Physics. — *Third preliminary note on some experiments concerning the isotope of hydrogen.* By P. Zeeman and J. de Gier.

(Communicated at the meeting of December 16, 1933.)

Exhibition of the mass defect.

We shall now proceed to show how the method of J. J. Thomson's parabolas gives valuable results with a mixture of He and hydrogen, containing 10 % of the heavy isotope. We have already announced [1]) that it was possible to exhibit the mass differences between He and $H_2^1 H^2$, $He\, H^1$ and $H^1 H_2^2$, $He\, H^{2+}$ and H_3^{2+}. The mass defects are most beautifully exhibited in some photographs, annexed to the present communication. The amount of the defect can be measured with some accuracy [2]).

The parabolas to be compared must not differ too much in intensity and at the same time they should be as narrow as possible. These conditions cannot be fulfilled at the same time for the three doublets mentioned.

When the doublet 5 appears well defined the doublet 4 is strongly superposed and not resolved.

Fig. 1a of the plate gives the original photograph in twofold magnification with the doublet 4, and Fig. 1b part of the photograph in eightfold enlargement.

Fig. 2a and Fig. 2b give corresponding photographs for doublet 5.

The photographs were measured by a comparator and the mass difference calculated by means of Thomson's interpolation formula

$$\frac{1}{\sqrt{m_3}} = \frac{y_3 - y_1}{y_2 - y_1}\left(\frac{1}{\sqrt{m_2}} - \frac{1}{\sqrt{m_1}}\right) + \frac{1}{\sqrt{m_1}}.$$

The results differ only by 1 or 1.5 % from the difference we deduce from Bainbridge's data [3]).

In order to obtain the best results from the photographs it will be necessary to use a calibration curve as first indicated by Aston. It appears however that the theoretical formula gives rather accurate results.

For the study of the mass defects of the heavier ions the parabolas are to be refined still further. On some of our photographs we obtained a nearly complete record of $O H$ combinations including $O H^1 H_2^2 = 21$.

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[1]) Zeeman and de Gier. Proceedings Amsterdam. Vol. 36. N⁰. 7, p. 717. 1933 being the continuation of a paper in the same Proceedings p. 609, communicated June 24. 1933.

[2]) A doublet for H_2^{1+} and He^{++} is already given by Lukanow and Schütte. Zs. f. Physik 82, 600. 1933.
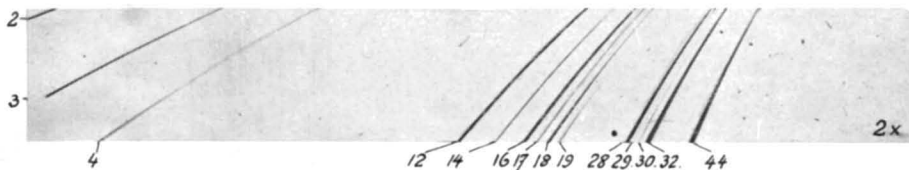
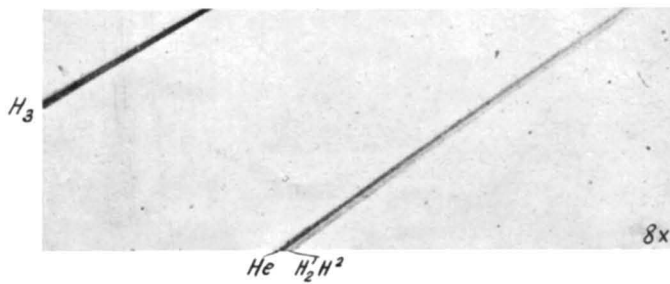[3]) K. T. Bainbridge. Phys. Rev. July 1933. 56, 57.
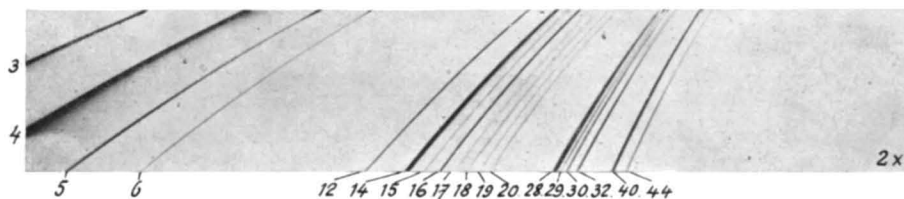
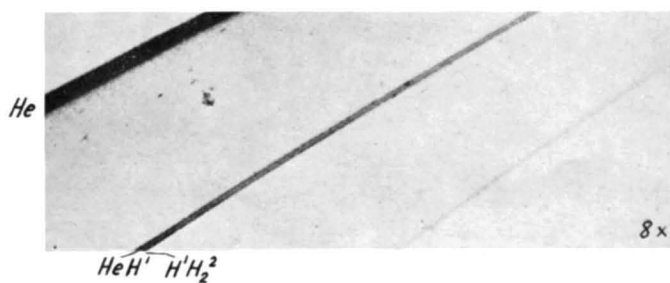Fig. 1a

Fig. 1b

Fig. 2a

Fig. 2b

It is to be regretted that the hydrogen used contained some traces of Ar so that $O H_2^1 H^2$ coincides with Ar^{++}.

On the other hand the contamination with argon gives a parabola $\frac{m}{e} = 42 \ ArH^2$ as is to be expected from the explanation that $\frac{m}{e} = 41$ corresponds to ArH^1 and not to an isotope of Ar[1]).

We are now experimenting with concentrated Ne in order to solve the problem hydride-isotope for the line corresponding to an element with an atomic weight 23.

The heavy isotope of hydrogen obtained directly from water vapour.

Finally we have to record an experiment made with hydrogen obtained by conducting a stream of the vapour of distilled water over sodium. The photograph showed a faint parabola with $\frac{m}{e} = 4$, the time of exposition being half an hour. With a very small addition of helium it became possible to determine an accurate value of the H isotope, without any previous concentration of the isotope.

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[1]) P. ZEEMAN and J. DE GIER. Amsterdam. Proceedings **36**. 609. note **4a**.

Astronomy. — *Mittlere Lichtkurven von langperiodischen Veränderlichen. XVII. S Coronae borealis. Von A. A. NIJLAND.*

(Communicated at the meeting of December 16, 1933.)

Instrumente S und R. Die Beobachtungen wurden alle auf R reduziert; die Reduktion R—S beträgt —0^m.19. Spektrum M6—8e (HA **79**, 174). Gesamtzahl der Beobachtungen 742 (von 2417317 bis 2427410). Es wurden wieder, wie in allen früheren Mitteilungen, die in zwei Instrumenten angestellten Schätzungen nur einmal gezählt.

Es wurden zwei stark abweichende Schätzungen (2421793 und 6449) verworfen. Einschliesslich der Beobachtung 9695 (S unsichtbar) zählten also drei Beobachtungen nicht mit, und es bleiben 739 Schätzungen für die Diskussion übrig.

Karte: HAGEN, *Atlas Stell. var. Series III.*

Die Tabelle I giebt eine Übersicht der benutzten Vergleichsterne. Das Spektrum der neunten Spalte wurde den HA **96** entnommen; die hier für die Sterne C, B, A, b und c gegebenen Helligkeiten sind mit denjenigen aus HA **37** identisch. Wiederholt wurde auch der Veränderliche U Cor. bor. im vollen Lichte als Vergleichstern herangezogen. Aber auch Schätzungen wie $A 7 S 5 U 2 b$ (9133.571, U in Zunahme begriffen) fanden in