OUR ASTRONOMICAL COLUMN.

COMET 1907*a*.—No. 4165 (March 26) of the *Astronomische Nachrichten* contains a new set of elements and an ephemeris for comet 1907*a* (Giacobini), calculated by Herr M. Ebell from places observed on March 9, 12, and 16. According to the elements, the perihelion passage took place on March 26, and, as shown by the ephemeris, the comet's brightness is decreasing, now being less than half what it was at the time of discovery. The position of this object for April 11 is $\alpha = 6h.\ 14m.$, $\delta = +4^\circ\ 47'$, and the comet is travelling in a nearly due northerly direction, its calculated position for May 6 being 6h. 10m.+13° 42′.

THE BRIGHTNESS OF THE SKY NEAR THE SUN'S LIMB.—With an apparatus described in No. 4164 (March 25) of the *Astronomische Nachrichten*, Prof. Ceraski, at Moscow, determined the relative intensities of the light at the sun's limb and the atmospheric illumination very near the limb on November 3 and 4, 1906. On the former date the mean value of the ratio $\frac{\text{edge of } \odot}{\text{atmosphere}}$ at the east and west limbs was 31·4, and on November 4 it was 38·4, values far below those which Prof. Ceraski expected to find.

Prof. Ceraski points out that this ratio might be employed as a term of comparison in evaluating the relative intensity of the corona. Using the method described by him in No. 4106 of the *Astronomische Nachrichten*, the coronal light could be compared with that of a standard lamp, which might, after the eclipse, be measured against the illumination of the atmosphere at a determined point in the sky. Thus the illumination of the sun's edge could be compared indirectly, in graduated steps, with that of the corona.

RADIAL VELOCITY OF η PISCIUM.—This star was announced by Mr. Lord as a possible spectroscopic binary having a long period, but Prof. Campbell was unable to find any variation in the line-of-sight velocity. The binary character is now confirmed by plates secured at the Dominion Observatory at Ottawa, the range of velocity so far detected being from +5·4 km. to +21·4 km. per second, and there are indications that the period is a comparatively short one.

α Draconis has also been observed, and the velocity curve practically completed; the period is between fifty and fifty-one days, and the velocity ranges from −53 km. to +35 km. per second.

In the case of ι Orionis, a considerably larger range of velocity than that announced by the discoverers was found, that already observed extending from −50 km. to +100 km. (the Journal R.A.S. Canada, No. 1, vol. i.).

SIMULTANEOUS OBSERVATIONS OF JUPITER.—In the *Bulletin de la Société astronomique de France* for December, 1905, it was suggested that simultaneous observations of Jupiter should be made by as many volunteer observers as could be obtained, and that the results, obtained with many different kinds of instruments and under varied conditions, should be communicated to and coordinated by the society.

One hundred and seventy-two observers made observations at prearranged hours on various dates between January 2 and 20, 1906, and the first batch of results is now discussed by M. Mascart in the April number of the *Bulletin*, the general conclusions derived from all the observations on one day being given, together with reproductions of the original drawings for January 2, 3, 4, and 5, 1906.

THE SUN AS A VARIABLE STAR.—At the meeting of the Royal Astronomical Society held on March 8 Prof. Turner briefly discussed the light curves of a number of variable stars, and showed that there existed a sequence in their forms. In most cases the minimum falls later than midway between two maxima, in others earlier, and on arranging the curves of thirty-one variables it was found that the sun falls into the sequence. Seeking some explanation for this arrangement, Prof. Turner has evolved the interesting suggestion that the form of the curve may, to some extent, depend upon the position of the star's axis in regard to the line of sight; thus we view the sun from a point lying nearly in the plane of its equator, but the poles of other stars may be turned towards us, whilst in other cases we may be looking normally at mid-latitudes.

An analysis, from this point of view, of the suitable data given in Chandler's catalogue of variable stars led to the tentative result that whilst the stars where we look directly at the equator are distributed in all galactic latitudes, those of which we see the polar regions are absent from the neighbourhood of the galactic poles. As a purely speculative interpretation of this difference, Prof. Turner suggests that the axes of the stars may be nearly parallel to the plane of the Milky Way, an arrangement which would, of course, account for the result found (the *Observatory*, No. 382, April).

EFFECTS OF PRUNING ON FRUIT TREES.

THE scientific work carried on at the Woburn Experimental Fruit Farm, by the Duke of Bedford and Mr. Spencer U. Pickering, F.R.S., is of great value to horticulturists, who usually follow rule-of-thumb methods in much the same way as the British farmer cultivates his crops. The fifth report of the Woburn Fruit Farm, noticed in NATURE of September 7, 1905 (vol. lxxii., p. 461), showed that several cherished ideas as to the proper treatment of fruit trees need modification, and that operations which are generally supposed to be beneficial to growth and fruit-bearing are really prejudicial to both. Measurements of leaves, trees and fruits, and weighings of the fruit, led to the conclusions that heavy thinning of the fruit is of no advantage; hard pruning is unprofitable; summer pruning is undesirable; and root pruning injurious. An explanation was also found of the fact that carelessly planted trees, though weak at first, ultimately make more growth than trees carefully planted.

The observations described in the fifth report of the Woburn Fruit Farm have since been extended, and the new results and conclusions are dealt with in the seventh report recently issued.[1] As the conclusions are based on experimental evidence, they are, of course, of far greater value than mere expressions of opinion; and though they apply only to particular trees in a particular soil, they suggest that the ways of the practical gardener are not always wise. The empirical horticulturist believes that "growth follows the knife," but by measuring and weighing trees it has been found that the less a fruit tree is pruned the larger and heavier it becomes, even when allowance is made for the amount of wood removed in the annual pruning of the normal trees. The fruit crops of trees are also increased as the amount of pruning is diminished, so it appears that the less pruning done the better is the result both as regards growth and fruit.

These conclusions, however, apply only to healthy and established trees. Transplanted, injured, or ailing trees may be regarded as prematurely old trees which tend to form an excessive number of fruit-buds and increased wood formation. The obvious way to prevent this is to prune hard; and the experiments at Woburn show clearly that if transplanted trees, that is, trees which have been checked in their development, are cut back at once, the operation results in the starting of many dormant buds followed by a clean, vigorous growth. Hard pruning also results in increased branch-formation in the case of mature trees, the effect being thus the opposite to what is found when the pruning is on young trees in the full vigour of growth.

The experiments show, in fact, that with trees, as with animals, there are certain periods in their life-history characterised by certain distinct differences of behaviour. All the results obtained at Woburn can be explained by remembering that any cause which disturbs the balance between the root and branch systems at any period of growth is followed by an effect which will adapt the organism to the new condition. The observations are thus not only of importance to practical horticulturists, but are also of scientific interest. The summary of the report, re-

[1] Seventh Report of the Woburn Experimental Fruit Farm. By the Duke of Bedford, K.G., and Spencer U. Pickering, F.R.S. Pp. 56. (London: Eyre and Spottiswoode, 1907.) Price 1*s*. 6*d*.

printed below by permission of the authors, presents the results in a convenient form, but a study of the report itself is necessary to appreciate the value of the experiments upon which the conclusions are based.

Records have been kept during the last twelve years of the behaviour of apple trees when pruned to different extents. The trees were chiefly dwarf trees on the paradise stock, and the main series of experiments were made on three varieties, possessing very different habits of growth. Measurements of the height of the trees, the spread of the branches, and the diameter of the stems led to the conclusion that the less the tree was pruned the larger did it become, and this conclusion has now been confirmed by lifting more than half the trees and ascertaining their weight. At the end of twelve years (the trees then being fifteen years old), those which had not been pruned at all were 20 per cent. heavier than those which had been moderately pruned, whilst those which had been hard-pruned were 16 per cent. lighter. The difference in weight between the unpruned and moderately pruned trees was too great to be accounted for by the weight of wood removed in the pruning, so that pruning not only does not increase the actual size of a tree, but it results in less new wood being formed.

These results were further established by pruning to different extents similar branches on the same tree. The less the pruning done the greater was the number, length, and weight of the new shoots formed, and the greater, also, was the increase in girth of the original branch.

From every point of view, therefore, the pruning of a healthy, growing tree seems to be inimical to wood-formation.

It is as regards the crops, however, that a reduction of pruning shows to greatest advantage. With the dwarf apple trees, the crops during the first five years were more than twice as great from the unpruned trees as from the moderately pruned ones, and more than three times as great as from the hard-pruned ones; in the second period of five years the differences were still greater, and in the twelfth year (when, however, one variety only was in bearing) the unpruned trees yielded nearly three times as much as the moderately pruned ones, and the hard-pruned trees had practically no crop at all. Similar results were obtained during the past season with trees of fifty-three and eighty varieties on the crab and paradise stocks respectively, the crops from moderately and hard-pruned trees being in the proportion of three to one in both cases. There was no appreciable difference in the size of the fruit from trees pruned to different extents, so that the values of the crops were proportional to the weights. The trees, however, were not allowed to overbear, the fruits being thinned to two to the truss.

Confirmatory evidence of the antagonism of pruning to fruiting was obtained by counting the fruit-buds formed on similar branches of the same tree, which had been cut back to different extents.

All these results refer to healthy trees which are still young enough to be growing vigorously. With a tree which is older, and has attained maturity, the results are somewhat different, not as regards fruiting, but as regards branch-formation. With a tree of this age, branch-formation, under natural conditions, has ceased, but if it be pruned new branches are formed to supply those removed, but they are formed only at the expense of the fruit. Most of the dwarf apple trees (now fifteen years old) used in these experiments seem to have reached this stage; hard pruning in their case now results in an increase of the new wood formed, though the reverse was the case when they were younger, but the crops are still reduced by the pruning, and even more so than in former years.

What applies to a tree which has passed the age of active growth, and has reached maturity, applies also to a tree which has become stunted, or has had its growth arrested by root-injury, as, for instance, when it has been transplanted. The deficiency of vigour of a freshly planted tree is shown by the small size of the leaves and the tendency to form fruit-buds instead of wood. The correction for fruiting is, as has been shown, hard pruning, and it is, therefore, most important that freshly planted trees should be cut back hard so as to prevent precocious fruiting, which would generally result in permanent stunting. To delay this cutting back until the end of the first season would appear to be a very wrong procedure. It has been found that with trees which were not cut back the size of the leaf was, on the average, 24 per cent. less, and the new wood formed 45 per cent. less, than with similar trees which were cut back; such vigour as the tree possessed went to form fruit-buds, which, when the cutting back was eventually performed, were removed altogether, or suppressed in favour of growth. A year's growth is practically lost by thus deferring the cutting back, and the ultimate result was found to be that the trees thus treated continued to form wood in subsequent years, whilst those which had been cut back at once were fruiting; so that the crop borne by them during the first ten years was only one-third of that borne by the latter.

Experiments on apples, pears, and plums show that the date of cutting back a freshly planted tree is immaterial so long as it is done before growth begins, that is, before about the middle of April. If delayed until the middle of July, the season's growth is much reduced, and the tree will probably suffer in subsequent years. This point was investigated more fully in the corresponding case of the hard cutting back, or lopping, of older trees (plums), which had become slightly stunted. The operation increased the amount of new wood formed by the tree, and the results were the same so long as the lopping was done during the dormant season. Lopping towards the end of May resulted in less growth during the year, but this was more than compensated by an additional growth during the succeeding season. It is doubtful, however, whether anything is really gained by anticipating the autumn lopping (as is sometimes possible), and doing it in the preceding early summer, for it was found that the trees thus treated did not appear to be so healthy in foliage as those which were cut back subsequently. This was especially so where the cutting back was postponed until July, for trees cut back then made very little growth during the remainder of that season, and were deficient in growth in the following season as well.

Apart from the cutting back of freshly planted trees, the present results are emphatic in showing that the less pruning is done the better. But this does not imply that no pruning at all should be done. The removal of branches which cross or rub each other, as well as that of any unripened wood, is evidently desirable, and no doubt a certain amount of pruning, in order to obtain a compact and shapely tree, should be done during the first few years after planting. But a tree which is growing freely, and is properly tended in other respects, will require very little pruning to keep it in shape. With precocious or weak-growing varieties more pruning will be necessary, and more is required with standards than with dwarfs, for in the former case it is very desirable that a compact head and strong stem should be obtained before any heavy crops are borne.

STANDARDS AND EXACT MEASUREMENT.

THE inaugural address delivered by Dr. R. T. Glazebrook, president of the Institution of Electrical Engineers—the full text of which is published in the current number of the Journal of the society (vol. xxxviii., No. 181, p. 4)—is likely to be remembered as one which stands apart among the various addresses which have been delivered in past years, owing to the fact that the subject treated is so rarely discussed or dealt with in ordinary engineering papers.

The subject in question, that of standards and exact measurement, is one which does not appeal to all, but is of special interest at the present time, when so much has been done of late by the Engineering Standards Committee to bring about more efficient work and more uniform results in the various branches of engineering. Dr. Glazebrook, in opening his address, gave a brief account of the history of standardisation from the first report of the Electrical Standards Committee of the British Association in 1862 down to the present day. This first