THE MEASUREMENT OF DOUBLE-STARS BY INTERFERENCE.

AN interesting form of micrometer is described by Herr Karl Schwarzschild in *Astronomischen Nachrichten*, No. 3335. The idea is gathered from the instrument which Michelson suggested and used for measuring small diameters and distances, an account of which appeared in the *Memoirs* of the National Academy of Science, Washington, 1891. Michelson, it may be remembered, placed before the object-glass of his refractor a disc in which were two parallel movable slits that set up interference phenomena; and an observation consisted in noting simply the disappearance and reappearance of the interference bands. Schwarzschild's disc, or more accurately oblong framework, on the other hand, contains several slits cut out at equal distances from one another, which cause several images to be visible at the eye-end of the telescope, forming a true multiple-image micrometer.

If one considers the case of the ordinary glass grating as used in spectroscopic work, it is well known that with a bright point as the source of light, we obtain a series of images, the angular distances of which from the unrefracted central image, for a certain wave-length, are given by the formula $\sin \alpha = \lambda . n/d$, when λ is the wave-length, d the distance between the lines on the grating, and n their number. In the case of daylight the centre image becomes sharp and white, while the others become broader and broader, in fact small spectra. By exaggerating this idea of the grating, and cutting out of a card slits three millimetres broad and ten millimetres distant from one another, the angular distances of the images for wave-length $\lambda = 570 \mu\mu$ become very small, and can hardly be separated with the unaided eye. Such a grating as this placed before the object-glass of a telescope directed to a star would show, in the field of view, one colourless image accompanied on its right and left sides by several other images, the first of which would differ only slightly in sharpness and colour from the middle image. It is only to these three images that Schwarzschild pays attention. Of course it is necessary that some means should be at hand by which these images may be moved with respect to one another, and this he accomplishes very simply.

To the object-glass ring, and in a plane parallel to it, he fixes a framework capable of rotation in this plane. Two circular rods, at opposite ends of a diameter of the object-glass, and perpendicular to the framework, are rigidly fixed to the latter, and to these rods is connected the apex of two inclined smaller frameworks containing the slits, the other two extremities of which slide in the grooves of the large frame. Since the distance of this apex from the object-glass can, by means of a rack and pinion movement, be increased or decreased, and since also the distances of the different slits vary consequently in a simple known manner, the displacement of the images in the field of view can be easily calculated.

In bringing a double star into the field of view, two parallel series of images would thus be seen, one series from the primary, the other from the companion. The whole framework containing the grating was then rotated in position-angle until the two lines of images coincided; the position of this line was then determined by means of a micrometer eyepiece, and the position-angle read off. To measure the distance between the stars, the rack and pinion motion connected with the apex of the two frames containing the grating was then used, until the image of he companion appeared exactly between the two images of the primary. The position of the grating was then read off, and a brief calculation gave the distance required. From a series of observations of several binaries, the total mean gave as a probable error of the mean for each evening:

Distance	Probable error in Distance	Probable error in Position angle
2″·3	0″·050	0″·052

The numbers show, as Herr Schwarzschild points out, that greater accuracy can be obtained by this means than by the thread micrometer. He is not, however, very confident about the usefulness of the method, for when the distances to be measured exceed 5″, the colour of the first images becomes very apparent, and thus destroys the accuracy in measuring. Further, the nature of the method stops it from being useful for measuring pairs dimmer than the 7th magnitude, because the aperture of the object-glass is cut down very considerably when the grating is much inclined and the light is distributed over several images. The simplicity of the method has, however, much to recommend itself to many, more especially to those who possess large apertures, and can therefore afford to spare a little light.

D.

FLORA OF ZERAFSHAN.

IN a communication to the St. Petersburg Society of Naturalist (*Proceedings*, 1895, i.), M. Komaroff thus sketches the flora of the Zerafshan region of Russian Turkestan. The Aral-Caspian flora covers the lowlands up to the 1000 to 1500 feet level. Next comes the prairie, or Steppe, zone, which spreads up to about 3500 feet of altitude. In its upper parts it is characterised by Steppe-bushes, of which the almond-tree (*Amygdalus spinosissimus*, Bunge) is the most characteristic representative. Higher up, from 3500 to 6000, or 6200 feet, comes the zone of deciduous trees, which may be subdivided into a lower sub-zone of Mediterranean trees (*Pistacia vera*, *Celtis australis*, *Amygdalus communis*, *Acer monspessulanum*, &c.), with a prevalence of fragrant Labiatæ, which attains approximately the 4500 feet level; and an upper sub-zone characterised by maple-trees (*Acer lactum*). The zone between 6000 feet and nearly 8500 feet is taken by the Juniperus-trees which correspond in Zerafshan to the coniferous trees of other regions. It is covered at its upper limits with rampant bushes of *Juniferus nana* and *pseudosabina*, *Comarum*, *Cotoneaster*, *Lonicera*, *Astragalus*, and so on. The Alpine zone attains the levels of 11,000 and 12,000 feet—the morainic plants, *Didymophysa fedtschenkoana*, *Corydalis fedtschenkoana*, *Cerastium lithospermifolium*, *Saxifraga axillaris* and *Allardia tomentosa* reaching the highest altitudes. On the Zerafshan glacier, at a spot where it was covered with some gravel, the author found specimens of *Saxifraga axillaris*, *Epilobium latifolium*, *Arabis tibetica*, *Poa karatavica*, and one *Carex*—a fact which shows how careful one must be in interpreting the real sense of plant-bearing strata imbedded amidst morainic deposits. It is also worthy of note, that the botanic zones of Zerafshan very much correspond to the zonal geological structure of the highlands. The Aral-Caspian flora covers the æolic deposits of the great desiccated inner sea of Central Asia; the Steppe flora covers the Loess girdle; the Mediterranean trees and shrubs occupy the limestones and the marls, while the Juniperus zone spreads over the crystalline slates and limestones, and the Alpine flora covers the higher granitic massives of the highlands. Man evidently alters to a great extent the character of the vegetation—pistachio-tree groves and the *Juniperus excelsa* trees being rapidly destroyed; while the hundreds of thousands of sheep which are brought every year to the Zerafshan mountains from the lowlands, entirely destroy the Alpine prairies—thickets of *Artemisia dracunculus* taking the place of the grasses.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—One of the arguments which are brought forward for granting the degree of B.A. to students from Newnham and Girton Colleges is that, when they apply for educational positions, they are at a disadvantage as compared with students from other universities which do grant the degree of B.A. Dr. W. H. Besant points out in a circular, which he had addressed to the members of the Senate, that this difficulty would be entirely removed if a charter were granted to Newnham and Girton Colleges, creating a Women's University, which should have the power of granting degrees. This need not interfere with the present arrangements for the teaching and for the examination of the students in the various subjects, the study of which they now undertake. Mr. J. L. Strachan-Davidson has suggested that Oxford, Cambridge, and Dublin—the three universities which have not as yet conferred degrees on women—should join in a petition to the Crown to grant a charter for a university whose sole function it shall be to give degrees to women. A scheme similar to that supported by Dr. Besant has been practically adopted by the University of Harvard.

THE members of the Skinners' Company visited Tonbridge on Saturday last, for the purpose of opening a new second-grade school which they have just built at a cost of upwards of £10,000