

LETTERS TO THE EDITORS

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Non-Solar Planetary Systems

IN discussing the significance of the two planet-like bodies which are now supposed to revolve around 61 Cygni and 70 Ophiuchi, Mr. Sen writes¹ that "we find that there can be at most two planetary systems in the galactic system, on Jeans's theory". If the true number were two, or anything like two, it would, of course, be out of the question to suppose that there could be three planetary systems so near to us in space. But I do not think that the true number is anywhere near to two; in a recent letter in NATURE², I calculated that something like one star in six might well be accompanied by planets, in which case the number of galactic planetary systems would not be two, but some tens of thousands of millions. There is no reason why 61 Cygni and 70 Ophiuchi should not be two out of these millions of systems, so that I think that Mr. Sen's argument against my tidal theory fails.

Mr. Sen refers with approval to Banerji's modification of this theory. This makes the original sun a Cepheid which had its oscillatory instability increased by the gravitational attraction of a passing star. But a passing star cannot increase the instability of a Cepheid appreciably unless it comes very near; and as a very near approach can do all that is needed with any star, why introduce the added complication of supposing the star to be a Cepheid? Judging by their luminosity, all Cepheids are much more massive than the sun or 61 Cygni or 70 Ophiuchi, although, of course, this may not have been so in the remote past.

I cannot see that the discovery of the new planet-like bodies affects the present tidal theory in any way, except that, if we interpret them as true planets, they may perhaps give some slight support to my calculation³ as to the frequency of planetary systems in space.

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¹ NATURE, 152, 600 (1943).

² NATURE, 149, 695 (1942).

³ *loc. cit.*

Non-Solar Planets and the Origin of the Solar System

THE discovery of two non-solar planets¹⁻³ makes it possible to check theories of the origin of the solar system.

Some time ago I pointed out that the motion of ionized matter even at the distance of the planets from the sun is affected very much more by the sun's general magnetic field than by solar gravitation, and that consequently this magnetic field may have been of fundamental importance at the genesis of the solar system⁴. A theory was put forward according to which the planets were formed of matter falling in from interstellar space towards the sun, and stopped by the action of the sun's magnetic field as soon as it became ionized by the heating due to gravitation. The theory requires that the main part of the matter become accumulated at that distance r from the sun

(mass = M_{\odot}) where the gravitational energy equals the ionization energy eV_{ion} . Thus we have:

$$\frac{M_{\odot}m}{r} = eV_{\text{ion}}, \quad (1)$$

where m is the mean atomic weight of the gas. The distance r equals the orbital radius of Jupiter if $V_{\text{ion}} = 12$ volts and $m = 7$ (or, through a certain correction, $m = 10$), which values are quite reasonable.

When Jupiter's mass is substituted for the solar mass in (1), r becomes equal to the distance of the large Jovian satellites, which indicates that they may have been generated in the same way as the planets. The structure of the Saturnian system also is consistent with the theory.

The invading matter probably originated from a gas cloud once surrounding the sun. If other stars have been surrounded by clouds of the same mean atomic weight, they are likely to possess similar planetary systems, the dimensions of which are proportional to the masses of the stars. Thus the 'Jupiter' of a star with the mass M (sun = 1) will have the orbital radius

$$r = 5.2 M \text{ astron. units.}$$

Observations have not determined to which components of the double stars the newly discovered non-solar planets belong. My theory requires that for a given cloud density the larger component shall have the more massive planetary system. As the components of 61 Cygni are almost equal, the largest planets of each of them should have almost the same masses and periods, so that the observed disturbance is due to both of them. For 70 Ophiuchi a planet of the larger component ought to produce the greatest effect. Thus we find:

Star	Mass	Distance of planet	
		Theory	Obs.
61 Cygni ²	0.56	2.9	2.4
70 Ophiuchi ³	1.1	5.7	6.8

The agreement indicates that these non-solar planets may have been formed in the same way as our planetary system.

The theory makes it probable that all stars are surrounded by planetary systems (more or less massive) of the same structure as ours. Planets corresponding to Jupiter will have the period

$$T = 11.9 M \text{ years.}$$

It may be worth while to look for disturbances with such periods.

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Stockholm. Nov. 3.

¹ Hunter, A., NATURE, 152, 66 (1943).

² Strand, K. A., *Pub. Ast. Soc. Pac.*, 55, 29 (1943).

³ Reuyl, D., and Holmberg, E., *Astrophys. J.*, 97, 41 (1943).

⁴ Alfvén, H., "On the Cosmogony of the Solar System", I and II, *Stockholms Observ. Ann.*, 14, No. 2 (1942) and No. 3 (1943).

Mutation and the Rhesus Reaction

RECENT announcements by Race, Taylor^{1,2} and their collaborators in these columns, and by Wiener and Landsteiner³, elsewhere, are of peculiar interest in connexion with some genetic implications of Levine's interpretation of erythroblastosis. Levine's hypothesis postulates a form of adverse selection restricted to heterozygous offspring of a particular