

That these paraffins have really the constitution which I have ascribed to them follows partly from their mode of formation; thus dipropyl was obtained from the normal propyl iodide, and dibutyl from normal butyl iodide. The constitution of the others was determined by converting them into alcohols and studying the oxidation products of the latter; thus the hexyl hydride from petroleum, as well as that obtained from mannite, was transformed into secondary hexyl alcohol, which on oxidation yielded acetic acid and *normal* butyric acid.

In the communication above referred to, I placed the hydrocarbon  $C_8H_{18}$  from methyl-hexyl carbinol amongst another group; but I have found now that this body is identical with dibutyl and also with the hydrocarbon which Zinke obtained from primary octyl alcohol. This chemist prepared also dioctyl,  $C_{10}H_{22}$ , which consequently is a normal paraffin; and it appears probable that dihexyl, which Brazier and Gossleth obtained by the electrolysis of œnanthyllic acid, belongs to this group too.

We are now acquainted with the following normal paraffins:—

		Boiling-points.		Difference.
		Found (mean).	Calculated.	
C	H <sub>4</sub>	—	—	
C <sub>2</sub>	H <sub>6</sub>	—	—	
C <sub>3</sub>	H <sub>8</sub>	—	—	
C <sub>4</sub>	H <sub>10</sub>	1°	1°	
C <sub>5</sub>	H <sub>12</sub>	38°	38°	37°
C <sub>6</sub>	H <sub>14</sub>	76°	71°	33°
C <sub>7</sub>	H <sub>16</sub>	99°	100°	29°
C <sub>8</sub>	H <sub>18</sub>	124°	125°	25°
C <sub>12</sub>	H <sub>26</sub>	202°	201°	4 × 19°
C <sub>16</sub>	H <sub>34</sub>	278°	278°	4 × 19°

From this it appears that the boiling-point is not raised 31° for each addition of  $CH_2$ , as I formerly assumed, but that, as the calculated numbers show, the difference between the boiling-points of the lower members decreases regularly by 4° until it becomes the well-known difference of 19°.

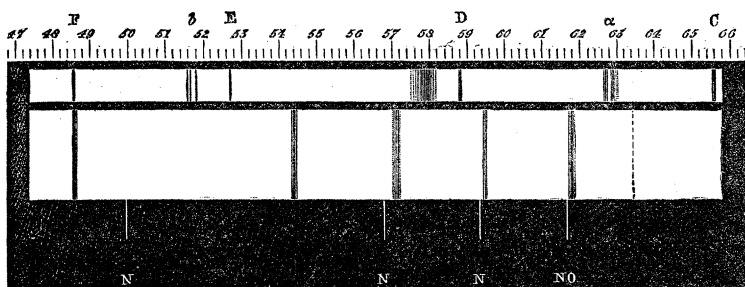
IV. "Note on the Spectrum of Uranus and the Spectrum of Comet I., 1871." By WILLIAM HUGGINS, LL.D., D.C.L., V.P.R.S.  
Received May 10, 1871.

In the paper "On the Spectra of some of the Fixed Stars"\*, presented conjointly by Dr. Miller and myself to the Royal Society in 1864, we gave the results of our observations of the spectra of the planets Venus, Mars, Jupiter, and Saturn; but we found the light from Uranus and Neptune too faint to be satisfactorily examined with the spectroscop.

\* Phil. Trans. 1864, p. 413; and for Mars, Monthly Notices R. Astr. Soc. vol. xxvii. p. 178.

By means of the equatorial refractor of 15 inches aperture, by Messrs. Grubb and Son, recently placed in my hands by the Royal Society, I have succeeded in making the observations described in this paper of the remarkable spectrum which is afforded by the light of the planet Uranus.

It should be stated that the spectrum of Uranus was observed by Father Secchi in 1869\*. He says: "le jaune y fait complètement défaut. Dans le vert et dans le bleu il y a deux raies très-larges et très-noires." He represents the band in the blue as more refrangible than F, and the one in the green as near E.



The spectrum of Uranus, as it appears in my instrument, is represented in the accompanying diagram. The narrow spectrum placed above that of Uranus gives the relative positions of the principal solar lines and of the two strongest absorption-bands produced by our atmosphere, namely, the group of lines a little more refrangible than D, and the group which occurs about midway from C to D. The scale placed above gives wave-lengths in millionths of a millimetre.

The spectrum of Uranus is continuous, without any part being wanting, as far as the feebleness of its light permits it to be traced, which is from about C to about G.

On account of the small amount of light received from this planet, I was not able to use a slit sufficiently narrow to bring out the Fraunhofer lines. The positions of the bands produced by planetary absorption, which are broad and strong in comparison with the solar lines, were determined by the micrometer and by direct comparison with the spectra of terrestrial substances.

The spectroscope was furnished with one prism of dense flint-glass, having a refracting-angle of  $60^\circ$ , an observing telescope magnifying  $5\frac{1}{2}$  diameters, and a collimator of 5 inches focal length. A cylindrical lens was used to increase the breadth of the spectrum.

The remarkable absorption taking place at Uranus shows itself in six strong lines, which are drawn in the diagram. The least refrangible of these lines occurs in a faint part of the spectrum, and could not be mea-

\* *Comptes Rendus*, vol. lxxviii. p. 761, and '*Le Soleil*,' Paris, 1870, p. 354.

sured. Its position was estimated only, and on this account it is represented in the diagram by a dotted line. The positions of the other lines were obtained by micrometrical measures on different nights. The strongest of the lines is that which has a wave-length of about 544 millionths of a millimetre. The band at 572 of the scale is nearly as broad but not so dark; the one a little less refrangible than D is narrower than the others.

The measures taken of the most refrangible band showed that it was at or very near the position of F in the solar spectrum. The light from a tube containing rarefied hydrogen, rendered luminous by the induction-spark, was then compared directly with that of Uranus. The band in the planet's spectrum appeared to be coincident with the bright line of hydrogen.

Three of the bands were shown by the micrometer not to differ greatly in position from some of the bright lines of the spectrum of air. A direct comparison was made, when the principal bright lines were found to have the positions, relatively to the lines of planetary absorption, which are shown in the diagram. The band which has a wave-length of about 572 millionths of a millimetre is less refrangible than the double line of nitrogen which occurs near it. The two planetary bands at 595 and 618 of the scale appeared very nearly coincident with bright lines of air. The faintness of the planet's spectrum did not admit of certainty on this point; I suspected that the planetary lines are in a small degree less refrangible. There is no strong line in the spectrum of Uranus in the position of the strongest of the lines of air, namely, the double line of nitrogen.

As carbonic-acid gas might be considered, without much improbability, to be a constituent of the atmosphere of Uranus, I took measures with the same spectroscope of the principal groups of bright lines which present themselves when the induction-spark is passed through this gas. The result was to show that the bands of Uranus cannot be ascribed to the absorption of this gas.

There is no absorption-band at the position of the line of sodium. It will be seen by a reference to the diagram that there are no lines in the spectrum of Uranus at the positions of the principal groups produced by the absorption of the earth's atmosphere.

#### *Spectrum of Comet I., 1871.*

On April 7 a faint comet was discovered by Dr. Winnecke. I observed the comet on April 13 and May 2. On both days the comet was exceedingly faint, and on May 2 it was rendered more difficult to observe by the light of the moon and a faint haze in the atmosphere. It presented the appearance of a small faint coma, with an extension in the direction from the sun.

When observed in the spectroscope, I could detect the light of the coma to consist almost entirely of three bright bands.

A fair measure was obtained of the centre of the middle band, which was the brightest; it gives for this band a wave-length of about 510 millionths of a millimetre. I was not able to do more than estimate roughly the position of the less refrangible band. The result gives 545 millionths. The third band was situated at about the same distance from the middle band on the more refrangible side.

It would appear that this comet is similar in constitution to the comets which I examined in 1868\*.

V. "On a New Instrument for recording Minute Variations of Atmospheric Pressure." By WILDMAN WHITEHOUSE, F.M.S. &c. &c. Communicated by R. H. SCOTT, F.R.S., Director of the Meteorological Office. Received May 8, 1871.

(Abstract.)

The occurrence of a heavy "ground-swell" on the sea-coast in perfectly calm weather suggested to the writer some years ago the possibility of atmospheric waves or pulsations accompanying a gale being propagated to a considerable distance (irrespective of any horizontal movement of air), and giving evidence of the disturbance existing elsewhere.

It was seen that, even if such were the case, it would be difficult to obtain proof of it, as any ordinary observations would fail to detect it, and that it could only be attained by the adoption of a system of continuous record specially adapted to the purpose. The writer therefore determined to design and construct an instrument with this object; and after many trials with varied apparatus, it was decided to adopt the hydraulic principle, as affording at once the means of accumulating force sufficient to actuate the instrument, and of measuring the force itself by the alteration produced in the height of the column of water.

The use of an air-chamber was suggested by the sympiesometer; it has, however, been enlarged to meet the altered conditions of this instrument, and is buried underground to secure freedom from all diurnal changes of temperature.

The action of the instrument essentially depends upon the flow and reflow of water between two hydraulic chambers (connected by a tube or siphon), one of which is open and exposed to atmospheric pressure, the other closed at top, and removed from such pressure, being in pneumatic connexion with the buried air-chamber.

Any difference in the levels of the water in these two chambers is a measure of the variation of pressure producing it, and the water in its flow is made to move the tracing-point or pen across the paper.

In order that the objects of the research should be attained, the action must be continuous, unfailling, of great delicacy—able to show changes of

\* Phil. Trans. 1868, p. 555; and Proc. Roy. Soc. vol. xvi. p. 386.

