OUR ASTRONOMICAL COLUMN.

FIREBALL OF OCTOBER 3.—A large number of additional observations have come to hand, and Mr. Denning writes us that the brilliant object was well observed as far north as Huddersfield and as far east as Hertford. Even at Huddersfield, where the observer was about 210 miles distant from the object, it exhibited a Venus-like lustre, and was followed until it disappeared in the mist very near the S.S.W. horizon. The new observations confirm, in general, the deductions already stated as regards the position and height of the fireball, but the exact place of the radiant point remains a little doubtful. With reference to the elevation at disappearance, this may have been less than thirty miles, for there are several observations indicating it at about twenty-four miles. The cloudy or misty condition of the sky at many places, however, hindered efforts at exact observation. Everywhere the spectators speak of the astonishing brilliancy of the object and admit that its startling aspect at first aroused fears of a calamitous sequel.

Erratum.—By a clerical error Launceston was mentioned instead of Seaton, East Devon, in NATURE, October 12, p. 116.

ANOMALOUS DISPERSION IN THE SUN.—The search for evidence of anomalous dispersion in the sun continues to attract considerable attention. Dr. Albrecht recently concluded that Rowland's measurements gave distinct indications of a mutual repulsion in close pairs of lines, such as is required by the anomalous dispersion theory. Mr. Evershed and Dr. Royds, however, have questioned the validity of this result, since it is not supported by data obtained at Kodaikanal by more direct methods (the *Observatory*, October, 1916). In agreement with Dr. St. John, Mr. Evershed finds that Rowland's separations were almost invariably overestimated; for eighteen pairs having a mean separation of 0·1920 according to Rowland, the Kodaikanal mean value was 0·1836. The tendency of Rowland was therefore to displace the violet components to the violet, and the red components to the red, thus simulating the effects of anomalous dispersion. Mr. Evershed considers that his results are decidedly against the view that anomalous dispersion is an effective agent in displacing solar lines.

Dr. St. John has also made an exhaustive examination of the cases included in Albrecht's list, and is strongly of opinion that the deviations are merely due to systematic errors in Rowland's measures of close lines (Proc. Nat. Acad. Sci., vol. ii., p. 458). He finds that the separations of pairs in the solar spectrum are identical with those obtained from terrestrial sources. "Within the limits of error, evidence of mutual influence is absent from the solar spectrum, and in so far as mutual influence is a necessary corollary of anomalous dispersion in the sun, evidence for it also is absent."

Experimental work bearing upon this question has been carried out at the Pasadena laboratory by Dr. A. S. King (Proc. Nat. Acad. Sci., vol. ii., p. 461). Anomalous dispersion effects in metallic vapours were obtained by the use of the electric furnace, in which a strong density gradient was produced by water-cooling the upper part of the tube. Tests for the mutual influence of lines were made on the mixed vapours of titanium, calcium, and chromium, in which certain lines of the two former elements fall well within the curved spectra given by the anomalous dispersion of chromium lines. When compared with the corresponding emission spectra of the mixture, and of the elements separately, the measures gave no evidence whatever of a mutual repulsion between close lines when anomalous dispersion is active.

THE VARIABLE STAR SZ CYGNI.—Extensive observations of SZ Cygni, covering the period from November, 1912, to August, 1916, have been made by F. C. Leonard (Mon. Reg. Soc. Prac. Astr., vol. viii., No. 5). The star is of the δ Cephei class, having a mean magnitude of 8·96 at maximum and 9·74 at minimum. The mean period is 15·10 days, with an interval of 6·6 days from minimum to maximum. Both range and period appear to be subject to slight variations. The star is stated to be of a reddish tinge, and to deepen in colour as the brightness diminishes.

FISHERIES INVESTIGATIONS AND DEVELOPMENT.

THE importance of utilising more fully the fisheries around our coasts was emphasised at the recent Newcastle meeting of the British Association, one day being devoted to papers and discussions on this and kindred subjects.

Prof. Herdman urged that with the view of making a rapid recovery from the effects of war, food-producing industries should be encouraged, and, among others, the inshore fisheries should be exploited. Shellfish cultivation, shrimping and prawning, whitebait and sprat fishing, and herring fishing and curing, if extended and exploited judiciously, would add to employment, increase the national food supply, and might lead to the establishment of permanent industries of a profitable nature. He illustrated by several instances how the transplantation of stunted mussels from an overcrowded area to suitable neighbouring areas resulted in the rapid production of mussels of good quality which were sold for eight to ten times the sum expended on their transplantation. As examples of local fisheries started recently, Prof. Herdman mentioned the winter sprat fishery in Morecambe Bay and the summer herring fishery in the Irish Sea.

Prof. Meek gave an account of the inshore fisheries of Northumberland, and pointed out what had been done to preserve them by legislation and to encourage them by such an attempt as that now being made to establish a mussel-bed large enough to supply the wants of the district. The importance to the nation of the fishermen of the smaller fishing stations has been emphasised during the present war. With the problem of the preservation and extension of the coastal fisheries is involved the economic consideration of better buying and selling, and also the social question of making life in the fishing village more attractive.

In his paper on the further development of the shell-fisheries Dr. James Johnstone dealt especially with the coasts of Lancashire, Cheshire, and North Wales, where such fisheries are of considerable actual value and of very great potential value. Here mussels and cockles exist in incredible abundance, though in certain areas a considerable proportion are always smaller than the specified legal size. Mussels are found to prefer shallow estuarine water of low salinity containing the drainage from cultivated land or from human communities. Dr. Johnstone dealt with the rationale of successful transplantation, and calculated that the yield in assimilable food substance of high nutritive value of a cultivated mussel-bed was probably greater than that of a similar area of land bearing a food crop. He pointed out that although mussels feed on contaminated material they can be cleansed, and regarded as pure, by placing them in an area where water coming in from the sea washes over them during the last hour of flood-tide for two to four days. Although it is practicable to develop the yield of the shell-fisheries to an enormous extent, it is difficult to see how this can be brought about without some

measure of State organisation for redepositing and cleaning the shell-fish. Dr. Johnstone considered briefly some of the administrative problems involved.

Dr. A. T. Masterman stated that in running sterile water mussels will, in three hours, cleanse themselves of sewage organisms which have been introduced into their mantle cavity and alimentary canal with food. Mussels may be relied upon to feed at night and at a suitably low temperature. It was found that chlorine in any form was not available as a direct sterilising agent, for its presence in the water in any appreciable quantity (0·5 per million) interfered with the normal functions of the mussel, and retarded the self-cleansing processes. Efficient sterilisation of sea-water can, however, be produced by the use of chlorine, and the following process of mussel purification has been devised at Conway by the Board of Agriculture and Fisheries. Into an upper tank river-water (80,000 gallons) is pumped and allowed to settle, and the clean water is run into a lower tank, together with sufficient hypochlorite solution to produce an initial strength of three parts per million. Sterilisation of the water is effected overnight. In other still lower, shallow tanks mussels, which have been thoroughly washed, scoured, and picked over, are placed two deep on grids. The sterile water is then passed into the mussel tanks, its surplus of hypochlorite being removed during its passage by addition of sodium thiosulphate. The mussels remain in the sterile water for at least one night, and are then washed and hosed. They are left in sterile water for another night, and are then ready for packing.

Dr. E. J. Allen referred to the account given by Prof. Herdman of the establishment of a fishery for sprats on the Lancashire coast, and expressed the hope that attempts would be made to establish in this country an industry for preserving these fish in oil, as had been done on a large scale in Norway. He thought that a great deal more might be done in the way of preserving fish if the matter were properly organised. There were often gluts, when large quantities of fish were wasted which might well be saved and made available as food.

In his account of the scales of fishes and their value as an aid to investigation Prof. Meek pointed out that it had been established by a wealth of observations that the physiological processes in fishes suffer a relapse in winter, and that the seasonal diminution in the rate of growth is recorded on the scales, as in other skeletal structures. This discovery has enabled investigators to state the rate of growth, the age-composition of samples, and other important correlated facts. The method was illustrated by photographs of the scales of the herring, bass, and several Gadoids and Pleuronectids.

Dr. Masterman stated that although the great majority of scales in a Gadoid fish, *e.g.* the haddock, show the same number of annual rings, it was possible to find a certain percentage with a smaller or greater number. In large samples of haddock from the Dogger Bank and other parts of the North Sea the scales showed evidence of active growth for two separate periods of the year, the explanation of which is obscure. In the salmon the determination of age is complicated by cessation of growth at certain periods, and also by destruction of the edge of the scale at spawning. As a general rule, the zones on the scales of fishes are an expression of variations in growth dependent upon seasonal changes, but the interpretation of individual cases is full of pitfalls.

Dr. E. C. Jee reviewed the fluctuations of the herring, mackerel, and pilchard fisheries off the south-west coasts in the light of seasonal variations of hydrographical factors. The landings of herring, mainly at Plymouth in December, appear to be heavier in those years in which the sea-temperature is below the normal, but are also dependent in some way upon the preceding summer maximum. During the years 1904–11 (inclusive) the landings of mackerel, which are caught chiefly in May, seem to be correlated with the sea-temperature of that month. For the years 1905–10 (inclusive) the yields of the pilchard fishery fluctuated in the same manner as the magnitude of the seasonal salinity ranges. These are probable measures of the strength of the Atlantic current, which was therefore stronger in those seasons which were followed by a more successful pilchard fishery.

J. H. A.

BITTER PIT.[1]

THE disease of apples (and pears) known as bitter pit manifests itself externally by depressions of the surface of the fruit and internally by patches of discoloured and dead tissue. It is a disease which may make its appearance whilst the fruit still hangs on the tree, or it may declare itself in the fruit-room and even in cold storage.

This disease has been, and still is, the cause of great loss to growers. Thus it has happened not infrequently that whole consignments of apples shipped from Australia to England have developed the disease so severely as to have become unsaleable. Hence it is not surprising that so progressive a community as the Commonwealth of Australia should have instituted, with the co-operation of the State Governments, a special research into the nature of the disease, its remedy and prevention. This research, endowed for a period of four years, was entrusted to Prof. D. McAlpine, and the fourth and final report now issued testifies to the assiduity and thoroughness with which both Prof. McAlpine and his colleagues have prosecuted their inquiries. As is pointed out in the introduction to the report, when the investigations which it summarises were begun bitter pit was regarded as a mysterious disease. It is associated with the presence of no parasite, nor is it a consequence of puncture by insects of the skin of the fruit. Ewert had, it is true, advanced evidence in support of the view that bitter pit is a result of the local toxic action of copper-containing spray fluids. That hypothesis has not, however, met with general acceptance.

Our knowledge of the ætiology of this disease being so vague, we turn with interest and curiosity to learn the results of Prof. McAlpine's inquiries; but it must be confessed that although we discover much valuable and interesting information in this large and admirably illustrated volume, we fail to find the revelation of the mystery. The symptoms of the disease are described in detail; evidence is brought forward that severely pruned trees yield more pitted fruit than is produced by lightly pruned trees; that nitrogenous manures appear, albeit often to no considerable degree, to increase the pitting of fruit; that certain varieties are more resistant and certain others more susceptible to the disease—in fine, we learn much that is useful and suggestive, but of the cause or causes of bitter pit we are no wiser after than before the perusal of this monograph. We insist on this point with some emphasis because we think that it should have been made clear at the outset of the report, instead of which we find it there claimed that the research has been brought to a successful issue.

[1] "Bitter Pit Investigation. The Experimental Results in Relation to Bitter Pit, and a General Summary of the Investigation." By D. McAlpine, issued by the Commonwealth and State Governments of Australia. Fourth Report, 1914–15. Pp. 178+70 figures and coloured frontispiece. (Melbourne: The Government Printer.)