

## OUR ASTRONOMICAL COLUMN.

THE TOTAL SOLAR ECLIPSE OF MAY, 1900.—The report of the expedition organised by a joint committee of the Royal Dublin Society and the Royal Irish Academy to observe the total solar eclipse of May, 1900, has just been published in vol. viii. (series ii.) of the *Scientific Transactions* of the Royal Dublin Society.

The instruments used were chiefly lent by Sir Howard Grubb and Mr. W. E. Wilson, F.R.S., who, with Prof. Joly, Dr. A. A. Rambaut and others, were members of the expedition. They included two coelostats and two coronagraphs, one of the latter being of 4 inches aperture and 19 feet 4 inches focal length, the other of 6 inches aperture and 7 feet 10½ inches focal length; a special spectroscopic apparatus for securing a continuous series of photographs of the spectrum of the chromosphere was also taken. The second of the two coronagraphs was used with a coloured screen, made by "fixing" an ordinary unexposed film, and then soaking it in a bath of tartrazine, which allowed only the green light about the chief coronal radiation to be photographed. The resulting negative, which was exposed for eighty seconds, shows considerable extension of the outer corona, although the spectroscopic observations indicated that the green corona line was very faint during this eclipse.

The spectra were obtained with a kinematograph especially designed by Sir Howard Grubb to take twelve plates at the second and twelve at the third contact, in such a manner that no interval occurred between two successive exposures, the idea being to observe whether all the bright lines appeared or disappeared simultaneously, or whether some became reversed earlier than others as would be expected if their respective absorptions took place at different levels. It was found that the lines generally disappeared in the order of brightness shown on the original spectrum, although there were several exceptions to this rule, notably the strontium lines at  $\lambda$  4078 and  $\lambda$  4216, which disappeared earlier than other lines of the same original intensity. These differences are shown in the analytical table which accompanies Dr. Rambaut's discussion of the spectra. The wavelengths and origins given in this table seem less determinate than those which have been previously published by other observers. Several plates showing reproductions of the corona photographs, which have been discussed by Mr. Wesley, and of the spectra are given at the end of the paper.

CLOUDS ON MARS.—An article by Mr. Denning, published in the December number of the *Bulletin de la Société astronomique de France*, records the appearance of cloud-like formations on Mars during the latter half of May. On May 19 and 21 the Syrtis Major was dark and sharply defined, but on the latter date a brilliant region appeared over its southern extremity, whilst on May 23 this region was very faint and ill-defined, although other features usually less obvious were plainly seen. Mr. Denning describes the region as appearing to be covered by strongly reflecting vapours which were not dense enough to hide completely the surface, but were sufficiently dense to give it a more luminous and less definite appearance. On May 25 and 27 a luminous zone was observed to the north of the Mare Cimmerium, and during the latter part of the month an extensive luminous band was visible along the northern edge of this sea, Syrtis Major, and the Linus Sabæus. It seems probable to Mr. Denning that the clouds of white vapour which were observed on the eastern edge, south of Syrtis Major, on May 21 travelled very rapidly in a northern direction, and thus caused the lack of definition observed in the above regions on the later dates, and he connects this phenomenon with the appearance of a white projection observed by Mr. Lowell, at Flagstaff, on May 26.

Several other remarkable phenomena, notably a marked division of Nilus by a bright spot, which extended far to the south-east from the eastern edge of the Lunæ Lacus, on May 4, were observed by Mr. Denning, and, on analysing his observations, he arrives at the conclusion that real changes do present themselves in the details of several Martian features, although many of them may be only temporary and due to atmospheric causes.

As regards the question of Martian canals, Mr. Denning

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states that there is no doubt as to the objective reality of the streaked and striated appearance of the northern hemisphere, and to him the canals appear not as straight and narrow lines, but as currents of dark material with frequent condensations having the appearance of a natural rather than an artificial origin.

## SEISMOLOGICAL NOTES.

THE fourteenth number of the *Publications* in European languages issued by the Earthquake Investigation Committee of Japan is entirely devoted to a profusely illustrated paper on the modulus of rigidity of rocks, by Mr. S. Kusakabe. The experiments, which are a continuation of investigations made by Prof. H. Nagaoka on the elastic constants of rocks, relate entirely to torsion, and show, amongst other things, that even for very small strains Hooke's law does not hold, that in the relationship of stress to strain, or twisting couple to twist produced, rocks exhibit a marked *hysteresis*, and that the modulus of rigidity of a rock in its virgin state is greater than is usually supposed. Inferences to be drawn from these important investigations (in which stresses are applied *slowly*) are that waves of small amplitude are propagated with a higher speed than those with a large amplitude (increase an amplitude ten times and the velocity is reduced to half or one-third), also in a strained medium, as, for example, along a mountain chain, velocity is somewhat increased. In view of the first of these inferences, Mr. Kusakabe does not see the necessity to assume that the tremors of an earthquake follow paths different from that of the large waves or shocks. Whether we agree or disagree with this suggestion, we can congratulate the author on his important memoir, which is a new leaf in seismometrical research.

Amongst other recent publications relating to earthquakes we have before us Nos. 13 and 14 of the new series of *Mitteilungen* issued by the commission appointed by the Vienna Academy of Sciences for seismological investigations.

The first of these, by Dr. R. Hoernes, gives an account of the earthquake which, on July 5, 1902, resulted in considerable destruction along a line to the east of Saloniki, and fairly parallel with the Vardar River. This is a fault line along which there are hot and other springs. From the fact that these became muddy, altered in temperature and in volume, whilst new springs were created, as at Güvezne, the inference is that the earthquake was accompanied by subterranean rearrangements of strata. A discussion of the movements along this and other fault lines in Macedonia, and of changes in level which are apparently in progress at Saloniki and its neighbourhood, leads to the conclusion that hypogenic geological processes have in this part of the world a marked activity.

The second communication, from Prof. Dr. W. Láska, is on the determination of the distance of earthquake origins from observing stations by means of seismograms. That the differences in time between the arrival of various phases of earthquake motion vary with the distance an earthquake has travelled is a fact which has received application for many years. In the reports of the Seismological Investigation Committee of the British Association (1900 and 1902), by means of curves the relationship between the time intervals and distances is expressed geometrically. Dr. Láska gives similar information by means of tables. From observations made at three stations he also gives equations the solution of which leads to the determination of a latitude and longitude for an epicentrum. In the British Association report for 1900 simpler and more certain solutions are given for the same problem.

In No. 15 of the same *Publications* Dr. Eduard Mazelle gives the results of his investigations respecting the connection between microseismical pendulum movements, the wind, barometric pressure, the state of the ocean, and other natural phenomena. The results at which the author arrives confirm the results from similar analyses made many years ago in Japan, and to be found in the *Transactions* of the Seismological Society of that country and in the reports of the British Association. We are told that it is difficult to find a direct connection between tremors and atmospheric