in use at a number of observatories. He claims that the results show, first, that the Carnegie Institution standards are in every way satisfactory, and second, that "the absolute precision obtainable with carefully designed magnetometers and (dip) inductors, provided instruments are carefully used and comparisons are made with reliable standards at least every two or three years, is of the order 0.2 in declination and inclination and of the order 0.00015H (i.e. 37 in England) in horizontal intensity." If this be true, the gain in accuracy to be hoped for from coil instruments is not great. If, however, as stated on p. 468, a complete observation of H with the coil instrument occupies only 2 minutes, its use at an observatory would represent a great economy of time, always

provided little time is spent on keeping the apparatus up to the mark.

However this may be, what is really more wanted is a coil instrument for measuring V (vertical force). Base line values of V curves are at present dependent on dip circles or inductors. Even if the accuracy claimed by Mr. Fleming for dip inductors be conceded, it must be remembered that an error of 0.2 in the dip at a place where the value of H is only 0.03 (the approximate value at the base station of the Australasian Antarctic Expedition 1912-13) leads to an error of about 90% in V. Thus a coil instrument which could give V directly, to within $\pm 5\%$ even, would be an immense improvement on a dip inductor for use in high latitudes.

New Social Coleoptera.¹

By Dr. A. D. IMMS.

IF we regard as truly social only those insects in which the parent, or parents, live with their offspring, protecting and feeding them, there have been known hitherto but three groups of beetles which come into this category, namely, the Platypodidae, Scolytidae, and Passalidae. Prof. W. M. Wheeler has recently added to the list two genera of Silvanid beetles belonging to the family Cucujidae, discovered by him in British Guiana. The beetles in question are *Coccidotrophus socialis* and *Eunaisibius wheeleri* both of Schwartz and Barber. The bulk of his observations concern the first-mentioned insect, the other species being apparently rare. The beetles enter the hollow petioles of a Leguminous tree *Tachigalia* and either bore their way in, or gain admittance through perforations previously made by other insects. They enter either as a single pair, or one beetle enters and is very soon joined by an individual of the opposite sex. Upon taking possession of their future habitation the beetles remove any loose pith, or the remains of previous tenants, by pushing this debris into the pointed ends of the cavity by means of their flattened heads. This behaviour brings the insects into contact with the outermost layer of pith adhering to the walls of the cavity, and certain strips of nutritive parenchyma. The latter tissue forms the food of the beetles, and is also shared by young Coccidae of the species *Pseudococcus bromeliae*, which soon begin to enter the petiole-cavity. By means of the feeding action of the beetles, the strips become converted into grooves, the coccids stationing themselves in a row in each groove. The beetles carefully avoid soiling their food material and store their frass in the areas between the grooves. They lay their eggs along the frass ridges, and the larvæ which hatch out feed upon the same nutritive parenchyma as their parents. When mature, they

construct brown cocoons within which pupation occurs. The beetles emerging from the latter remain in the petiole with the original pair; they mate and produce eggs and larvæ in turn, thus leading to the climax stage of the colony, which may eventually consist of several dozens of beetles of both sexes, and many larvæ and pupæ in all stages of development. The Coccidae also increase in number, so that the cavity of the petiole sometimes becomes crowded with inmates. In the meantime, the old and exhausted beetles die off, and their bodies are consigned to the refuse accumulations already mentioned. When this crowded condition is reached, beetles begin to leave the colony either singly or in pairs and, seeking other petioles, thus found new colonies.

Both the larvæ and imagines of the *Coccidotrophus* solicit honey dew from the coccids by "stroking" the latter by means of the antennæ. The relations of the beetle to the coccids, moreover, are physiologically similar to those of symphile beetles to host ants that supply them with regurgitated liquids. *Coccidotrophus*, like the symphiles, has specially modified antennæ and labium, such modifications occurring in both the larvæ and adults. This type of relationship with Coccidae has not been noted hitherto in any Coleoptera and, apart from ants, very few insects are known to have developed the ability to solicit honey dew from among the Homoptera.

It appears that the Silvanids have a more primitive social life than any of the three families of beetles previously alluded to, but there is no definite preparation of larval food by the parents. Their colonies represent a stage in social development intermediate between the families mentioned and the merely gregarious species of Cucujidae. For further details, and many interesting observations on the numerous and heterogeneous "biocenose" of other insects associated with the plant *Tachigalia*, the reader is referred to Prof. Wheeler's original paper.

¹ W. M. Wheeler, "A Study of some Social Beetles in British Guiana and of their Relations to the Ant-Plant *Tachigalia*," *Zoologica*, New York, vol. iii, Nos. 3-11, Dec. 24, 1921.

Spectroscopic Studies of Stellar Velocities.¹

By Dr. WILLIAM J. S. LOCKYER.

IN order to determine the distribution and motion of stars in space it is necessary to know four important facts about each star. The first is its position, known as its Right Ascension and Declination; the second is its proper motion, i.e. the move-

ment at right angles to the line of sight; the third is the radial velocity or movement towards or away from the earth; and lastly, the parallax or distance of the star from the earth.

During the last few years the accumulation of a large amount of such data, extending over many years, has led astronomers to the important problem of investigating the systematic motions of the stars

¹ "The Radial Velocities of 594 Stars," Publications of the Dominion Astrophysical Observatory, Victoria, B.C. (vol. 2, No. 1), by J. S. Plaskett, W. E. Harper, R. K. Young, H. H. Plaskett (Ottawa, 1921).

and their distances, thus leading to our knowledge of the distribution of stars in space, and finally to the structure of the universe.

At the present time, however, data are most lacking regarding stellar radial velocities, and any attempt to increase our knowledge in this respect deserves particular attention. It is, therefore, very satisfactory to know that, when planning the equipment of the Dominion Astrophysical Observatory of Victoria, B.C., the first consideration was given to its suitability for this class of work, which it is proposed to make the great feature of the new institution. Quite recently the first volume of measures has been published, and this comprises the determination of the radial velocities of 594 stars between the fifth and eighth magnitudes, the velocities of which have not been measured before.

The work was commenced in May 1918 by the Director of the Observatory, Dr. J. S. Plaskett, and Dr. R. K. Young. In the following year Mr. W. E. Harper and Mr. H. H. Plaskett joined the staff, so that this volume is the outcome of the endeavours of these four observers, who together made the observations, the measurements and the reductions of the spectrograms, as no computing assistance was available.

The introduction to the volume describes briefly the telescope, the spectrograph, the observing arrangements, measuring machines, wave-lengths of spectral lines employed, etc. The telescope was the large 72-inch reflector, and the spectrograph was used with the Cassegrain combination of the telescope. The regulation and control of the temperature in the spectrograph was at first attained by the use of a mercury contact thermometer actuating a special relay, but this was replaced later by the installation of a Callendar recorder. Considerable attention was devoted to the wave-lengths of the lines employed in the reduction of the spectrograms, and the system eventually adopted was one developed by Dr. Young, which is to some extent a compromise of different methods and systems used by various observers. Tables showing the standard wave-lengths employed are given, and they indicate the wave-lengths used for B-type stars and for A- to F-type stars, together with a list of iron comparison lines.

The work accomplished may be briefly summarised by referring to the results of the measures which are brought together in various tables. The first contains the mean velocities, with their probable errors,

of all stars, 537 in number, assigned to be of constant velocity, including their positions, magnitudes, spectral types, etc. Next follows a summary table of the velocities of the systems of all spectroscopic binaries, the orbits of which have been determined at the Victoria Observatory. Table IV. gives complete information as regards the details of all the 3287 radial velocity plates of the 537 constant velocity stars, an average of 6.1 plates per star. This information is concise, compact, and in a convenient form, and will be valuable for detail reference when required. Similar detailed information is given in Table V. with respect to 206 plates of 35 probably binary stars.

It is interesting to make a short reference to the accuracy of the determinations of the radial velocities, because this accuracy depends to a very great extent on the definition of the lines in the star's spectrum under examination. Thus, some spectra have clean-cut lines which render their measurement easy, while others exhibit fuzzy lines, making measurements difficult. The authors have, therefore, divided the probable errors into three classes. The first includes stars of spectral types between Fo and M (excluding some early F stars) which give the most trustworthy values; the probable errors for these range between ± 0.1 and ± 1.0 kms. for the mean velocity obtained from all plates, and between ± 0.2 and ± 2.5 kms. for a single plate. The second main class includes about one-fourth of the A-type, about two-thirds of the B-type, and the early F-type mentioned above. The probable errors for this group are given as ranging from ± 0.5 to ± 1.5 kms. for the mean velocity, and from ± 1.2 to ± 3.5 kms. for a single plate.

The last group embraces mostly A-type stars with the addition of a few B- and O-type, the lines of which are diffuse, broad, and frequently weak. For these the probable errors range from ± 1.0 to ± 3.8 kms. for the mean and from ± 2.5 to ± 10.0 kms. for a single plate.

The original programme as to the number of photographs of the spectrum of each star to be secured, namely, six plates for each star with well-defined lines and eight or ten plates with poor lines, was almost carried out; the whole system of velocities here deduced is therefore homogeneous and a high grade of accuracy has been maintained. The radial velocity values are the result of a great amount of painstaking care, and their early publication is evidence of the industry that has been displayed in all stages of the research.

Geology of Antarctic Lands.

A USEFUL reference to recent summaries of the geological features of Antarctica occurs in the Proceedings of the first Pacific Conference, part iii. p. 644 (1921). It is unfortunate that the various researches based on the results of different British expeditions have not been carried out in a common clearing-house and published as an interlocking series. At present three sets of quarto publications are appearing in our libraries, two of them under the auspices of the Royal Society of Edinburgh, and one under those of the Trustees of the British Museum. Mr. J. M. Wordie's observations on the Weddell Sea area (Shackleton expedition, 1914-17) have been already noticed (NATURE, vol. 109, p. 218). The geological results of the expedition from the Falkland Islands in 1913, financed by Messrs. Salvesen of Leith, are now described by the leader, Mr. D. Ferguson ("Geological Observations in the South Shetlands, the Palmer Archipelago, and Graham Land," Trans. Roy. Soc. Edin., vol. liii, p. 29, 1921).

The unrest in the earth's crust in Oligocene and Miocene times is illustrated by great outpourings of basalt in the South Shetland Islands. The later lavas of the series are notably columnar, and are correlated with similar rocks in Patagonia. Volcanic activity continued almost down to recent times; and there is a series of andesitic tuffs and lavas that go back to Jurassic or early Cretaceous age. The photographic landscapes in this memoir are of unusual excellence. The rocks collected abundantly by its author are described by G. W. Tyrrell in a separate memoir (*ibid.* p. 57). They include the varied intrusive masses of Graham Land and its group of islands, and the red adamellite of Mount Theodore, "the most imposing natural feature" of the district. Mr. Tyrrell regards these older igneous rocks as distinctly Andean in type.

Dr. H. H. Thomas (*ibid.* p. 81) deals with the rocks and minerals collected from islands of the same region by Mr. Innes Wilson, of the Falkland Islands, in