in the minimum quantity of water, acidulated with sulphuric acid.
· This acid alkaloidal solution was washed repeatedly with ether
until the latter removed no more colouring matter. The solution
was then rendered alkaline and again shaken with ether; the
ethereal solution was separated and evaporated to dryness and the
residue was again treated in the way described above, in order to
obtain the alkaloid finally in as pure a condition as possible.

This dry alkaloid, which had been purified several times, was
now dissolved in water containing a trace of hydrochloric acid, and
the faintly acid solution was evaporated to dryness in a dessiccator;
the residue was dissolved in a few drops of water, and after
filtration the solution was placed on a microscope slide.

A platinum wire which had been moistened with a solution of
sodium tartrate, was placed in the previously warmed solution and
the latter was allowed to cool slowly under a double watchglass.

After some time needles separated (fig. 1).

These needles could be: quinine tartrate, cinchonidine tartrate or
a mixture of the two.

In order to determine whether we were indeed concerned with
quinine, the needles were washed a few times very carefully with
a little water, so that they remained on the slide.

Then a trace of dilute sulphuric acid was added and a little of
a mixture of equal parts of alcohol, of water, and of acetic acid
coloured pale yellow ·by means of ·a potassium triiodide solution.
After a short time there appeared at the edges of the preparation
the very fine dichroïtic leaflets of HI iodine-quinine sulphate (fig. 2),
a reaction which is so characteristic of quinine, that the presence
of this alkaloid in the seed of *C. ledyeriana* can no longer be
doubted.

·Finally I may add that the seed investigated contained 18.6 °/₀ of
a pale greenish yellow oil, having a specific gravity of 0.930 at
18° and a rotation of —26° at 20° C. in a tube of 20 c.m.


**Physics.** — *"The red lithium line and the spectroscopic determina-
tion of atomic weights."* By Prof. P. ZEEMAN.

In a former communication I showed that the red lithium line
6708 is a close doublet. The distance between the components was
found by a rough measurement to be of the order of a quarter
Ångström. I now have been able to photograph the mentioned line
in the second order spectrum of a large ROWLAND grating. Using an
iron-arc spectrum in the third order violet, coinciding with the

domain of the red lithium line in the second order, the distance or the components of the natural lithium doublet (6708) was now measured and found to be 0,144 Ångströms. We can be sure only of the second figure.

A reproduction of the lithium doublet is given in Fig. 1. of the Plate. Fig. 2 is considered in the communication, immediately following. It exhibits the outer components of the magnetically divided $D$-lines in the inverse effect, but it may be used now to give an idea of the closeness of the lithium doublet, the two narrow sodium lines due to the arc-light being also present. As the sodium- as well as the lithium-doublet has been photographed in the second order, the scale value can be derived from the first mentioned pair.

RYDBERG, KAYSER and RUNGE in their researches on spectrum series have emphasised that the distances between the components of pair lines in a group of chemically related elements increase with the atomic weights. With sodium, potassium, rubidium and cesium, the atomic weight is approximately proportional to the square root of the distances between the pair lines.

The ratio of the difference $v_1$ between, the frequencies of the components of the pair lines and the square of the atomic weight $\mu$ should therefore be a constant. According to our observation the difference of the frequencies for the lithium doublet is 0.32.

RITZ [1]) came to the conclusion, a result to which my attention has been kindly drawn by Dr. LADENBURG, that for related elements the difference of the constants $p_1$ and $p_2$ of RITZ's spectrum formula divided by the square of the atomic weight is even more nearly constant than the ratio $\dfrac{v_1}{\mu^2}$.

Taking for $Li$ [2]) $p = -0.047510 = p_2$, I calculate $p_1 = -0.047521$. We thus find for the alkalis:

|  | Li | Na | K | Rb | CS |
|---|---|---|---|---|---|
| $\dfrac{v_1 \cdot 10^3}{\mu^2}$ [3]) | 6.53 | 32.3 | 37.8 | 32.3 | 31.6 |
| $\dfrac{(p_2 - p_1) \cdot 10^5}{\mu^2}$ | 0.022 | 0.142 | 0.189 | 0.180 | 0.186 |

It appears that, if the data for lithium be included, there is no question about a constancy of the proposed ratios in the group of the alkalis.

---

[1]) RITZ. Oeuvres. p. 145.

[2]) RITZ. l. c. p. 57.

[3]) The last four numbers according to RYDBERG. Rapports, etc. T. II. p. 219. Paris. 1900.

A more general form of the rule, first tested, has been proposed by RUNGE[1]: in every group of chemically related elements the atomic weight is proportional to a power of the distance of the lines of the doublet. Or expressed differently, when taking the logarithms of atomic weight and of distance as coordinates, the corresponding points in a group of chemically related elements are in a straight line.

Our graphical representation shows that for $Na$, $K$, $Rb$, $Cs$ the mentioned rule is beautifully fulfilled, but that lithium forms an exception.

log. atomic weight.



log. line distance
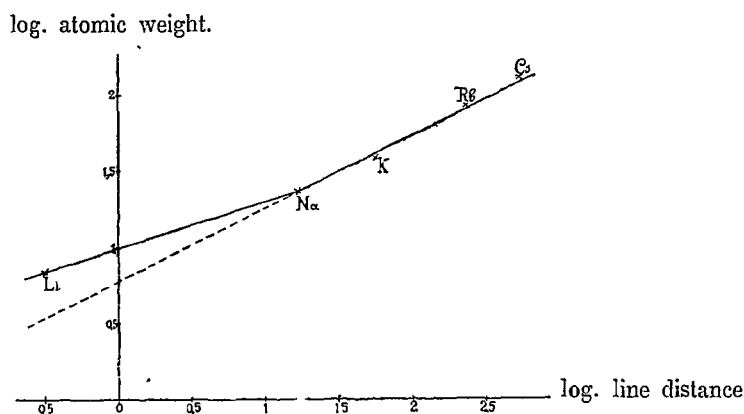
Hence we must conclude that the law connecting the frequency difference of the components of pair lines and the atomic weight is yet unknown to us.

One observation concerning the intensities of the lithium pair 6708 seems worthy of record. With very small vapour density the violet component is the most intense. With increased vapour density, a case to which Fig. 1 of the Plate relates, the ratio of the intensities is reversed and no more corresponds to that of the sodium lines. With still greater density new absorption lines appear in the vicinity of the lithium pair. They merit a separate investigation, but they arc probably of the same nature as the line groups observed by WOOD[2] in the neighbourhood of several lines of the principal series of sodium.

---

[1] RUNGE and PRECHT. Physik. Zeitschr. 4. 285, 1903.
[2] WOOD. Phil. Mag. 18, 530, 1900.