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H_0 as well as on H_1. Now it is true that we have also considered a somewhat "idealised" state, where no mutual action between the elementary crystals would exist and where all the "tipped over" magnetic moments would keep their direction, as long as the external field did not place them in the opposite direction, and which therefore might be called a state of "perfect" hysteresis; this does not change however that also at "imperfect" hysteresis the final state will depend on H_1 and not only on H_0. This would only be the case, when there was no hysteresis at all, but then every magnetization-curve would be free from hysteresis, also that for a continuous current alone, without use being made of an alternating current. Moreover I have convinced myself by some experiments that really the final state depends on the original intensity of the alternating current. The greater this is for a constant field H_0, the stronger is the magnetization. If an alternating current is used we may therefore not say that the magnetization corresponds to the field H_0 independently of the alternating current.

January 1916. *Physical Laboratory of* TEYLERS *Institute.*

Physics. — *"On the ratio between the* ZEEMAN*-effect and the pressure-effect in the spectrum of nickel."* By Dr. T. VAN LOHUIZEN. (Communicated by Prof. P. ZEEMAN.)

(Communicated in the meeting of January 29, 1916).

It will be known, that generally a connection is supposed to exist between the changes which spectrum lines undergo in a magnetic field and by an increase of pressure. In different spectra that are rich in lines the comparison between the magnitude of these two effects has been investigated among others by KING[1]) for the spectra of Fe, Cr and Ti.

As far as I know such an investigation has never yet been made for the spectrum of nickel. Therefore it seemed to me of some interest to determine also for this spectrum, which is so rich in lines, the ratio between the two effects. In order to use observations as equivalent as possible I took for the magnetic decompositions exclusively the observations of MISS GRAFTDIJK[2]), for the pressure

[1]) A. S. KING The correspondence between ZEEMAN-Effect and Pressure-Displacement for the Spectra of Iron, Chromium and Titanium. Astroph. J. 31. p. 433. 1910.

[2]) I. M. GRAFTDIJK. Magnetische splitsing van het Nikkel- en Cobaltspectrum en van het IJzerspectrum. Diss. Amsterdam 1911 and Arch. Neerl. III A. Tome II. p. 192. 1912.

shifts, those of BILHAM[1]) as to the spark-spectrum and those of DUFFIELD[2]) as to the arc-spectrum.

In his above-mentioned paper the latter author has made a comparison between his observations and those of BILHAM and this suggested the question to me which of the series of observations would agree best with the observed ZEEMAN-effect and whether perhaps in this spectrum a closer connection might be found.

From the observation-material it is evident that there does not exist a simple proportionality between the two effects.

We may however take together large groups of lines and see, whether we can remark something about these groups. As most of the lines, which can be taken into consideration for the investigation give triplets in the magnetic field, while only a few quadruplets and sextuplets are among them, a division into groups according to the magnetic decomposition is not well possible.

The different behaviour of the lines at an increase of pressure however suggests a division into groups. Corresponding to GALE and ADAMS[3]) we shall distinguish:

Group I. Lines which are symmetrically reversed.

Group II. Lines which are asymmetrically reversed.

Group III. Lines which under pressure remain bright and narrow.

Group IV. Lines which under pressure remain bright and symmetrical, but which become wide and diffuse.

Group V. Lines which under pressure remain bright, but which are widened asymmetrically towards the red side of the spectrum.

In this division of groups all lines will be taken up of which BILHAM has determined the group to which they belong and the intensity (I) for the spark-spectrum; then also the difference in wavelength between the two magnetic components which vibrate perpendicularly to the lines of force, measured in 0,001 Å.U. (Z). The following 4 columns contain the difference in wavelength expressed in 0,001 Å.U. per atmosphere increase of pressure. The first two (B_1 and B_2) have been calculated from the observations of BILHAM for 5 resp. 10 atm. pressure-increase and the two next ones (D_1 and D_2) from those of DUFFIELD for an increase of 10 resp. 20 to 100 atm.

[1]) E. G. BILHAM. The Spark Spectra of Nickel under Moderate Pressures. Phil. Trans 214 A. p. 359. 1914.

[2]) W. G. DUFFIELD A Comparison of the Arc and Spark Spectra of Nickel Produced under Pressure. Phil. Mag (6) **30**. p. 385. 1915.

[3]) H. G. GALE and W. S. ADAMS. An Investigation of the Spectra of Iron and Titanium under Moderate Pressures. Astroph. J. **35** p. 10. 1912.

1311

Group I.

λ	I	Z	B_1	B_2	D_1	D_2	$\frac{Z}{B_1}$	$\frac{Z}{B_2}$	$\frac{Z}{D_1}$	$\frac{Z}{D_2}$	Mean $\frac{Z}{B \text{ or } D}$
3446.41	6	350		1.7				206			206
3453.06	4	391		1.3				301			301
3458.62	-10	300		1.8				167			167
3461.84	10	386		2.5				154			154
3489.13	10	362		1.5				241			241
3510.52	8	210	3.4	2.2		2.6	62	95		81	79
3515.21	10	346	2.8	2.7			124	128			126
3524.69	15	409	2.8	3.0			146	136			142
3561.92	2	390		1.1		0.7		355		557	456
3566.55	10	356	3.0	2.0		2.1	119	178		169	155
3609.49	2	369		1.6	2.9	1.0		231	127	369	242
3619.54	15	393	2.6	1.8	4.7	2.6	151	218	84	151	151
3624.69	2.(15)	455		0.7	3.4	0.8		650	134	569	451
3739.38	2	487		1.0		1.2		487	—	406	446
3783.67	5	523	2.4	1.6	1.3	1.3	218	328	402	402	450
3831.87	2	286		3.6	3.2	1.8		80	89	159	109
3858.50	8	441	2.4	2.1	3.9	2.1	184	210	113	210	179
Mean:		380	2.8	1.9	3.2	1.6	143	245	158	307	239

Group II.

λ	I	Z	B_1	B_2	D_1	D_2	$\frac{Z}{B_1}$	$\frac{Z}{B_2}$	$\frac{Z}{D_1}$	$\frac{Z}{D_2}$	Mean $\frac{Z}{B \text{ or } D}$
3467.63	2	374									
3469.61	2	501									
3472.71	6	447		1.4				319			319
3483.95	6	242		1.5				161			161
3501.01	3	358		1.5		1.5		239		239	239
3519.90	3	231	2.0	1.9		1.4	116	122		165	134
3528.10	3	370		1.8				206			206
3548.32	3	464	5.0	2.1		1.2	93	221		387	234
3572.06	6	358	2.4	1.8		1.9	149	199		188	179

Group II (continued).

λ	I	Z	B_1	B_2	D_1	D_2	$\frac{Z}{B_1}$	$\frac{Z}{B_2}$	$\frac{Z}{D_1}$	$\frac{Z}{D_2}$	Mean $\frac{Z}{B \text{ or } D}$
3588.07	2	278		1.4		1.1		199		253	226
3597.86	6	499		2.1	4.9	2.1		238	102	238	193
3602.44	2	559		1.6	3.1	1.8		349	180	311	280
3610.68	4	451	2.6	2.6	6 4	2.2	174	174	70	205	156
3612.91	3	317	2.8	1.6	4.4	1.4	113	198	72	226	152
3664.26	3		3 6	2.2	4 8	1 7					
3669 39	1	330		1.2	3.1	1.3		275	107	254	212
3670.59	2	0		2.5	3.9	2.1		0	0	0	0
3674.29	3	313	2.6	1.9	4.2	1.7	120	165	75	184	136
3688.57	2	580		2.0	3.7	1.8		290	157	322	256
3722.62	3	897		2.9		2.2		309		408	358
3736 96	3	355		1.0		1.6		355		222	289
3775.74	5	379	2.4	2.2	1.0	1.5	158	172	379	253	241
3807.29	7	611	1.8	1.8	3.0	1 5	339	339	204	407	322
Mean:		405	2.8	1 9	3.9	1.7	120	226.5	135	251	215

Group III.

λ	I	Z	B_1	B_2	D_1	D_2	$\frac{Z}{B_1}$	$\frac{Z}{B_2}$	$\frac{Z}{D_1}$	$\frac{Z}{D_2}$	Mean $\frac{Z}{B \text{ or } D}$
3635.07	1			5.1	4.7	1.5					
3662.11	1			3.5	3.7	1.1					
3694.07	2			2 5	2.6	1.0					
3972.32	2		5.6	2.8	1.2	0.8					
4142.47	1			3.2	10.5						
4331.83	4	456		4.4	6.3	3.0		104	73	152	110
4359 70	2	670		10.6	11.5	12 2		63	58	55	59
4520 16	2										
4686.41	4										
5137.23	4										
5424.85	4										
5436.10	2										

Group III (continued).

λ	I	Z	B_1	B_2	D_1	D_2	$\frac{Z}{B_1}$	$\frac{Z}{B_2}$	$\frac{Z}{D_1}$	$\frac{Z}{D_2}$	Mean $\frac{Z}{B \text{ or } D}$
5578.98	2										
5588.12	2										
5709.80	3										
5712.10	2										
5748.57	1										
5754.86	4	1350									
5893.13	3										
6116 34	4										
Mean:		825	5.6	4.6	5.8	3.3		84	66	104	85

Group IV.

λ	I	Z	B_1	B_2	D_1	D_2	$\frac{Z}{B_1}$	$\frac{Z}{B_2}$	$\frac{Z}{D_1}$	$\frac{Z}{D_2}$	Mean $\frac{Z}{B \text{ or } D}$
3454.29 E.	2	506		1.5				337			337
3471 50 E	2	600									
3576.91 E.	6	425	10.2	8.2			42	52			47
3769.62 E.	5	549	11.0	7.7	4.0	1.4	50	71	137	392	162
3849.70 E.	5	319		14.9				21			21
3889.80	3	450			5.9	2.5			76	180	128
4015.65	3	0	18.2				0	0			0
4067.20 E.	6	463									
4600 58	3										
4855.59	3	821									
4904.57	6	740									
4980.36	6	702									
4984.30	6	483									
5080.70	5										
5081.30	5										
5142.96	2										
5146.64	4	610									
5155.91	4	740									
5168.83	4										
5411.50	2										
5805.45	2										
5858.03	3										
Mean:		529	13.1	8.1	5.0	2.0	31	98	107	286	116

Group V.

λ	I	Z	B_1	B_2	D_1	D_2	$\frac{Z}{B_1}$	$\frac{Z}{B_2}$	$\frac{Z}{D_1}$	$\frac{Z}{D_2}$	Mean $\frac{Z}{B \text{ or } D}$
3973.75	3		16.4	5.8	4.4	1.9					
4288.20	5	516		12.1	16.2	10.9		43	32	47	41
4401.77	6	579		10.2	11.6	12.0		57	50	48	52
4459.25	6	517		9.3	10.2	10.9		56	51	47	51
4462.65	3	280		9.9	12.3	9.5		28	23	29	27
4470.70	6	469		8.9	12.4	11.0		53	38	43	45
4547.40	2	520									
4592.76	5	475		11.8	14.1	10.3		40	34	46	40
4605.20	6	581									
4648.89	8	590									
4667.98	6	605									
4714.59	10	666									
4732.66	3(13)	740									
4756.70	8	741									
4764.07	5	677									
4786.66	9	779									
4807.17	6	635									
4829.22	3	650									
4831.38	3	787									
4832.86	1										
4866.42	6	893									
4873.60	6	840									
4887.16	2										
4918.53	6	610									
4936.02	4	520									
4953.34	4										
5017.75	6	852									
5099.50	3	560									
5100.13	3										

Group V (continued).

λ	I	Z	B_1	B_2	D_1	D_2	$\frac{Z}{B_1}$	$\frac{Z}{B_2}$	$\frac{Z}{D_1}$	$\frac{Z}{D_2}$	Mean $\frac{Z}{B \text{ or } D}$
5115.55	6	680									
5265.89	1										
5268.59	2										
5371.64	4										
5592.44	4										
5615.00	3	1060									
5715.31	5	1160									
5761 10	3	990									
Mean:		678	16.4	9.7	11.6	9 5		46	38	43	43

The ratios given in the last column are sufficiently indicated by the symbols at the head.

From the observation-material given above it is evident that there are still many observations to be made before we shall be able to compare ZEEMAN-effect and pressure-effect for each given spectrum-line. Most observations have been made for the groups I and II. For group III fewer. It is remarkable that just in this group nearly all determinations of a magnetic resolution are missing. Though also in the following groups some investigations of this effect are missing, this lack is so conspicuous in the third group that the few measurements occurring in column Z more resemble exceptions. Already this phenomenon proves the suitableness of a division into definite groups. Of the lines of this group we might then say the following:

These lines taken together in one group because at an increase of pressure they remain bright and narrow, show also the same property to be of so small intensity at an investigation in a magnetic field, that they are not or hardly observable. So Miss GRAFTDIJK gives for the three lines of which still a Z. E. could be determined the intensities: 2, 2, 1, so that they belong to the weakest visible lines.

Therefore the circumstances under which in Miss GRAFTDIJK's experiments the spark-spectrum was excited (with an ordinary inductor) prove to have been such, that the lines of group III together could not reach a sufficient or only an exceedingly small intensity.

It would be interesting to know, how these lines behave in a magnetic field, if they have been excited by other means e.g. by those of which BILHAM could dispose. Evidently for this group the comparison of ZEEMAN-effect and pressure-effect can be only very incomplete.

Still I thought it suitable to point to the remarkable absence of the lines of this group in Miss GRAFTDIJK's observations. Possibly this remark may still be useful for an explanation of the connection which in all probability exists between the two effects.

The incompleteness of the groups IV and V must principally be ascribed to the want of quantitative observations of the pressure-effect. For these groups the measurements of the ZEEMAN-effect are rather complete.

Though BILHAM has qualitatively investigated the given lines, which has rendered possible the division into groups, he has unfortunately not made quantitative measurements on them. Also in DUFFIELD's paper we miss most lines of these groups.

I have still mentioned all these lines, that in any case I might be able to say something about the value of the ZEEMAN-effect for each of these groups.

Let us now firstly consider the magnitude of the two effects separately and let us begin with the ZEEMAN-effect.

Then we can directly remark that the different lines which belong to one and the same group have not all the same ZEEMAN-effect. From the numbers it is also evident that this will neither be the case with the quantity: $\frac{d\lambda}{\mathfrak{H}\lambda^2}$, from which it will be known that in spectra showing line-series it is a constant for the lines of the same series. Because of the different values of the ZEEMAN-effect it seems therefore for the moment impossible to find spectral series in these groups, the existence of which is suggested by the analogous behaviour of the lines.

Still we can make some remarks on the different groups. Excluding group III because there is too little observation-material, we can make up for each of the groups a mean value of the ZEEMAN-effect. From these values: 380, 405, 529, 678 we see directly that the first two groups give the lowest value of this effect. For the groups II and I these values differ only slightly from each other, which behaviour we shall find back for other quantities which we have calculated for these two groups. From the five groups we have distinguished, these two are the least different ones. With a single exception the lines of the groups IV and V show large ZEEMAN-effects.

This is still more evident from fig. 1, where for each group we have

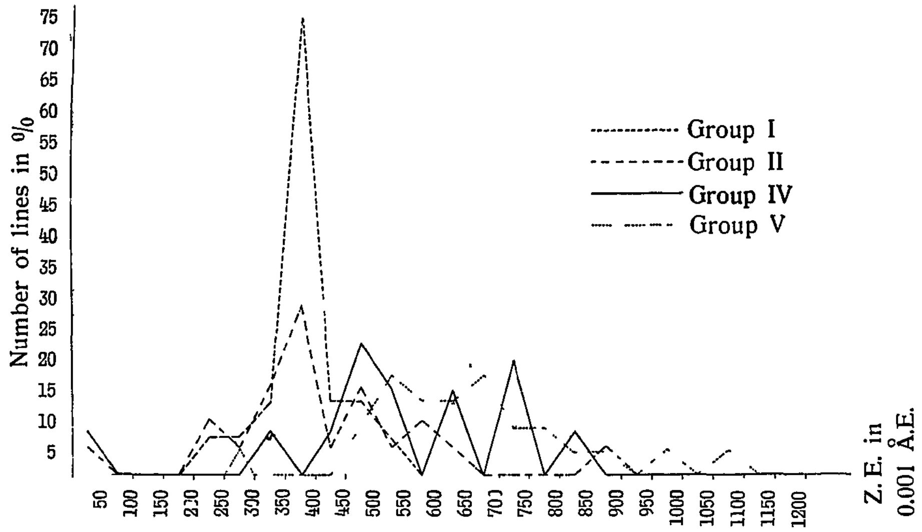

Fig. 1.

clearly indicated the percentage of the lines of each group that shows a Z.E. (expressed in 0.001 ÅU) from 0—50, 50—100, etc. From this we see that group I has a sharp maximum between 350 and 400 (73 %) of all lines). Further that also group II shows a maximum in that same region though much less sharp (27 %) and that this group shows already distinctly some inclination for greater ZEEMAN-effects. The groups IV and V have each two equivalent maxima viz. for group IV between 450 and 500 and between 700 and 750 each of 21 % with a lower maximum (14 %) between them and for group V between 500 and 550 and between 650 and 700 both of 16 % while between these lie still 24 % of all the lines of this group.

Considering now the observations on the pressure-effect, then we directly remark that for the lines of one and the same group the magnitude of this effect is very different. That for one and the same line observations of the arc or of the spark-spectrum would give somewhat different values was to be expected a priori, but that observations on the same line in the same spectrum give such different values of the pressure-effect per atmosphere seems very strange.

From the observations of BILHAM at 5 atmospheres over-pressure (B_1) we find a higher value for the pressure-effect than from those of the same author at 10 atmospheres over-pressure (B_2). We may therefore directly conclude:

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In the nickel-spectrum the pressure-effect is *not* proportional to the increase of the pressure.

A general study of the question how then the pressure-effect changes with the pressure cannot be made from the present observation-material. In general there is no regularity to be seen, though for most of the lines $B_1 > B_2$ which indicates that for a strong increase in pressure the shift changes less, but to this rule there are exceptions e.g. group I (λ 3524.69, where $B_1 < B_2$, and group II (λ 3610.68 and λ 3807.29) where $B_1 = B_2$.

Still it is remarkable that the groups I and II have the same mean value of B_1 and B_2 (2.8 resp. 1.9). For group IV these values (λ 13.1 resp. 8.1) are in a ratio to each other which is a little greater than 2.8 and 1.9. Of the groups III and V nothing can be said because there are too few observations of B_1.

That for a pressure-increase of 5 atmospheres we get a larger shift than for one of 10 atmospheres as is the case for λ 3548,32 (Group I) (for 5 atm. $5 \times 5.0 = 25$ and for 10 atm. $10 \times 2.1 = 21$) will make the explanation of the pressure-effect still more difficult A similar case is found for λ 3972.32 (Group III), for which BILHAM observed the same shift (28) for 5 and for 10 atmospheres pressure-increase, from which it follows, that an increase of the pressure from 5 to 10 atmospheres does not shift the spectrum line.

Let us now consider DUFFIELD's observations. Here also we find, that the shift per atmosphere calculated from the lower pressures (10 atm.) (D_1) is generally larger than that calculated from the observations at higher pressures (20—100 atm.) (D_2). Exceptions are found in group I for λ 3783.67, which line shows in the arc-spectrum a shift proportional to the pressure-increase; further for λ 3775.74 in group II where at a stronger pressure-increase the shift increases more than at a pressure-increase to 10 atm. Something similar, though in a less degree, is found in group III for λ 4359.70 and in group V for λ 4401.77.

Cases in which the differences between the observations at low and high pressure are very pronounced are found e.g. for λ 3597.86 and λ 3610.68 of group II.

As to the four first groups the ratios between the means of D_1 and D_2 are then higher than those of the means of B_1 and B_2, as is shown in this table. For the lines of group V the ratio between D_1 and D_2 for one and the same line approaches more and more to one.

The comparison between the columns B_2 with D_1 and D_2 has been made by DUFFIELD [1]) already, who has however not extended

[1]) l. c.

Group	B_1/B_2	D_1/D_2
I	1.47	2.00
II	1.47	2.30
III	1.22	1.76
IV	1.62	2.50
V	1.69	1.23

the comparison to B_1. In that case he would have found for λ 3619.54 (group I) a better agreement between B_1 and D_2 than between B_2 and D_2. By the comparatively small number of observations B_1 however, this investigation would not have brought much new light.

If for a moment we compare still the results for the shift per atm. from the observations at 10 atm. over-pressure in the spark-spectrum with those in the arc-spectrum (viz. B_2 with D_1), we see that generally the shifts in the arc-spectrum are larger than those in the spark-spectrum, though also here are exceptions found e.g. for λ 3783.67 in group I, λ 3775.74 in group II, λ 3972.32 in group III, λ 3769.62 in group IV and 3973.75 in group V.

(Must we consider it as a coincidence that these lines λ 3769.62 λ 3775.74, λ 3783.67) and (λ 3972.32 and λ 3973.75) lie near each other in two groups? Is it possible that in the observations on the pressure-effect a mutual influence can play a part here, as is sometimes found in observations on the ZEEMAN-effect?).

The ratio between the mean values of B_2 and D_1 is different for the different groups, as is evident from the following table:

Group	D_1/B_2
I	1.68
II	2.05
III	1.26
IV	0.62
V	1.20

Only in group IV $B_2 > D_1$, but perhaps this may be ascribed to the small number of observations that have been made in this group.

Let us now proceed to the investigation, in how far there exists a connection between the two phenomena which we have now considered each separately.

Though, after what we have seen of the different results for the pressure-effect, we can directly say that there is no question of a direct proportionality between the two effects, we may still make up these ratios, as in any case they will teach us something about the ratio of the magnitude of the two effects in the different groups.

As far as there existed observations of both effects for the same spectrum line, I have therefore calculated these ratios and put them in the columns $\frac{Z}{B_1}$, $\frac{Z}{B_2}$, $\frac{Z}{D_1}$ and $\frac{Z}{D_2}$. For each line I have given in the last column the mean of the number occurring in each of the other columns separately.

Even if we confine ourselves to one and the same column, a preliminary consideration shows already that these ratios have very different values. The import of the "Means" given below must therefore be taken in a wide sense. Fig. 2 clearly shows how the ratios are divided in the different groups.

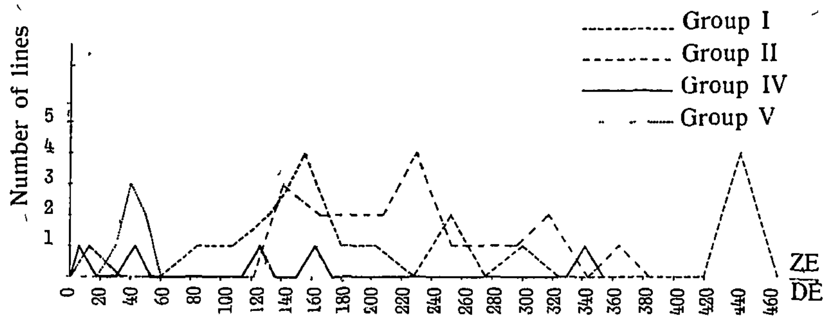

Fig. 2

Group I shows a maximum at ± 150 with which smaller maxima are connected. In this group there occurs a maximum quite separately at ± 450 where 4 lines are found which have nearly the same mean ratio between the ZEEMAN-effect and the pressure-effect viz.

λ 3561,92 ; 3624,69 ; 3739,38 ; 3783,67 with a ratio
456 451 446 450.

With the exception of one value of a line which shows Pr. E., but no Z.E., the ratios of group II vary between 136 and 356, that is between narrower limits than those of group I. The highest maximum lies at 230.

As of group III only two ratios could be calculated, this group has not been taken up in the figure. From these two means: 110 and 59 we can infer little.

From the figure is seen that the ratios of group IV are distributed over a wide region without showing anywhere a trace of a maximum.

Group V shows a very small region in which all values of the ratios are lying, viz. between 27 and 52. Except for the first line for which no Z.E. has been determined, the values of B_2, D_1 and D_2 show here a very great and rather good agreement among each other. If therefore in any group there can be question of a direct proportionality between Z.E. and Pr. E, it will be for the lines of group V. Unfortunately BILHAM has not extended his quantitative observations over more lines of this group; else we might perhaps have been able to verify this conclusion still better.

After this explication of the figure we may use still further the numbers given as "Means." Assembling the means of $\frac{Z}{B_1}, \frac{Z}{B_2}, \frac{Z}{D_1}, \frac{Z}{D_2}$ and $\frac{ZE}{DE}\left(\text{viz. the mean of } \frac{Z}{B \text{ or } D}\right)$ in a table, and reducing those of the first group all to one, we obtain:

Group	$\frac{Z}{B_1}$	$\frac{Z}{B_2}$	$\frac{Z}{D_1}$	$\frac{Z}{D_2}$	$\frac{ZE}{DE}$
I	1	1	1	1	1
II	0.84	0.93	0.85	0.82	0.90
III		0.34	0.42	0.34	0.36
IV	0.22	0.40	0 68	0.93	0.48
V		0.19	0.24	0.14	0.18

From this table it is evident that in the study of the ratio of ZEEMAN-effect and pressure-effect the distinction of the different groups gives as pronounced results as in the investigation of the pressure-effect alone. For the groups I and II this ratio is greatest, while group V is characterized by a very small ratio. Though the groups I and II show great agreement, so that BILHAM[1]) feels inclined to combine them to one single group, we see here that in the comparison of the two effects the difference is still considerable. As for these two groups a sufficient number of observations was at our disposal, we can look upon this difference as being a "real" one,

[1]) l. c. p. 368.

The greatest difference in the different columns is shown by group IV. Here the different numbers 0.22, 0.40, 0.68, 0.93 point to the fact that the lines of this group (to which belong all so-called "enhanced lines") are sensitive in very different degrees to the different ways in which the pressure-effect has been determined. As to the ZEEMAN-effect these lines (except that one of them does not show a magnetic decomposition) do not show any particularity.

Comparing the columns with each other, we see that the column $\frac{Z}{B_2}$ agrees best with the column of the mean $\frac{ZE}{DE}$. Also for the other columns there may be found partial correspondences.

Though there is not much observation-material, we see from the above that a division into groups can still teach something about the connection between ZEEMAN-effect and pressure-effect. An investigation, as KING[1]) made for the spectra *Fe*, *Cr* and *Ti*, which has given a great number of observations, could not be carried out here. Perhaps that later still more observations on the pressure-effect and also on the ZEEMAN-effect will be published which would give us the opportunity to carry out this investigation more completely.

Physics. — "*The Theory of the* BROWN'*ian Movement*". By Prof. J. D. VAN DER WAALS JR. and Miss AUDA SNETHLAGE. (Communicated by Prof. J. D. VAN DER WAALS).

(Communicated in the meeting of January 29, 1916).

§ 1. In different ways it has been tried to derive a formula for the deviation which a suspended particle will present on an average in a definite time in consequence of the Brownian movement. In most of these derivations the supposition is introduced that the particle when moving experiences a friction, i.e. that a force acts on the particle which can be represented by $-p\mathfrak{v}$, when $\mathfrak{v}$ represents the velocity of the particle and p a positive constant. As far as is known to us the first of the two formulae derived by VON SMOLUCHOWSKI[2]) is the only one where this supposition has not been made use of; in the derivation of this formula kinetic considerations have been exclusively used.

The formula derived in this way, which we shall call Sm. I, deviates pretty considerably from the second [3]) derived by VON

[1]) l. c.

[2]) VON SMOLUCHOWSKI. Ann. der Phys. **21**. p. 769. Ann. 1906.

[3]) VON SMOLUCHOWSKI l.c. p. 773.