OUR ASTRONOMICAL COLUMN

THE ELLIPTICITY OF URANUS.—It may be remembered that Sir William Herschel, who was at first under the impression that the disk of Uranus presented a perfectly circular outline, was afterwards convinced that there was an appreciable elongation in the direction of the major-axis of the orbits of the satellites, though he has not recorded any measures to test this conclusion. On October 13, 1782, about eighteen months after the discovery of the planet, he writes: "I perceived no flattening of the polar regions." On March 5, 1792, he used "a newly polished mirror of an excellent figure: it showed the planet very well defined and without any suspicion of a ring." With powers 240–2400, all which his speculum bore with great distinctness, he formed a different opinion, and remarked, "I am pretty well convinced that the disk is flattened." On February 26, 1794, he has an observation thus recorded, "20-feet reflector, power 480. The planet seems to be a little lengthened out in the direction of the longer axis of the satellites' orbits." Further, in a paper communicated to the Royal Society in December, 1797, wherein he announces his supposed discovery of four additional satellites of Uranus, he says: "The flattening of the poles of the planet seems to be sufficiently ascertained by many observations. The 7-foot, 10-foot, and the 20-foot instruments equally confirm it, and the direction pointed out February 26, 1794, seems to be conformable to the analogies that may be drawn from the situation of the equator of Saturn and of Jupiter." This ellipticity being admitted, he inferred that Uranus had a rapid axial rotation.

In September, 1842, Mädler, remarking that notwithstanding the statement made by Sir W. Herschel no measures of the planet existed which would confirm it or otherwise, instituted a series with the filar-micrometer of the Dorpat refractor. The measures were made on five nights, and the diameter of the planet was determined at every 15° of the circumference, the mean of each set being made to fall nearly at the time of meridian passage. The nights (September 16, 17, 19, 20, and 21) were of exceptional clearness, and permitted of a power of 1000 being used. Mädler found the greater diameter of Uranus 4″·249 at the planet's mean distance, and the compression $\frac{1}{10{\cdot}85}$; the angle of the greater axis was 160° 40′ counted from north towards east. At this time Uranus was less than 11° from the descending node of the orbits of the satellites, as determined by Prof. Newcomb.

Between August 24 and October 20, 1843, Mädler repeated his measures on seven nights: his results from this year's series were—

Greater axis of projected ellipse ...	4″·3274
Lesser axis ,, ,, ...	3·8910
Compression	$\frac{1}{9{\cdot}92}$
Angle of greater axis with declination circle	15° 26′·1

This ellipse is for September 28, 1843, when the distance of Uranus was 19·079. The greater axis for the mean distance of Uranus would be 4″·304.

An ellipticity comparable with that of the planet Saturn might have been expected to strike the generality of observers provided with the large instruments which have been available since the epoch of Mädler's measures; yet neither with the Pulkowa refractor, with the late Mr. Lassell's 4-foot reflector, employed by him and Mr. Marth in measures of Uranus at Malta in 1864–5, nor with the Washington 26-inch refractor, or many other instruments of adequate power, do we find that there has been any confirmation of the great inequality of diameters found by Mädler, up to 1877.

It now appears from a communication made by Prof. Safarik of Prague to the *Astronomische Nachrichten* in April last, that on March 12, 1877, he found Uranus "certainly elliptical, the greater axis in the parallel," and this impression he received on various occasions up to the date of his letter. On April 2 in the present year he records of the appearance of the planet: "Stets stark länglich; in den besten Momenten schätze ich die Elliptität stärker als jene Saturns"; the greater axis was at 190°. The instruments used were of very moderate capacity, being an achromatic of 11 cm. and a silver-on-glass speculum of 16 cm.

In consequence of a representation from Prof. Safarik, who laid stress upon the actual proximity of the planet to the ascending node of the orbits of the satellites, Prof. Schiaparelli has made, this year, an extensive series of measures of the diameter of Uranus, the results of which have appeared in No. 2526 of the above-named periodical. The measures are discussed on two methods giving for the ellipticity of the planet in the one case $\frac{1}{10{\cdot}98 \pm 0{\cdot}93}$, and in the other (perhaps the more preferable value), $\frac{1}{10{\cdot}94 \pm 0{\cdot}67}$. In addition to actual measures, Prof. Schiaparelli drew the outline of the planet, as it appeared to the eye, on thirteen nights, the drawings giving by measurement an ellipticity of $\frac{1}{11{\cdot}07}$. An assistant in the same way found $\frac{1}{10{\cdot}9}$. The Milan measures with the filar-micrometer were made between April 12 and June 7. For the equatorial diameter at the mean distance Prof. Schiaparelli found 3″·911.

PHYSICAL NOTES

IN the current number of *Wiedemann's Annalen*, Prof. C. Christiansen of Copenhagen resumes his researches on the indices of refraction of coloured liquids. The methods adopted consisted in the examination of the liquid in hollow prisms of very small refracting angle; a few drops of the liquid being placed between two small pieces of glass touching each other at one side, but separated about half a degree. Another method consisted in inclosing the liquid between a piece of very thin glass and a biprism made of a glass the index of refraction of which was known, the index of the liquid being calculated by taking the refraction as the difference of the two separate refractions of the glass and the liquid. Prof. Christiansen gives tables of results for water, alcohol, turpentine, and nitrobenzol, and also for solutions of permanganate of potash of various degrees of concentration. For the latter substance the results agree with the determinations of Kundt, but are probably more exact.

PROF. G. M. MINCHIN has greatly improved the form of the absolute sine electrometer invented by him some months ago. The first of the new instruments constructed by Mr. Groves of Bolsover Street is now complete, and is to be sent out to Prof. Anthony of the enterprising and wealthy Cornell University. We hope shortly to illustrate and describe this beautiful instrument.

PROF. EWING of Tokio prints in the *Proceedings of the Seismological Society of Japan* three valuable seismological notes. The first of these describes a duplex pendulum seismometer the principle of which is the following:—A common pendulum having its centre of gravity below the centre of suspension is stable; an inverted pendulum with pivoted supporting rod is unstable. By placing an inverted pendulum below a common one, and connecting the bobs so that any horizontal displacement must be common to both, the equilibrium of the jointed system may be made neutral or as nearly stable as is desired. A very sensitive seismograph is thus obtained. The instrument has not yet been put to the test of an actual earthquake.

PROF. QUINCKE has contributed to the *Proceedings of the Royal Prussian Academy of Sciences* an important memoir on the changes produced by hydrostatic pressure in the volume and refractive index of transparent liquids. The ratio of these changes exhibits, it appears, a definite relation. The compressibility in volume was measured by subjecting the liquids to pressure in glass vessels furnished with capillary tubes. The indices of refraction were measured by observing the number of interference bands in homogeneous light in an interferential refractometer. One of the most important results of this research is the light it throws on the disputed formula called the *constant of refraction*. According to Dale and Gladstone the name of *constant of refraction*, or *specific refractive power*, should be assigned to the quantity $\frac{\mu - 1}{s}$, where μ is the index of refraction and s the specific gravity of the substance. According, however, to Laplace the quantity $\frac{\mu^2 - 1}{s}$ is the true constant of refraction; whilst, according to Professors H. A. and L. Lorenz, that name should be given to the more complicated function $\frac{\mu^2 - 1}{(\mu^2 + 2)s}$. Now since with liquids that are subjected to pres-