Physics. — *Magnetic resolution of spectrum lines and temperature.* By H. R. WOLTJER and Prof. P. ZEEMAN.

An influence of the temperature of the source of light on the magnitude of magnetic separation till now has been vainly sought. There seems to be a possibility for such an influence, due to the free electrons in the source of light, if we accept RITZ's theory of magnetic resolution, at least in its original form. We thought it of interest to inquire for such an action, now that we are able to produce narrow spectrum lines of low temperature by means of the small tubes of WOOD and ZEEMAN [1]). On the other hand we possess sources of light of very high temperature, viz. the oxygen-acetylene flame and the electric spark.

With these means for the magnetised source of light, Mr. H. R. WOLTJER has made an investigation concerning magnetic resolution at different temperatures. An exhaustive discussion only of the results of the measurements, which shall be published in H. R. WOLTJER's thesis for the doctorate, can fix the maximum change of the magnetic resolution. Besides, the magnitude of the resolution the *ratio* of the intensities of the divided components is of importance to theory. We have begun a separate investigation concerning this subject. In the first place the behaviour of the line D_2 was investigated. Under the influence of the magnetic field it is resolved into six components, of which four vibrate at right angles to the field and therefore under the same circumstances as to polarisation. The polarising action of the grating [2]) and of the glass sodium tube cannot change therefore the *ratio* of the intensities of these four components. The reproduction in fig. 2 shows the outer components of the magnetised absorption sodium-lines using one of the above mentioned tubes (temperature 350° C.). The narrowness of the lines is well exhibited in the reproduction. The Figures 3 and 4 refer to experiments with a calc-spar rhomb placed before the slit of the spectroscope, and a horizontal slit near the source of light. The field of view is divided into three parts: one with the horizontal, one with the vertical vibrations and the third due to natural light [3]).

The photograph reproduced in Fig. 3 was made with a gas-oxygen flame, which in later experiments (with similar results) was

[1]) R. W. WOOD and P. ZEEMAN, These Proceedings. Febr. 1913.

[2]) P. ZEEMAN, These Proceedings, October 1907.

[3]) Cf P. ZEEMAN and B. WINAWER, These Proceedings. January 1910.

P. ZEEMAN. The red lithium line and the determination of atomic weights.
H. R. WOLTJER and P. ZEEMAN. Magnetic resolution and temperature.

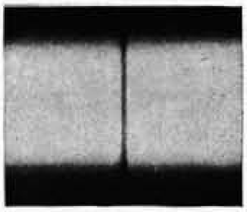

Fig. 1. Lithium doublet (6708).

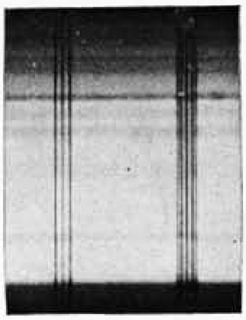

Fig. 2. Outer components of sodium lines of low temperature in magnetic field.

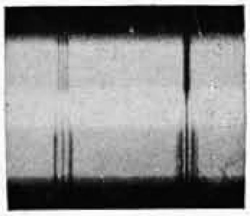

Fig. 3. Magnetised sodium lines in gas-oxygenflame.

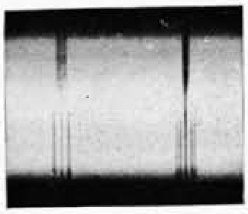

Fig. 4. Magnetised sodium lines of 300° C.

replaced by an acetylene-oxygen flame. The temperature of the gas-oxygen flame is estimated at 2000° C, that of the acetylene-oxygen flame at 2400° C.

The temperature of the sodium tube, used for the experiment to which Fig. 4 relates, was determined at about 300° C. by means of a thermo-couple.

A comparison of the photographs 3 and 4 clearly exhibits a difference of the ratio of the intensities of the outer components At the higher temperature the outer components appear much fainter in relation to the inner ones than at the temperature of 300° C. A closer inspection shows that in the latter case also, the inner components surpass the outer ones in intensity, but the difference is less. If the density of the sodium vapour is increased, there is a greater difference in the behaviour of inner and outer components at the higher than at the lower temperature. We have the intention to return to this point on a further occasion. It would appear that we are able by merely changing the temperature to influence the separate magnetic components and to change within certain limits their intensities.

With the electric spark the outer components are relatively feeble just as with the oxygen-acetylene flame.

It should be noticed that in the experiment to which Figures 3 and 4 relate, the temperature has been changed, but the pressure as well.

In the glass tube the pressure is of the order of some millimetres, whereas the total pressure — which according to HUMPHREYS is decisive in the phenomena of pressure-shift of spectrum lines, — in the experiment with the gas-oxygen flame is equal to one atmosphere. In a few cases HUMPHREYS observed also a change in the relative intensities of spectrum lines. Hence there would be a possibility that the difference between figures 3 and 4 is partially due to a change of the total pressure.

The effect now under review is of a rather complicate character. Besides the DOPPLER-effect, also the density of the vapour, the change of pressure and the length of the path of the light rays must play a part. Though apparently there exists an influence of temperature on the aspect of the resolved lines under the circumstances of our experiments, it cannot be denied that the interpretation of observations concerning the amount of the separation is more easy. The complications mentioned are then eliminated.