

mind should treat its ideas, and at every step in the progress of a problem the machine indicates the proper condition of a mind exempt from mistake.

It is believed that this logical machine may be usefully employed in the logical class-room to exhibit the complete analysis of any argument or logical problem; and it is superior for this purpose to a more rudimentary contrivance, the logical abacus, constructed by me for the same purpose and previously described. But by far the chief importance of the machine is in a theoretical point of view as demonstrating, in the simplest and most evident manner, the character and powers of a universal system of logical deduction, of which the first, although obscure solution, was given by Dr. Boole.

II. "Preliminary Paper on certain Drifting Motions of the Stars."

By RICHARD A. PROCTOR, B.A., F.R.A.S. Communicated by
WARREN DE LA RUE, V.P.R.S. Received October 26, 1869.

A careful examination of the proper motions of all the fixed stars in the catalogues published by Messrs. Main and Stone (Memoirs of the Royal Astronomical Society, vols. xxviii. and xxxiii.) has led me to a somewhat interesting result. I find that in parts of the heavens the stars exhibit a well-marked tendency to drift in a definite direction. In the catalogues of proper motions, owing to the way in which the stars are arranged, this tendency is masked; but when the proper motions are indicated in maps, by affixing to each star a small arrow whose length and direction indicate the magnitude and direction of the star's proper motion, the star-drift (as the phenomenon may be termed) becomes very evident.

It is worthy of notice that Mädler, having been led by certain considerations to examine the neighbourhood of the Pleiades for traces of a community of proper motion, founded on the drift he actually found in Taurus his well-known theory that Alcyone (the *lucida* of the Pleiades) is the common centre around which the sidereal system is moving. But in reality the community of motion in Taurus is only a single instance, and not the most striking that might be pointed out, of a characteristic which may be recognized in many regions of the heavens. In Gemini and Cancer there is a much more striking drift towards the south-east, the drift in Taurus being towards the south-west. In the constellation Leo there is also a well-marked drift, in this case towards Cancer.

These particular instances of star-drift are not the less remarkable, that they (the stars) are drifting almost exactly in the direction due to the proper motion which has been assigned to the sun, because the recent researches of the Astronomer Royal have abundantly proved that the apparent proper motions of the stars are not to be recognized as principally due to the sun's motion. Mr. Stone has shown even that we must assign to the stars a larger proper motion, on the average, than that which the sun possesses.

Looking, therefore, on the stars as severally in motion, with velocities exceeding the sun's on the average, it cannot but be looked upon as highly significant that in any large region of the heavens there should be a community of motion such as I have described. We seem compelled to look upon the stars which exhibit such community of motion as forming a distinct system, the members of which are associated indeed with the galactic system, but are much more intimately related to each other.

In other parts of the heavens, however, there are instances of a star-drift opposed to the direction due to the solar motion. A remarkable instance may be recognized among the seven bright stars of Ursa Major. Of these, the stars β , γ , δ , ϵ , and ζ are all drifting in the same direction, and almost exactly at the same rate, towards the "apex of the solar motion," that is, the point from which all the motions due to the sun's translation in space should be directed. If these five stars, indeed, form a system (and I can see no other reasonable explanation of so singular a community of motion), the mind is lost in contemplating the immensity of the periods which the revolutions of the components of the system must occupy. Mädler had already assigned to the revolution of Alcor around Mizar (ζ Ursæ) a period of more than 7000 years. But if these stars, which appear so clear to the naked eye, have a period of such length, what must be the cyclic periods of stars which cover a range of several degrees upon the heavens?

In like manner the stars α , β , and γ of Arietis appear to form a single system, though the motion of α is not absolutely coincident either in magnitude or direction with that of β and γ , which are moving on absolutely parallel lines with equal velocity.

There are many other interesting cases of the same kind. I hope soon to be able to lay before the Society a pair of maps in which all the well-recognized proper motions in both hemispheres are exhibited on the stereographic projection. In the same maps also the effects due to the solar motion are exhibited by means of great circles through the apex of the solar motion, and small circles or parallels having that apex for a pole.

It appears to me that the star-drift I have described serves to explain several phenomena which had hitherto been thought very perplexing. In the first place, it accounts for the small effect which the correction due to the solar motion has been found to have in diminishing the sums of the squares of the stellar proper motions. Again, it explains the fact that many double stars which have a common proper motion appear to have no motion of revolution around each other; for clearly two members of a drifting-system might appear to form a close double, and yet be in reality far apart and travelling not around each other, but more closely around the centre of gravity of the much larger system they form part of.

I may add that, while mapping the proper motions of the stars, I have been led to notice that the rich cluster around χ Persei falls almost exactly on the intersection of the Milky Way with the great circle which

may be termed the equator of the solar motion; that is, the great circle having the apex of the sun's motion as a pole. This circumstance points to that remarkable cluster, rather than to the Pleiades, as the centre of the sidereal system, if, indeed, that system have a centre cognizable by us. When we remember that for every fixed star in the Pleiades there are hundreds in the great cluster in Perseus, the latter will seem the worthier region to be the centre of motion. I should be disposed, however, to regard the cluster in Perseus as the centre of a portion of the sidereal system, rather than as the common centre of the Galaxy.

The peculiarities of the apparent proper motions of the stars seem to me to lend a new interest to the researches which Mr. Huggins is preparing to make into the stellar proper motions of recess or approach.

III. "On Jacobi's Theorem respecting the relative Equilibrium of a Revolving Ellipsoid of Fluid; and on Ivory's Discussion of the Theorem." By I. TODHUNTER, M.A., F.R.S., late Fellow of St. John's College, Cambridge. Received November 23, 1869.

(Abstract.)

Jacobi discovered the theorem that a fluid ellipsoid revolving with uniform angular velocity round its least axis might be in equilibrium. Ivory discussed the theorem, and made several statements regarding the limitations of the proportions of the axis. Ivory's statements contain various errors and truths based on erroneous reasoning. The object of the present memoir is to correct Ivory's errors, to supply his imperfections, and to add something to what is already known respecting the theorem.

January 27, 1870.

ARCHIBALD SMITH, M.A., Vice-President, in the Chair.

Professor Wyville Thomson was admitted into the Society.

The Presents received were laid on the Table, and thanks ordered for them, as follows:—

Transactions:—

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The Society.