

tional Association. These two reports indicate the increasing differences between the eastern and western college. Some of the differences are, of course, evident. Practically all students of western colleges are prepared in public schools and are admitted on certificate, whereas the New England "examining" colleges depend very largely upon special fitting schools. But the more radical and far-reaching distinction between colleges of the east and the west arises from the fact that the more conservative of eastern colleges still prescribe a large proportion of the subjects and methods of the preparatory school. The western college, on the other hand, has in large measure accepted the dictates of the high school and has practically surrendered the right of intervention in the courses of preparatory study.

This position of the western university is well shown and ably defended in the reports just referred to. They urge that the requirements for admission should be entirely divorced from *subjects* and that the college should confine itself to stating the number of units required. In other words, the college should content itself with stating the *process* and *time* requisite for preparation rather than the *content*.

In view of the prevalence and strength of this "insurgent" movement in the western institutions there can be little question that these plans and methods will be urged upon the eastern colleges. To the conservative, the measures adopted and advocated seem absurdly radical and subversive of sound education, but he recalls that the high school curricula, except in very restricted areas of influence, go their own way with little or no consideration of college requirements, and that in the long run the high-school man has usually dictated the requirements for college. A preparation for college, however, which did not include foreign language or mathematics (except arithmetic) and with more than half of the school course represented by commercial and vocational studies would seem to him to be a misnomer. There can be little doubt that such extremes bear the seeds of reaction; but this does not relieve the eastern college from the responsi-

bility of making its entrance requirements such as not to bar it from intimate connection with the public-school system of both the east and the west.—Professor Robert N. Corwin in the *Yale Alumni News*.

SCIENTIFIC BOOKS

An Investigation of the Rotation Period of the Sun by Spectroscopic Methods. By WALTER S. ADAMS, assisted by JENNIE B. LASBY. Carnegie Institution, Washington. 1911.

This publication gives a complete account of the investigations undertaken at the Solar Observatory of the Carnegie Institution, Mount Wilson, Cal., upon the Rotation of the Sun in the years 1906-07 and 1908, embodying results previously published in the *Astrophysical Journal* and in the "Contributions from the Mount Wilson Solar Observatory." These, however, contained only brief summaries of the principal portions of the work which is treated in detail in an admirably comprehensive and yet concise and logical manner in the publication under review. The arrangement of the material in this work and the plan of treatment of the numerous observations recorded is one that might with advantage be copied in reports of scientific investigations which are too frequently lacking in the logical treatment necessary for the proper exposition of the results obtained.

After a succinct and yet complete account of the work previously done on the spectroscopic determination of the solar rotation, the instrumental equipment used in the two series of determinations is described. The first series in 1906-07 was made by means of the "Snow" cœlostast telescope and an 18 foot focus, Littrow form, grating spectrograph. The second series, which, as the author claims and the observations show, is superior in accuracy to the first, was made in 1908 with the 60-foot Tower telescope and a 30-foot focus grating spectrograph also of the Littrow form. The linear dispersion for the first series at $\lambda 4250$, the center of the region employed, was $1 \text{ mm.} = 0.71 \text{ \AA.}$, and for the second $1 \text{ mm.} = 0.56 \text{ \AA.}$, comparatively high dis-

pensions, the latter giving a maximum displacement, at the solar equator, of about 0.090 mm.

Considerable space is devoted to a discussion of the possible sources of error and it is evident that the greatest possible care was taken to avoid all known causes of systematic displacements of the lines and consequent error in the velocity. In most astronomical work systematic errors are much more to be feared than accidental errors and this is especially true in this case where the line displacements to be measured are small. The greater relative importance of what might be called plate errors over the accidental errors of measurement is clearly shown by the results obtained in this investigation, where the probable error of the mean value of 21 plates is considerably less than the probable error of a *single* plate as determined from the internal agreement of the 22 lines on the plate—a ratio of plate errors to measurement errors of more than five to one. The method of measurement and reduction is concisely and yet fully described and is followed by the detailed measures of the plates obtained in the two main and two supplementary series which are then conveniently summarized.

The discussion of these results is admirably arranged so as to present in a convenient form the conclusions reached, the most interesting and important of which may be briefly stated.

1. So far as the period covered by these observations goes, the sun's rate of rotation is constant, the slight difference found in the two series being ascribed to the slightly less satisfactory instrumental conditions in the first series.

2. The retardation of the rate in higher latitudes is satisfactorily represented by an equation of the Faye type taking the form for these observations of

$$\xi = 11''.04 + 3''.50 \cos^2 \phi$$

where ξ is the daily angular sidereal velocity and ϕ is the solar latitude.

3. The lines of different elements in the reversing layer give different values of the ro-

tational velocity, which, though small, are believed to be real, those known to lie at low levels giving low values, and *vice versa*. This is especially the case with H_{α} and $\text{Ca } \lambda 4227$, which move at a more rapid rate than the general reversing layer and in which the retardation towards the higher latitudes is very much less.

4. The comparison of H_{α} , $\lambda 4227$ and lines in the reversing layer shows that the velocity increases and the polar retardation decreases with increasing distance outward, the cause being assigned as probably due to the effects of friction in the lower portion of the solar atmosphere.

The whole work sets an exceedingly high standard of accuracy, which it will be difficult for other observers to equal. Taking for example some of the probable errors of measurement obtained, we have in the second series the probable error of measurement of the displacement of a single line ± 0.009 km. per sec., equivalent to a linear error of only about 0.0004 mm., less than half a micron. Those who have had experience in measuring spectrum lines where a probable error of a micron is considered good measuring will recognize the remarkable accuracy obtained, several times greater than previously secured in the same problem. The corresponding error of a plate is ± 0.002 km., the thousandth part of the equatorial velocity. Notwithstanding what was previously said concerning systematic displacements the agreement among different plates is also remarkably good, the probable error of a single determination of the rotational velocity being not much greater than ± 0.01 km., giving the probable error of the mean value of the velocity in the neighborhood of ± 0.003 km.

Professor Adams and Miss Lasby are to be congratulated upon the very high accuracy of this determination of the solar rotation, upon the interesting and important conclusions derived from their measures, and upon the manner of presenting the formidable amount of material on hand. Furthermore, they, with the Carnegie Institution, are to be

congratulated on the mechanical excellence of the completed volume.

J. S. PLASKETT

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Photography for Bird-Lovers: a Practical Guide. By BENTLEY BEETHAM, F.Z.S. With Photographic Plates. London. 1911. Pp. i-vi + 122.

This handy little volume is designed to serve as a manual and guide in bird-photography in its widest sense, and while addressed to beginners in the art, and to lovers of birds and of sport rather than to ornithologists and trained naturalists, all interested in birds will find in it much to attract them. More particularly, the expressed object of the author is to show how pictures of birds, whether dead or alive, captive or free, can be best obtained, rather than to direct the steps of his reader into the paths of the naturalist, to show him how to study, and to use his camera as a tool for recording and supporting his observations.

In every such work we should like to see it clearly stated that the higher object of bird-photography is not simply to "embody a little story," or even "to portray the living bird in some characteristic pose or action," though this be all very well, but rather to obtain a pictorial analysis of behavior, as registered in all the more characteristic movements and attitudes, made or assumed by birds. This, 'tis true, is a subject which requires ample leisure as well as training and skill, but one, it would seem, in which many young students, who, happily possessing the former, might be led to acquire the latter, and thus to extend the boundaries of knowledge. We think that the attitude of any author could be raised to this plane without loss in interest, and with decided gain in value.

Some of Mr. Beetham's specimen illustrations, and particularly the habitat pictures, which show the nest or bird with its surroundings, could hardly be improved, such as the oyster catcher's eggs on page 28, or the grouse on page 56, obtained by setting the camera very low down. I think, however, that the value to students of all really excellent

photographs of this character would be enhanced by adding, either on the page or at the end of the book, the essential photographic data, a thing usually neglected.

If one were disposed to be critical, though we hope, not hypercritical, he could find more exercise of this power in the longest and most important chapter in the book, that on the use of the concealing tent. The present reviewer, so far as he knows, was the first to use a *bona fide* unadorned tent for the close at hand study of birds, in the summer of 1899, so that perhaps he is a little over keen on the subject. In a work on the "Home Life of Wild Birds," published in 1901 and again in 1905, the bird-tent was fully described and illustrated, with an exposition of the psychological principles governing its use. Many were inclined to look askance upon our tent and methods in 1901, but no attempt seems ever to have been made to dispute the principles at stake. All this, however, is a matter of history, and we are now interested to see that our tent has become a fixture for the intimate study of nest-life, and further that at the end of this very volume a "hiding tent" is advertised for sale by a London dealer. To continue, the present writer's tents, plain and unadorned, have been in use—one of them at least—for twelve years, and with them he has worked at the close range of 70 nests, pertaining to from 30 to 40 species of wild birds, often spending a week at a given one. Further, since accidents from every cause, including the weather and living enemies, have hardly exceeded one in ten, and can be reduced to almost nothing by a proper use of the wire screen whether the original position of a nest is changed or not—he should be qualified to speak on the score of experience at least.

The use of the concealing tent is indeed based upon certain fundamental principles, the force of which experiments in the field, year after year, have only tended to confirm. While any detailed discussion of them would be quite out of place here, we might intimate that the most important are the gradual rise of the "parental instincts," and consequent depression of fear, most marked from the beginning of incubation, the force of habit, and