universes" by Prof. Turner), I yet venture to suggest an explanation of the apparently (perhaps really) opposite "drifts," which seems to me to agree sufficiently with the observed facts.

If we adopt Lord Kelvin's postulate of a single vast stellar universe very slowly condensing towards its common centre of gravity, we might expect that the component stars would move for the most part in ellipses or spirals of very varying degrees of eccentricity and of inclination to the mean orbit—perhaps indicated by the Milky Way. If we further postulate (what is very generally admitted) that our sun is situated towards the central rather than towards the outer portion of the whole system, then, just as the planets, through differential angular motions as regards the earth, appear sometimes to move in a retrograde direction or to be quite stationary, so a certain proportion of the stars might be expected, at any given period, to exhibit the same phenomena.

But further, considering the enormous distances that are known to separate the stars and star-groups from each other and the extreme slowness of their angular motions, there seems no reason why their respective orbits should not be almost as frequently in a right-hand as in a left-hand direction in regard to the central plane of general motion.

Our knowledge of the actual motions of the stars may not inaptly be compared to what astronomers would possess of the solar system supposing the whole of their observations had been limited to a period of about twenty-four hours, and that the sun was invisible. The motions of the planets and their satellites thus determined would seem as strange and incomprehensible as do those of the stars at the present time, our accurate observations of which have been limited to a few centuries.

It will probably be of interest to many of your readers (as it certainly will be to myself) if some of your mathematical correspondents will explain why, and in what way, some such system as is here suggested is incompatible with the facts set forth by Prof. Kapteyn and others.

ALFRED R. WALLACE.

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In the article to which Dr. A. R. Wallace refers, and elsewhere, I have confined myself to attempting to establish the result that the stars distribute themselves into two systems according to their motions, abstaining as far as possible from defining what physical connection is implied by the rather vague word "system." Whether the two systems are comparatively permanent and have come together from different parts of space, or whether they may have been evolved from a single system, is, in the present state of our knowledge, a somewhat speculative question, and it is with some reluctance that I enter upon it. Still, without asserting that the hypothesis of two permanent systems is the only possible one, I know at present of no other satisfactory explanation. In the system suggested by Dr. Wallace (in which the stars move about the centre of the universe in ellipses, some forward and some retrograde, with all sorts of eccentricities) the motions would be for our purposes haphazard. Thus the system would form a single and not a double drift; the extremely eccentric orbits form a perfect transition between the direct and retrograde orbits. To account for two drifts, it is not sufficient to show that some stars move forward and some backward; it must be shown that there is a concentration of the motions about two definite veloci-

ties (definite in magnitude and direction), and it does not appear to me that the suggested system provides for this. In fact, it is difficult to see how gravitation towards the centre of the universe could separate the motions of the stars into two systems, if they originally formed one system.

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