corrections required by the catalogues compared. But further, if these practical difficulties could be considered overcome in the best determinations, there is a vagueness in the very definition of the solar motion. The motion of the sun relative to the stars depends on what stars are selected as representative. There is no a priori reason to expect the same result from the different classes of stars, such as the brighter or fainter, northern or southern, nearer or more distant, Solar type or Sirian stars. There is for example some evidence that the declination of the solar apex is really increased when the motion is referred to fainter stars. For those reasons a really close agreement between the results of different investigators is not to be expected.

Of the various modern determinations of the apex, we give first those which depend, wholly or mainly, on the Auwers-Bradley proper motions. Setting A for the right ascension, D for the declination of the apex, these are:—

L. Boss A = 17h 48m D=+42°∙8

L. Struve A = 18h 20m D=+23°∙5

S. Newcomb A = 18h 10m D =+31°∙3

J. C. Kapteyn A=18h 14m D=+29°∙5.

The large differences between these results, derived from the same material, depend mainly on the different systematic corrections applied by each astronomer to the declinations of Bradley. From the data of his *Preliminary General Catalogue* (1910), L. Boss found A=18h2m, D = +34°∙3. Having regard to the special precautions taken to eliminate systematic error, and to the fact that the stars used were distributed nearly equally over both hemispheres, it is fair to conclude that this is the most accurate determination yet made. From the Groombridge proper motions Dyson and Thackeray found A = 18h20m, D=+37°. Other determinations have been made by O. Stumpe (*Ast.* *Nach.* No. 3000) and J. G. Porter (*Ast.* *Journ.* xii. 91), using mainly stars of large proper motions derived from various sources; their results are of the same general character. Most of the above investigators, besides giving a general result, have deter­mined the apex separately for bright and faint stars, for stars of greater or less proper motion, and in some cases for stars of Sirian and Solar spectra. Considerable divergences in the resulting position of the apex are found.

It will be seen that the proper motion of any star may be regarded as made up of two components. The part of the star’s apparent displacement, which is due to the solar motion, is gener­ally called the *parallactic* motion ; the rest of its motion *(i.e.* its motion relative to the mean of all the stars, is called its *peculiar* motion *(motus peculiaris).* Regarded as a linear velocity, the parallactic motion is the same for all stars, being exactly equal and opposite to the solar motion; but its amount, as measured by thecorresponding angular displacement of the star, is inversely proportional to the distance of the star from the earth, and foreshortening causes it to vary as the sine of the angular dis­tance from the apex. To arrive at some estimate of the speed of the solar motion, we may consider the motions of those stars whose parallaxes have been measured, and whose actual linear speed is accordingly known (disregarding motion in the line of sight). If a sufficient number of stars are considered, their peculiar motions will mutually cancel and the parallactic or solar motion can then be derived. But not much reliance can be placed on this kind of determination. A very weighty objection is that the stars whose parallaxes are determined are mainly those of large proper motion and therefore not fairly representative of the bulk of the stars; in fact their peculiar motions will not neutralize one another in the mean. A better method is to derive the speed from the radial motions observed with the spectroscope. In this way W. W. Campbell from the radial motions of 280 stars found the velocity to be 20 kilometres per second with a probable error of 11/2 km. per second *(Astrophysical Journal,* 1901, vol. xiii). This result depends on the northern stars only. By the addition of the data for southern stars, so as to obtain a distribution fairly symmetrical over the whole sphere, S. S. Hough and J. Halm deduced a velocity of 20∙8 km. per second towards the apex A=18h5m, D =+26°. the speed is very nearly four radii of the earth’s orbit per year; thus the annual parallactic motion is equal to four times the parallax, for a star lying in a direction 90° from the solar apex; for stars nearer the apex or antapex it is foreshortened. This result, while it does not afford any means of determining the parallaxes of individual stars, enables us to determine the mean parallax of a group of stars, if we may assume their peculiar motions practically to cancel one another.

In researches on the solar motion the assumption is almost always made that the motions of the stars relatively to one another —the *peculiar* motions—are at random. The correctness of this hypothesis has long been under suspicion, but it has generally been accepted as the best simple approximation to the actual distribution of the motions that could be made. Naturally exceptional regions must be recognized ; for example, a connected system such as the Pleiades, whose stars have the same proper motion, must constitute an exception. There can occasionally be traced a certain commu­nity of motion over a much larger area. Thus R. A. Proctor found that between Aldebaran and the Pleiades most of the stars have a motion positive in right ascension and negative in declination, a phenomenon which he designated “ star-drift.” A more precise investigation by L. Boss has shown that there is in this region a "moving cluster ” of globular form. The stars composing this all have equal and parallel motions; about 40 stars brighter than the seventh magnitude are known to belong to it. The group consisting of five stars of Ursa Major together with Sirius has already been alluded to; another very marked group of 16 stars in Perseus, all of the Helium type of spectrum, form a similar association. Spectroscopic evidence has indicated that most of the stars of Orion are associated, and share nearly the same motion (or rather, in this case, absence of motion).

But, whilst recognizing the existence of local drifts and systems, and admitting the possibility of relative motion between the nearer- and more distant, or other classes of stars, it is only recently that astronomers have seriously doubted the correctness of the hypothesis of random distribution of stellar motions as at least a rough repre­sentation of the truth. the hypothesis was put to the test by J. C. Kapteyn, with the result that it appears to be not even approxi­mately accordant with the facts. His researches indicate that, instead of being haphazard, the proper motions of the star show decided preference for two "favoured ” directions, apparently implying that the stars surrounding us do not constitute a simple system but a dual one. The motion of the stars in the mean towards Cam’s Major is thus a *resultant* motion, which, when examined more minutely, is found to be due to the intermingling of two great streams of stars moving in very different directions. These two streams or drifts prevail in every part of the sky examined, and contain nearly equal numbers of stars; that is to say, in whatever part of the sky we look about half the stars are found to belong to one and half to the other of the two great drifts. This hypothesis of two star-drifts does not imply that all the stars move in one or other of two directions. The stars have on this theory random peculiar motions in addition to the motion of the drift to which they belong, just as on the older theory the stars have peculiar motions in addition to the solar or parallactic motion shared by all of them. But the two theories lead to a very different statistical distribution of the stellar motions. The older one—which may be called the “ one-drift ” hypothesis, since according to it the stars appear to form a single drift moving away from the solar apex—requires that the apparent directions of motion should be so distributed that fewest stars are moving directly towards the solar apex, and most stars along the great circle away from the solar apex, the number decreasing symmetrically, for directions inclined on cither side of this great circle, according to a law which can be calculated. This is found not to agree with the facts at all. The deviation is unmistakable; in general the direction from the solar apex is not the one in which most stars are moving; and, what is even more striking, the directions, in which most and fewest stars respectively move, are not by any means opposite to one another. It seems difficult to account for the very remarkable and unsymmetrical distribution of the motions, unless we suppose that the stars form two more or less separate systems superposed ; and it has been found possible by assuming two drifts with suitably assigned velocities to account very satisfactorily for the observed motions.

The phenomenon of two drifts was discovered by an examination of the Bradley proper motions *(Brit. Assoc. Rep.,* 1905, p. 257), and has subsequently been confirmed by a discussion of the Groombridge proper motions *(Mon. Not. R.A.S.,* 1906, 67, p. 34; 1910, 71, p. 4). By an examination of the stars of very large proper motion F. W. Dyson has traced the presence of the two drifts in all parts of the sky. They have been shown to prevail among fainter stars down to magnitude 9·5, by an examination of the Greenwich-Carrington proper motions; these, however, only cover a region within 9° of the north pole. Of the behaviour of stars fainter than magnitude 9∙5 there is at present no direct evidence. About 10,000 stars altogether were dealt with in the above-mentioned investigations. The general results indicate that one of the drifts is moving (rela­tively to the sun) directly away from a point near α Ophiuchi (about R.Λ. 270°, Dec. +12°), and the other from a point in Lynx (R.A. 83°, Dec. +60°). These two points may be called the apices of the two drifts, for they arc analogues of the solar apex on the one-drift theory; they are about 110° apart. The velocities of the drifts differ considerably, the one whose apex is in Ophiuchus having about 11/2 times the speed of the other. We may conveniently distinguish the two drifts as the *slow-moving* and *fast-moving* drifts respectively; but it should be remembered that, since these motions are measured relatively to the sun, this distinction is not physically significant. The stars appear to be nearly equally divided between the two drifts. The magnitudes of the stars are distributed in the same way in each drift. There is also clear evidence that the mean distances of both drifts from us are very approximately the same. Thus we are led to regard the two systems as completely intermingled, a fact which adds considerably to the difficulty of explaining the phenomena otherwise than as produced by two great systems—*uni­verses* they have been called—which have come together, perhaps, by their mutual attraction, and are passing through one another. The chances of individual stars of the two systems colliding are infinitesimal. Until the hypothesis has been thoroughly tested by an