LETTERS TO THE EDITOR

TWO MORE PLANETARY SYSTEMS

OBSERVATION has at last come to the aid of theory which had given conflicting verdicts on the uniqueness of the Solar System. A planetary companion to the 61 Cygni system has recently been discovered by Dr. K. Aa. Strand (Feb. 1943) from a study of parallax observations of the star. A periodic deviation from the Keplerian orbit was found for the system, and this can only be due to the presence of a third body (61 Cygni C) of small mass. 61 Cygni C is found to be sixteen times as massive as Jupiter and very feebly luminous. It can, therefore, be classified as a planet.

Reuyl and Holmberg (Jan. 1943) have about the same time discovered a non-solar planetary body of even smaller mass in the binary star system, 70 Ophiuchi. As both the stars, 61 Cygni C and 70 Ophiuchi, are within 10 parsecs of the Sun (Jeans, 1929*a*), it is significant that two other planetary systems have been discovered quite close to our Solar System.

These observations very much weaken the case for the tidal theories of Jeans (1919) and Jeffreys (1929), according to which planetary systems should be very rare. Jeans (1929) estimates that on his theory about one planetary system in the whole of the galactic system should be formed every 5,000 million years. This gives us at the most two planetary systems in our galactic system, if we take the age of the Universe to be between 10^9 and 10^{10} years. Planetary systems have hardly any chance of being formed on Lyttleton's binary star collision theory (1938).

Banerji's Cepheid theory (1942), on which a star passes an oscillating Cepheid at a moderate distance and disrupts it, makes the birth of planetary systems much more probable. We shall quote Banerji on this point (1942*a*), "One conclusion seems to be irresistible. If the theory be correct in its essentials, there may be more planetary systems than at present supposed". Banerji's conclusion is fully borne out by the recent observations.

It may be remarked that the author has recently advanced a Cepheid theory of the origin of binary stars (Sen, 1941-42), which makes it possible for binary stars to possess planetary systems. Radiation of energy and consequent increase of angular velocity causes a Cepheid to break up into a double star system. The filamentary ribbon connecting the two stars may condense into planets.

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August 7, 1943. H. K. SEN.

1. Banerji, A. C., *Proc. Nat. Inst. Sci. Ind.*, 1942, **8**, 173-97. 2. —, *loc. cit.*, 1942*a*, p. 196. 3. Jeans, J. H., "The Problems of Cosmogony and Stellar Dynamics," 1919, p. 275. —, "Astronomy and Cosmogony," 1929, p. 409. 4. —, *loc. cit.*, 1929*a*, pp. 7 and 22. 5. Jeffreys, H., "The Earth," 1929, p. 16. 6. Lyttleton, R. A., *M.N.*, 1938, **98**, 536. 7. Reuyl and Holmberg, *Ap. J.*, Jany, 1943, **97**, 41. 8. Strand, K. Aa. *Publ. Astron. Soc. Pac.*, Feb. 1943, **55**, 29. 9. Sen, H. K., *Science and Culture*, 1941-42, **7**, 582.

EFFECT ON B.H. CURVES OF ELECTRIC CURRENTS THROUGH A TRANSFORMER CORE

THE B.H. curves for ferromagnetic materials as obtained on a cathode-ray oscillograph provides a good visual and photographic method for studying the variations in the magnetic properties of these materials with various physical changes. The hysteresis loop can be obtained on the oscillograph provided only with electrostatic deflection plates (Fig. 1) if a resistance (R_1) is included in series with the primary coil of the transformer, and a suitable phasing condenser (c) and resistance (R_2) are present in the secondary circuit. The magnetising force is proportional to the primary current and thus to the voltage built in the series resistance (R_1) and this is applied after amplification for horizontal deflection of the beam, while the voltage in R_2 is proportional to B and is applied after amplification to the plates giving vertical deflection.

With this circuit we have tried to study any change in the loop if simultaneously with the current through the primary or secondary coils, we send an electric current through the iron core of the transformer (shown by arrows).

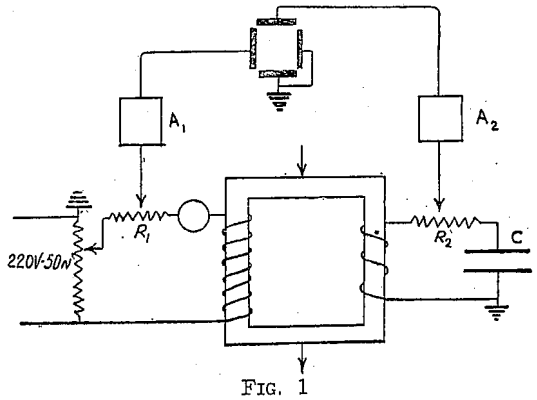

FIG. 1

A_1, A_2 Amplifiers

Some change would not be unexpected on general theoretical considerations as in each cycle of current passing through the primary, there is a reversal of the magnetic field through the core and the spin axis of the magnesting electrons would reverse in direction each time. Now if, in addition to this magnetic field acting on the core, an electric current was to traverse it, the flow of these myriads of electrons may interfere with the free reversal of the spin axes and produce a widening of the hysteresis loop.

A photographic exposure of the hysteresis pattern was obtained on the camera plate, first

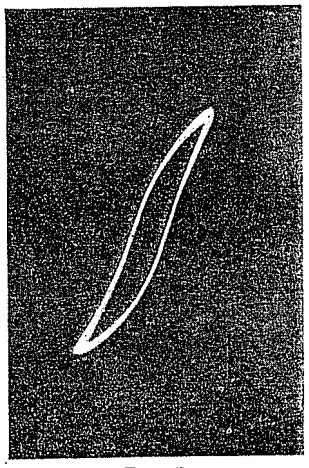

FIG. 2

in the normal condition, *i.e.*, without current in the core and then without disturbing the position of the camera or any other part of the apparatus, the current through the core was switched on, and a further exposure given on the same plate.

With D.C. current upto 5 amps., the two patterns are completely superposed showing no trace of change. Same result is obtained, with the direction of the current reversed (Fig. 2). With an A.C. current (3 amps.), and same frequency (50 cyc.) as that flowing through the coils, a broadening of the loop takes place (Fig. 3), with the peculiarity that the widening is marked only during the two quarter

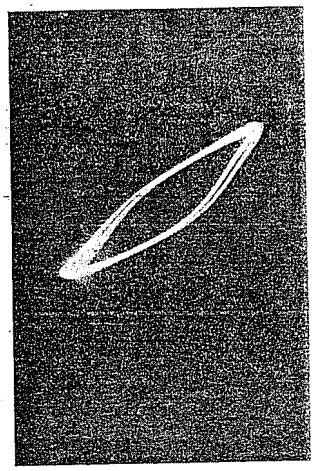

FIG. 3

cycles when the magnetising current is increasing on the positive side or on the negative side. During the quarter cycles when the magnetising current is decreasing the two traces are superposed. With the A.C. currents induced effects in the coils have to be taken into consideration. But the change depicted is quite peculiar and although induced effects will be there, the atomic magnetic properties may also have to be considered.

However, we are carrying on these experiments along with other variations as to temperature, etc., which will throw more light on this phenomenon. We owe our gratitude to Prof. J. B. Seth for facilities provided for this work.

Physics Laboratories,
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July 27, 1943.

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1 K. Kreiselheimer, *J. Sci. Inst.*, 1942, **19**, 137. 2. Reyner, *Cathode Ray Oscillograph*.

SPECIFIC HEAT OF SOLID CARBON DIOXIDE

IN a symposium of papers[1] which appeared in the *Proceedings of the Indian Academy of Sciences*, the Raman theory[2] of specific heat has been applied to many elements and simple ionic compounds, namely, rocksalt and sylvine. The thermal energy of rocksalt calculated on the basis of the discrete, though weak, Raman lines reported by Fermi and Rasetti[3] for a single crystal has been shown by the author[4] to be in good agreement with the experimental data. In the present note, the investigation has been extended to molecular compounds.

Sirkar and Gupta[5] have observed an intense and sharp Raman line at 58 cm.$^{-1}$ for solid carbon dioxide, besides the inner frequencies of the molecule. The latter, however, attributed