Physics. — *The* ZEEMAN-*effect of the spectrum of ionized Argon (Ar II).*
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1. *Introduction.*

The ZEEMAN-effect of the spectrum of ionized Argon *(Ar II)* has been investigated for checking the analysis of this spectrum given by one of us (DE BRUIN) [1]). The research [2]) was especially important because one can expect in this spectrum according to theoretical considerations deviations from the normal *g*-values of LANDÉ. The theory of BOHR gives that the atomic core of *Ar II* contains four *3p*-electrons. According to the conception of LANDÉ this should give rise to anomalous *g*-values. Certain groups of *g*-values must give, on account of theoretical considerations of PAULI, LANDÉ and HEISENBERG constant "*g*-sums", which can be calculated beforehand.

2. *Experimental part.*

The grating mounting.

We made use of the stigmatic grating mounting of the laboratory. The light from the source, whose image is focussed on the slit, falls upon a concave mirror, which sends a parallel beam of light to the grating [3]). We could photograph at once a region of 15 cm at both sides of the normal of the grating. The investigation was made in the second order and there the dispersion is about 2.4 Å/mm, so we could photograph with one focussing of the camera a region of 300×2.4 Å $= 720$ Å; thus we had to focuss four times for investigating the spectral region between 2700 and 5300 Å.

The 5 inch grating used has 14438 lines to the inch (originally the width of the grating is 6 inches, but one inch gives disturbances and was therefore covered during the exposures). For resolving very narrow magnetic separations it is necessary that the temperature of the grating remains constant to at least 0°.05 during a whole exposure. Especially for this

1) DE BRUIN: These Proceedings **31**, N°. 6, 593, 1928 and **31**, N°. 7, 771, 1928. Zeitschr. f. Phys., **48**, 62, 1928.

2) The ZEEMAN-effect is not very much investigated. Some lines in the visible part of the spectrum has been investigated by LÜTTIG (Dissertatie Halle a. S. 1911; Ann. der Phys. **38**, 69, (1912).

3) RUNGE und PASCHEN, Wied. Ann., **61**, 641, 1897, P. ZEEMAN used this mounting since 1900 for many investigations.

MEGGERS and KEIVIN BURNS, Sc. Pap. Bur. of Stand. N°. 441, (vol. 18), 1922.

purpose an automatical regulation of the temperature is made in the large room of the laboratory where the grating is mounted [1]). This regulation enables us to keep the temperature of the grating constant to 0°.01 during the exposure.

The magnetic field.

The magnet is a large WEISS-electromagnet, with water cooled copper coils, made by the engine factory „Oerlikon" (Zürich). It is operated on a current of 100 Ampères. The field is then with the used distance of the endplanes of the poles about 41000 Gauss. The cooling is very effective and makes that the temperature of the magnet does not change observably; in this way satisfactory constancy of the field is obtained.

The light source.

We made use of a gasdischarge *without* Geissler tube, that passes parallel to the field. The Argon gas is therefore led into a copper "BACK-box" [2]) enclosing the magnetic poles and provided with quartz windows. The gas discharge passes between 2 circular platin discs, just covering the pole tips of the magnet (5 mm in diameter). The platin discs are insulated from the pole pieces by using thin pieces of mica. Platin discs and mica are attached to conical plugs, to our purpose made of ebonite and ground to fit into openings into the box. *Without* the magnetic field the discharge spreads through the whole of vacuum space, *with* magnetic field and well choosen gas pressure (in the case of Argon between 2 and 3 cm) the discharge contracts to the central part of the field and comes to high brilliancy there. We used un uncondensed high potential alternating current furnished by a large transformer that operated indefinitely on ½ K.W., while the current in the secundary was 25 m.A.

The times of exposure varied between 4 and 6 hours.

Intensity measurement of the field.

The intensity of the magnetic field can be measured by means of the exactly known ZEEMAN-effect of spectral lines, that may not show dissymmetries in their magnetic separations. In connexion with the spectral region that was investigated, we used the ZEEMAN-effect of the well known *Zn*-triplet 4811, 4722 and 4680 or of the *Ag* grounddoublet 3883 and 3281.

When none of these lines fell in the spectral region we investigated, we could satisfactory make use of the accurately known and measured ZEEMAN-effect of *Ar II* lines, because the regions we investigated always covered each other over some distance.

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[1]) We refer to: GEHRCKE: Handb. der Physik. Optik, Band II, zweite Hälfte, erster Teil. P. ZEEMAN und T. L. DE BRUIN: Magnetische Zerlegung der Spektrallinien, p. 605.

[2]) Struktur der Materie I: E. BACK und A. LANDÉ: ZEEMAN-effekt und Multiplettstruktur der Spektrallinien.

	λ	Termcombination	ZEEMAN-effect
Zn.	4810.534	$^3P_2 - {}^3S_1$	**(0.00)** (0.50) **1.00** 1.50 2.00
	4722.163	$^3P_1 - {}^3S_1$	(0.50) 1.50 2.00
	4680.140	$^3P_0 - {}^3S_1$	(0.00) 2.00
Ag	3382.89	$^2S_1 - {}^2P_1$	(0.67) 1.33
	3280.67	$^2S_1 - {}^2P_2$	**(0.33)** **1.00** 1.67

3. *Normal and anomalous g-values.*

According to the theory of LANDÉ [1]) the ZEEMAN-effect of a classified spectralline, arising from the combination between two energy levels (terms) can be calculated. An external magnetic field splits up a term with the inner quantumnumber j in $2j+1$ sublevels with the magnetic quantumnumbers $m=j,\ j-1, \ldots -j$. The energy alteration of the term, $\triangle E = h \,.\, \triangle \nu$, is given bij the expression: $\triangle \nu = m.\,g.\,o.$ $\left(o = \frac{e}{m} \cdot \frac{H}{4\pi c}\right.$ means the normal resolution$\left.\right)$ g is LANDÉ's splitting factor, which can be calculated directly by means of the quantumnumbers of a term namely;

$$g = 1 + \frac{j(j+1) + s(s+1) - l(l+1)}{2j(j+1)},$$

in which $j =$ inner quantumnumber, $s =$ rotational quantumnumber, $l =$ azimuthal quantumnumber.

EXAMPLE: A II. λ 3729,300 $= 4s\,{}^4P_3 - 4p\,{}^4S_2$. [2])

$4s\,{}^4P_3 : j = {}^5/_2,\ s = {}^3/_2,\ l = 1,\ g = 1{,}60;\ 2j+1 = 6$ magnetic levels with $m = {}^5/_2,\ {}^3/_2,\ {}^1/_2,\ -{}^1/_2,\ -{}^3/_2,\ -{}^5/_2.$

$4p\,{}^4S_2 : j = {}^3/_2,\ s = {}^3/_2,\ l = 0,\ g = 2{,}00;\ 2j+1 = 4$ magnetic levels with $m = {}^3/_2,\ {}^1/_2,\ -{}^1/_2,\ -{}^3/_2.$

The levels with $\triangle m = 0$ and ± 1 combine ($\triangle m = 0$, π-component, $\triangle m = \pm 1$, σ-component).

[1]) Struktur der Materie I; E. BACK und A. LANDÉ: ZEEMAN-effekt und Multiplettstruktur der Spektrallinien.

[2]) The inner quantum number j is for typographical simplicity replaced by the whole number: $j + {}^1/_2$.

Thus the calculated energy alterations are:

$$4\,s\,{}^4P_3: -4{,}00 \quad -2{,}40 \quad -0{,}80 \quad 0{,}80 \quad 2{,}40 \quad 4{,}00$$
$$4p\,{}^4S_2: \qquad -3{,}00 \quad -1{,}00 \quad 1{,}00 \quad 3{,}00$$

combine

$$-2{,}20 \quad -1{,}80 \quad -1{,}40 \quad \mathbf{-1{,}00} \quad -(0{,}60) \quad -\mathbf{(0{,}20)} \quad \mathbf{(0{,}20)} \quad (0{,}60) \quad \mathbf{1{,}00} \quad 1{,}40, \quad 1{,}80 \quad 2{,}20$$

or:

$$\pm\,\mathbf{(0{,}20)} \quad (0{,}60) \quad \mathbf{1{,}00} \quad 1{,}40 \quad 1{,}80 \quad 2{,}20.$$

Observed is:

$$\pm\,\mathbf{(0{,}20)} \quad (0{,}60) \quad \mathbf{1{,}00} \quad 1{,}40 \quad 1{,}80 \quad 2{,}20.$$

It appears however that in many cases the ZEEMAN-effect calculated in this way does not agree with the experiments. One supposes, that when the g-formula holds, the coupling of the quantumnumbers is the normal one, (RUSSELL-SAUNDERS coupling) symbolically given by

$$\{[(s_1\,s_2\ldots)\,(l_1\,l_2\ldots)]\,H\} = (s\,l)\,H = jH.$$

Other kinds of coupling give rise to anomalous $g =$ values [1]).

EXAMPLE: Multiplet 2.

A II. $\lambda\,4657{,}889 = 4\,s\,{}^2P_2 - 4\,p\,{}^2P_1$. According to LANDÉ's formula the normal g-values are $g\,{}^2P_2 = 1{,}33$ and $g\,{}^2P_1 = 0{,}67$ and the ZEEMAN-effect calculated with these g-values is

$$\mathbf{1{,}67} \quad 1{,}00 \quad \mathbf{(0{,}33)} \quad \mathbf{(0{,}33)} \quad 1{,}00 \quad \mathbf{1{,}67}.$$

Observed however is:

$$\mathbf{1{,}50^5} \quad 1{,}14^5 \quad \mathbf{(0{,}16^5)} \quad \mathbf{(0{,}16^5)} \quad 1{,}21 \quad \mathbf{1{,}51},$$

From this are now calculated the g-values $g_1 = g\ 4s\,{}^2P_2$ and $g_2 = g\ 4p\,{}^2P_1$ as follows:

$$4\,s\,{}^2P_2: -{}^3/_2\,g_1 \quad -{}^1/_2\,g_1 \quad +{}^1/_2\,g_1 \quad +{}^3/_2\,g_1$$
$$4p\,{}^2P_1: \qquad -{}^1/_2\,g_2 \quad +{}^1/_2\,g_2$$

combine

$$\pm\,(\,{}^1/_2\,(\mathbf{g_1} - \mathbf{g_2})\,) \quad {}^1/_2\,(g_1 + g_2) \quad {}^3/_2\,\mathbf{g_1} - {}^1/_2\,\mathbf{g_2}$$

This gives:

$${}^1/_2\,(g_1 - g_2) = 0{,}16^5 \text{ and } {}^3/_2\,g_1 - {}^1/_2 g_2 = 1{,}50^5$$

thus:

$$g_1 = 1{,}33 \text{ and } g_2 = 0{,}99.$$

Hence we see that $g\,4p\,{}^2P_1$ is an anomalous one.

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[1]) S. GOUDSMIT und G. E. UHLENBECK: Zeitschr. f. Phys. **35**, 618, 1926.
S. GOUDSMIT und E. BACK: Zeitschr. f. Phys. **40**, 530. 1927.

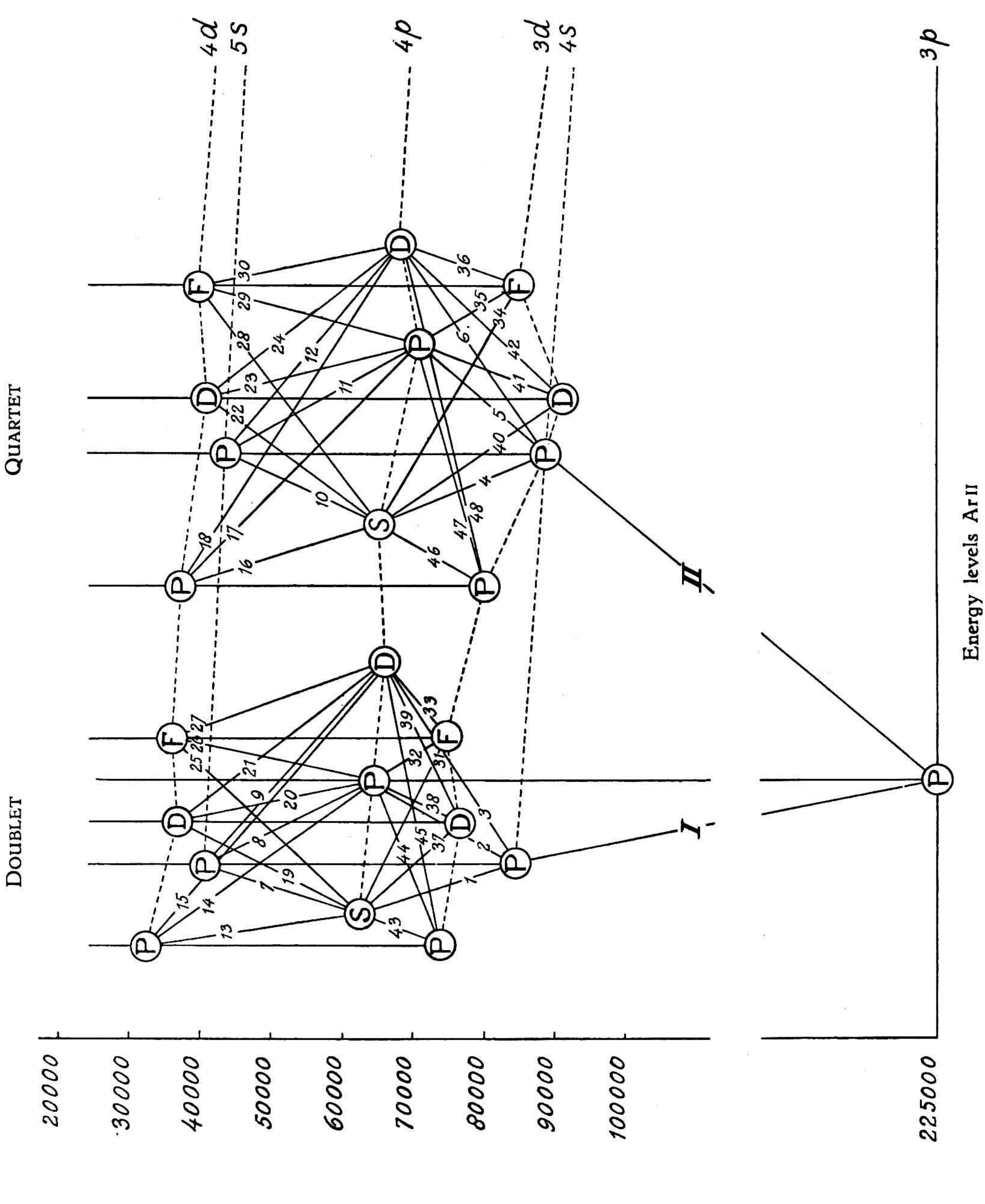
The observed ZEEMAN-effect of the line λ 4764,848 $= 4s\,^2P_1 - 4p\,^2P_2$ is:

1,51 0,92 (**0**,**28**) (**0**,**28**) 0,99 **1,54**.

The g-values are here calculated in the same way to:

$$g\ 4s\,^2P_1 = 0{,}67 \text{ and } g\ 4p\,^2P_2 = 1{,}23.$$

According to the g-formula one should expect 0,67 and 1,33.
We now can predict with the found g-values the deviating ZEEMAN-



effects of both the other lines of the multiplet. We expect e.g. with the given g-values that the line $\lambda\,4545{,}040 = 4\,s\,{}^2P_2 - 4\,p\,{}^2P_2$ shows the ZEEMAN-effect

$$\pm\ (0{,}05)\ \mathbf{(0{,}15)}\ 1{,}18\ \mathbf{1{,}28}\ 1{,}38.$$

Observed is

$$\pm\qquad \mathbf{(0{,}16)}\qquad \mathbf{1{,}28}.$$

When the coupling is the normal one, that means when we may use the g-formula, of LANDÉ one should expect that the ZEEMAN-effect of this line would show a sharp triplet (0,00) 1,33.

The deviating g-values in the following tables [1]) are calculated in the same way as in this example.

4. *The* ZEEMAN-*effect of the Ar II lines.*

MULTIPLETS 5, 6 and 4.

	4p \ 4s	$^4P_1$	515.70	$^4P_2$	844.40	$^4P_3$
5.	$^4P_1$	3. 4972.16 20106.4	515.85	6. 4847.783 20622.25		—
	357.30					
	$^4P_2$	5. 5062.019 19749.47	515.60	5. 4933.226 20265.07	844.42	7. 4735.855 21109.49
	307.78					
	$^4P_3$	—		6. 5009.246 19957.53	844.03	9. 4805.993 20801.56
6.	$^4D_1$	8. 4379.657 22826.44	515.72	5. 4282.894 23342.16		—
	260.31					
	$^4D_2$	7. 4430.185 22566.11	515.74	7. 4331.194 23081.85	844.36	3. 4178.344 23926.21
	494.40					
	$^4D_3$	—		9. 4425.995 22587.23	844.38	6. 4266.524 23431.71
	439.40					
	$^4D_4$	—		—		10. 4348.062 22992.30
4.	$^4S_2$	6. 3928.599 25447.20	515.68	9. 3850.565 25962.88	844.21	10. 3729.300 26807.09

[1]) See for the numbers of the multiplets the figure of the energy levels.

	λ	Termcomb. x—y		ZEEMAN-effect	g_x theor.	g_x obs.	g_y theor.	g_y obs.	Remarks
5.	5062.019	4s $^4P_1$ — 4p $^4P_2$	L [1])	(**0.47**) **1.27** 2.20					
			obs.		2.67		1.73		1)
	5009.246	4s $^4P_2$ — 4p $^4P_3$	L	(**0.07**) (0.20) **1.40** 1.53 1.67 1.80					
			obs.		1.73		1.60		2)
	4972.16	4s $^4P_1$ — 4p $^4P_1$	L	(0.00) 2.67					
			obs.		2.67		2.67		3)
	4933.226	4s $^4P_2$ — 4p $^4P_2$	L	(**0**.00) 1.73					
			obs.	(0.00) 1.73	1.73	1.73	1.73	1.73	4)
	4847.783	4s $^4P_2$ — 4p $^4P_1$	L	(**0.47**) **1.27** 2.20					
			obs.	(**0.46**) **1.27**	1.73	1.73	2.67	2.67	5)
	4805.993	4s $^4P_3$ — 4p $^4P_3$	L	(0.00) 1.60					
			obs.	(0.00) 1.60	1.60	1.60	1.60	1.60	6)
	4735.885	4s $^4P_3$ — 4p $^4P_2$	L	(**0.07**) (0.20) **1.40** 1.53 1.67 1.80					
			obs.	(**0.00**) **1.48**	1.60	1.60	1.73	1.73	7)
6.	4430.185	4s $^4P_1$ — 4p $^4D_2$	L	**0.47** (**0.73**) 1.93					
			obs.	**0.46** (**0.74**) 1.93	2.67	2.67	1.20	1.20	8)
	4425.995	4s $^4P_2$ — 4p $^4D_3$	L	(**0.18**) (0.54) **0.83** 1.19 1.55 1.91					
			obs.	(**0.20**) **0.67** 1.13 1.52 —	1.73	1.73	1.37	1.33	9)
			calc.	(**0.20**) (0.60) **0.73** 1.13 1.53 1.93					
	4379.675	4s $^4P_1$ — 4p $^4D_1$	L	(1.33) 1.33					
			obs.	(1.33) 1.33	2.67	2.67	0.00	0.00	10)
	4348.062	4s $^4P_3$ — 4p $^4D_4$	L	(**0.09**) (0.26) (0.43) **1.00** 1.17 1.34 1.51 1.69 1.86					
			obs.	(**0.00**) **1.09**	1.60	1.60	1.43	1.43	11)
	4331.194	4s $^4P_2$ — 4p $^4D_2$	L	(0.27) (**0.80**) 0.93 **1.47** 2.00					
			obs.	(0.28) **0.83** **1.47** 2.00	1.73	1.73	1.20	1.20	12)
	4282.894	4s $^4P_2$ — 4p $^4D_1$	L	(**0.87**) 0.87 **2.60**					
			obs.	(**0.86**) 0.86 **2.58**	1.73	1.73	0.00	0.00	13)
	4266.524	4s $^4P_3$ — 4p $^4D_3$	L	(0.11) (0.34) (**0.57**) 1.03 1.26 **1.49** 1.71 1.94					
			obs.	(**0.66**) **1.47**	1.60	1.60	1.37	1.33	14)
			calc.	(0.13^5) (0.40^5) (**0.67^5**) 0.92^5 1.19^5 **1.46^5** 1.73^5 2.00^5					
4.	3928.599	4s $^4P_1$ — 4p $^4S_2$	L	(**0.33**) **1.66** 2.33					
			obs.	(**0.33**) **1.66** 2.32	2.67	2.67	2.00	2.00	15)
	3850.565	4s $^4P_2$ — 4p $^4S_2$	L	(0.13) (**0.40**) 1.60 **1.87** 2.13					
			obs.	(**0.38^5**)	1.73	1.73	2.00	2.00	16)
	3729.300	4s $^4P_3$ — 4p $^4S_2$	L	(**0.20**) (0.60) **1.00** 1.40 1.80 **2.20**					
			obs.	(**0.20**) (0.60) **1.00** 1.40 1.80 2.20	1.60	1.60	2.00	2.00	17

[1]) L = ZEEMAN-effect calculated with LANDÉ's g-formula.
obs. = observed ZEEMAN-effect.
calc. = ZEEMAN-effect calculated with anomalous g-values.

REMARKS.

1) 2) 3) These 3 lines 5062.019, 5009.246 and 4972.16 fall in a region, that is not yet investigated. The qualitative results of LÜTTIG agree with the classification.

4) Sharp triplet.

5) Weak quartet.

6) Sharp triplet.

7) Diffuse triplet.

8) Sharp sextet. See photogram 8.

9) Component 0.67 enlarged. See photogram 16.

10) Sharp doublet. See photogram 10.

11) "Pseudotriplet" Central component enlarged; in both the other large components decrease of intensity to the outside. See photogram 12.

12) Partial coincidence with 4332.035 ($3d\,^4D_2$—$4p\,^4P_1$).

13) Weak, but sharp quartet.

14) Outside components diffuse.

15) Sharp sextet. See photogram 15.

16) This line falls in the *CN* band 3883, therefore the components could not be measured exactly.

17) Completely resolved in 12 components. See photogram 9.

MULTIPLETS 3, 2, 1.

	4p \ 4s	$^2P_2$	1014.74	$^2P_1$
3.	$^2D_3$	8. 4879.824 20486.83		—
	663.02			
	$^2D_2$	6. 4726.847 21149.85	1014.71	6. 4965.059 20135.14
2.	$^2P_1$	6. 4657.889 21462.96	1014.86	3. 4889.06 20448.1
	532.90			
	$^2P_2$	7. 4545.040 21995.86	1014.60	5. 4764.848 20981.18
1.	$^2S_1$	5. 4375.942 22845.82	1014.74	6. 4579.347 21831.08

	λ	Termcomb. $x-y$		ZEEMAN-effect						g_x theor.	g_x obs.	g_y theor.	g_y obs.	Remarks
3.			L	**(0.07)**	0.73	**0.87**								
	4965.059	4s $^2P_1$ — 4p $^2D_2$	obs.	**(0.00)**		**1.02**				0.67	0.67	0.80	0.90	1)
			calc.	**(0.11^5)**	0.78^5	**1.01^5**								
			L	**(0.07)**	(0.20)	**1.00**	1.13	1.27	1.40					
	4879.824	4s $^2P_2$ — 4p $^2D_3$	obs.	**(0.00)**			**1.14**			1.33	1.33	1.20	1.24	2)
			calc.	**(0.05)**	(0.13^5)	**1.10^5**	1.19^5	1.28^5	1.37^5					
			L	(0.27)	0.53	**(0.80)**	**1.07**	1.60						
	4726.847	4s $^2P_2$ — 4p $^2D_2$	obs.	(0.24)	**(0.65)**		**1.12**	1.54		1.33	1.33	0.80	0.90	3)
			calc.	(0.22)	**(0.65)**	0.69	**1.12**	1.54						
2.			L	(0.00)	0.67									
	4889.06	4s $^2P_1$ — 4p $^2P_1$	obs.	(0.17)	0.83					0.67	0.67	0.67	0.99	4)
			calc.	(0.16)	**0.83**									
			L	**1.67**	1.00	**(0.33)**	**(0.33)**	1.00	**1.67**					
	4764.848	4s $^2P_1$ — 4p $^2P_2$	obs.	**1.51**	0.92	**(0.28)**	**(0.28)**	0.99	**1.54**	0.67	0.67	1.33	1.23	5)
			calc.	**1.51**	0.95	**(0.28)**	**(0.28)**	0.95	**1.51**					
			L	**1.67**	1.00	**(0.33)**	**(0.33)**	1.00	**1.67**					
	4657.889	4s $^2P_2$ — 4p $^2P_1$	obs.	**1.50^5**	1.14^5	**(0.16^5)**	**(0.16^5)**	1.21	**1.51**	1.33	1.33	0.67	0.99	6)
			calc.	**1.50**	1.16	**(0.17)**	**(0.17)**	1.16	**1.50**					
			L	(0.00)	1.33									
	4545.040	4s $^2P_2$ — 4p $^2P_2$	obs.		**(0.16)**		**1.28**			1.33	1.33	1.33	1.23	7)
			calc.	(0.05)	**(0.15)**	1.18	**1.28**	1.38						
1.			L	(0.67)	1.33									
	4579.347	4s $^2P_1$ — 4p $^2S_1$	obs.	(0.50^5)	1.17					0.67	0.67	2.00	1.68	8)
			calc.	(0.50^5)	1.17^5									
			L	1.67	**1.00**	**(0.33)**	**(0.33)**	**1.00**	1.67					
	4375.942	4s $^2P_2$ — 4p $^2S_1$	obs.	1.51	**1.15**	**(0.17)**	**(0.17)**	**1.12**	1.51	1.33	1.33	2.00	1.68	9)
			calc.	1.51	**1.15**	**(0.17)**	**(0.17)**	**1.15**	1.51					

REMARKS.

1) Weak triplet. Central component enlarged.
2) Diffuse triplet.
3) Sharp octet. See photogram 2.
4) Weak quartet.
5) Sharp sextet. See photogram 1.
6) Sharp sextet. See photogram 3. (The slight deviations of these values from those given in the original dutch paper are due to recent measurements on the photogram.)
7) See photogram 6.
8) See photogram 5.
9) Component 1.51 weak.

MULTIPLETS 11, 12 and 10.

	4p \ 5s	$^4P_1$	729.50	$^4P_2$	627.90	$^4P_3$
11.	$^4P_1$	1. 3669.550 27243.56	729.87	4. 3770.569 26513.69		—
	357.30					
	$^4P_2$	4. 3622.204 27599.69	728.96	3. 3720.467 26870.73	627.99	5. 3809.499 26242.74
	307.78					
	$^4P_3$	—		3. 3678.328 27178.54	627.84	6. 3765.313 26550.70
12.	$^4D_1$	6. 4076.704 24522.72	730.96	3. 4201.946 23791.76		—
	260.31					
	$^4D_2$	5. 4033.872 24783.10	729.04	6. 4156.135 24054.06	627.66	3. 4267.49 23426.4
	494.40					
	$^4D_3$	—		4. 4072.429 24548.48	627.91	4. 4179.329 23920.57
	439.40					
	$^4D_4$	—		—		10. 4103.957 24359.88
10.	$^4S_2$	1. 4564.50 21902.1	729.0	3. 4721.66 21173.1	628.1	2. 4866.00 20545.0

	λ	Termcomb. $x - y$		ZEEMAN-effect	g_x theor.	g_x obs.	g_y theor.	g_y obs.	Remarks
12.	4156.135	4p $^4D_2$ — 5s $^4P_2$	L obs. calc.	(0.27) (**0.80**) 0.93 **1.47** 2.00 (**0.63**) (0.21^5) (**0.64**) 0.98^5 **1.41^5** 1.84	1.20	1.20	1.73	1.63	1)
	4076.704	4p $^4D_1$ — 5s $^4P_1$	L obs. calc.	(1.33) 1.33 (1.24^5) 1.24^5 (1.26^5) 1.26^5	0.00	0.00	2.67	2.53	2)
	4033.872	4p $^4D_2$ — 5s $^4P_1$	L obs. calc.	**0.47** (**0.73**) 1.93 **0.61** **0.53^5** (**0.66^5**) 1.86^5	1.20	1.20	2.67	2.53	3)

	λ	Termcomb. $x - y$		ZEEMAN-effect	g_x theor.	g_x obs.	g_y theor.	g_y obs.	Remarks
11.	3809.499	4p $^4P_2$ — 5s $^4P_3$	L obs.	**(0.07)** (0.20) **1.40** 1.53 1.67 1.80 **(0.00)** **1.47**	1.73	1.73	1.60	1.60	4)
	3770.569	4p $^4P_1$ — 5s $^4P_2$	L obs. calc.	**(0.47)** **1.27** 2.20 **(0.51^5)** **1.09** **(0.51^5)** **1.11** 2.14^5	2.67	2.67	1.73	1.63	5)
	3765.313	4p $^4P_3$ — 5s $^4P_3$	L obs.	(0.00) 1.60 (0.00) 1.60	1.60	1.60	1.60	1.60	6)
	3720.467	4p $^4P_2$ — 5s $^4P_2$	L obs. calc.	(0.00) 1.73 **0.16^5** **1.70** (0.05) **(0.15^5)** 1.58 **1.68** 1.78^5	1.73	1.73	1.73	1.63	7)
	3678.328	4p $^4P_3$ — 5s $^4P_2$	L obs. calc.	**(0.07)** (0.20) **1.40** 1.53 1.67 1.80 **(0.00)** **1.57** **(0.01^5)** (0.04^5) **1.55^5** 1.58^5 1.61^5 1.64^5	1.60	1.60	1.73	1.63	8)
	3622.204	4p $^4P_2$ — 5s $^4P_1$	L obs. calc.	**(0.47)** **1.27** 2.20 **(0.42)** **1.34** **(0.40)** **1.33^5** 2.12^5	1.73	1.73	2.67	2.53	9)

REMARKS.

1) Diffuse, weak doublet.
2) Coincidence with 4077.057 ($4p\ ^2D_2$—$5s\ ^2P_1$). Only one component can be measured in regard to the *Fe*-line 4076.642, therefore the measurement is not very exact.
3) Diffuse doublet.
4) "Pseudotriplet", diffuse.
5) Sharp quartet, component 0.51 exactly measurable.
6) Sharp triplet.
7) Weak, very diffuse quartet.
8) "Pseudotriplet", diffuse.
9) Very weak quartet.

MULTIPLETS 9, 8 and 7.

	4p \ 5s	$^2P_2$	824.00	$^2P_1$
9.	$^2D_3$	10. 4103.957 24359.88		—
	663.02			
	$^2D_2$	5. 4218.683 23697.43	823.16	2. 4077.057 24520.59
8.	$^2P_1$	4. 4275.167 23384.36	823.9	1. 4129.67 24208.2
	532.90			
	$^2P_2$	2. 4375.031 22850.68	824.32	6. 4222.679 23675.00
7.	$^2S_1$	(4543.68) (22002.44)	824.00	8. 4379.657 22826.44

	λ	Termcomb. x—y		ZEEMAN-effect						g_x theor.	g_x obs.	g_y theor.	g_y obs.	Remarks
9.			L	(0.27)	0.53	**(0.80)**	**1.07**	1.60						
	4218.683	4p $^2D_2$ — 5s $^2P_2$	obs.			**(0.79)**				0.80	0.90	1.33	1.43	1)
			calc.	(0.26^5)	0.63^5	**(0.79^5)**	**1.16^5**	1.69^5						
			L	**(0.07)**	(0.20)	**1.00**	1.13	1.27	1.40					
	4103.957	4p $^2D_3$ — 5s $^2P_2$	obs.	**(0.00)**		**0.97**				1.20	1.24	1.33	1.43	2)
			calc.	**(0.09^5)**	(0.28^5)	**0.95^5**	1.14^5	1.33^5	1.52^5					
			L	**(0.07)**	0.73	**0.87**								
	4077.057	4p $^2D_2$ — 5s $^2P_1$	obs.	**(0.00)**		**0.94**				0.80	0.90	0.67	0.81	3)
			calc	**(0.04^5)**	0.85^5	**0.94^5**								
8.			L	**(0.33)**	1.00	**1.67**								
	4275.167	4p $^2P_1$ — 5s $^2P_2$	obs.	**(0.22)**		**1.64^5**				0.67	0.99	1.33	1.43	4)
			calc.	**(0.22)**	1.21	**1.65**								
			L	**(0 33)**	1.00	**1.67**								
	4222.679	4p $^2P_2$ — 5s $^2P_1$	obs.	**(0.21)**	1.03	**1.45**				1.33	1.23	0.67	0.81	5)
			calc.	**(0.21)**	1.02	**1.44^5**								
7.			L	(0.67)	1.33									
	4379.657	4p $^2S_1$ — 5s $^2P_1$	obs.							2.00	1.68	0.67	0.81	6)
			calc.	(0.43^5)	1.24^5									

REMARKS.

1) Diffuse doublet, decrease of intensity clearly to the inside.
2) Coincidence with 4103.957 ($4p\,{}^4D_4$—$5s\,{}^4P_3$). "Pseudotriplet".
3) Partial coincidence with 4076.704 ($4p\,{}^4D_1$—$5s\,{}^4P_1$).
4) Sharp quartet. (The slight deviations of these values from those given in the original dutch paper are due to recent measurements on the photogram.)
5) Sharp sextet.
6) Coincidence with the strong doublet 4379.657 ($4s\,{}^4P_1$—$4p\,{}^4D_1$). We measured a distance 1.65 , which perhaps can agree with the distance from -0.43^5 to $+1.24^5 = 1.68$ of the calculated ZEEMAN-effect. See photogram 10.

MULTIPLETS 41, 42 and 40.

	4p \ 3d	$^4D_1$	107.00	$^4D_2$	149.53	$^4D_3$	153.90	$^4D_4$
41.	$^4P_1$	5. 4352.198 22970.46	106.91	5. 4332.035 23077.37		—		—
	357.30							
	$^4P_2$	4. 4420.943 22613.14	107.25	6. 4400.101 22720.39	149.61	5. 4371.334 22869.90		—
	307.78							
	$^4P_3$	—		4. 4460.512 22412.69	149.26	5. 4431.002 22561.95	153.86	7. 4400.986 22715.81

MULTIPLETS 41, 42 and 40 (*Continued*).

	4p \ 3d	$^4D_1$	107.00	$^4D_2$	149.53	$^4D_3$	153.90	$^4D_4$
42.	$^4D_1$	3. 3891.400 25690.44	107.05	4. 3875.256 25797.49		—		—
	260.31							
	$^4D_2$	3. 3931.232 25430.14	106.87	4. 3914.781 25537.01	149.61	3. 3891.978 25686.62		—
	494.40							
	$^4D_3$	—		4. 3992.046 25042.75	149.57	5. 3968.346 25192.32	153.84	4. 3944.259 25346.16
	439.47							
	$^4D_4$	—		—		4. 4038.816 24752.76	153.95	8. 4013.852 24906.71
40.	$^4S_2$	(3551.18) (28311.05)	106.66	1. 3517.929 28417.71	148.31	1. 3499.665 28566.02		—

	λ	Termcomb. x—y		ZEEMAN-effect	g_x theor.	g_x obs.	g_y theor.	g_y obs.	Remarks
41.	4431.002	3d $^4D_3$—4p $^4P_3$	L obs. calc.	(0.11) (0.34) (**0.57**) 1.03 1.26 **1.49** 1.71 1.94 (**0.53**) (0.11) (0.33) (**0.55**) 1.05 1.27 **1.49** 1.71 1.93	1.37	1.38	1.60	1.60	1)
	4400.986	3d $^4D_4$—4p $^4P_3$	L obs.	(**0.09**) (0.26) (0.43) **1.00** 1.17 1.34 1.51 1.69 1.86 (**0.00**) **1.08**	1.43	1.43	1.60	1.60	2)
	4400.101	3d $^4D_2$—4p $^4P_2$	L obs.	(0.27) (**0.80**) 0.93 **1.47** 2.00 **0.83** **1.49**	1.20	1.20	1.73	1.73	3)
	4371.334	3d $^4D_3$—4p $^4P_2$	L obs. calc.	(**0.18**) (0.54) **0.83** 1.19 1.55 1.91 (**0.18**) (0.55) **0.86** (**0.18**) (0.57) **0.85** 1.20 1.56 1.91	1.37	1.38	1.73	1.73	4)
	4352.198	3d $^4D_1$—4p $^4P_1$	L obs.	(1.33) 1.33 (1.32) 1.32	0.00	0.00	2.67	2.67	5)
	43 32.035	3d $^4D_2$—4p $^4P_1$	L obs.	**0.47** (**0.73**) 1.93 **0.47**	1.20	1. 20	2.67	2.67	6)
42.	4013.852	3d $^4D_4$—4p $^4D_4$	L obs.	(0.00) 1.43 (0.00) 1.44	1.43	1.43	1.43	1.43	7)
	3968.346	3d $^4D_3$—4p $^4D_3$	L obs. calc.	(0.00) 1.37 (**0.00**) **1.36** (0.02^5) (0.07^5) (**0.12^5**) 1.12^5 1.25^5 1.30^5 **1.35^5** 1.40^5 1.45^5	1.37	1.38	1.37	1.33	8)
	3944.259	3d $^4D_4$—4p $^4D_3$	L obs. calc.	(**0.02**) (0.09) (0.14) 1.29 1.34 1.40 1.46 1.51 **1.57** **1.47** (**0.00**) **1.57** (**0.04^5**) (0.14^5) (0.24^5) 1.18^5 1.28^5 1.37^5 1.47^5 1.57^5 **1.67^5**	1.43	1.43	1.37	1.33	9)

REMARKS.

1) Partial coincidence with 4331.194 (($s\,^4P_2$—$4p\,^4D_1$). The 0.53 components are weak. With the micro-projection apparatus 2 very weak components can yet be observed outside the 0.53 components.
2) "Pseudotriplet". Central component enlarged, in both the other large components decrease of intensity clearly to the outside.
3) Weak, partial coincidence with 4400.986 ($3d\,^4D_4$—$4p\,^4P_3$).
4) Partial coincidence with 4370.785.
5) Sharp doublet. See photogram 11.
6) Partial coincidence with 4331.194 ($4s\,^4P_2$—$4p\,^4D_1$), therefore not exactly measurable.
7) Sharp triplet.
8) All components diffuse.
9) Very asymmetric triplet, diffuse.

The following lines, combinations with the higher $4d$-terms, generally are weak lines of the spectrum. Therefore the separations of these lines are not resolved so finely, that all g-values of these levels could be calculated.

MULTIPLETS 23, 24, 30, 18 and 16.

	λ	Termcomb. $x—y$		ZEEMAN-effect	Remarks
24.	3826.826	4p $^4D_3$ — 4d $^4D_3$	L. obs.	(0.00) 1.37 (0.00) 1.44	1)
	3780.868	4p $^4D_4$ — 4d $^4D_4$	L. obs.	(0.00) 1.43 (0.00) 1.41	
	3763.565	4p $^4D_4$ — 4d $^4D_3$	L. obs.	**(0.02)** (0.09) (0.14) **1.29** 1.34 1.40 1.46 1.51 **1.57** **(0.00)** **1.51**	2)
23.	3535.364	4p $^4P_1$ — 4d $^4D_2$	L. obs.	**0.47** **(0.73)** 1.93 **0.60**	3)
	3514.426	4p $^4P_2$ — 4d $^4D_3$	L. obs.	**(0.18)** (0.54) **0.83** 1.19 1.55 1.91	4)
	3509.811	4p $^4P_1$ — 4d $^4D_1$	L. obs.	(1.33) 1.33 1.32⁵	5)
	3491.573	4p $^4P_3$ — 4d $^4D_4$	L. obs.	**(0.09)** (0.26) (0.43) **1.00** 1.17 1.34 1.51 1.69 1.86 **(0.00)** **1.09**	6)
	3491.290	4p $^4P_2$ — 4d $^4D_2$	L. obs.	(0.27) **(0.80)** 0.93 **1.47** 2.00 **(0.72⁵)** **1.49⁵**	7)
	3476.776	4p $^4P_3$ — 4d $^4D_3$	L. obs.	(0.11) (0.34) **(0.57)** 1.03 1.26 **1.49** 1.71 1.94 **1.46** **(0.53⁵)** **(0.53⁵)** **1.58**	8)
	3466.3₈₃	4p $^4P_2$ — 4d $^4D_1$	L. obs.	**(0.87)** 0.87 **2.60** **2.33** **(0.74)** **(0.74)** **2.43**	9)

MULTIPLETS 23, 24, 30, 18 and 16 (*Continued*).

	λ	Termcomb. $x—y$		ZEEMAN-effect	Remarks
30.	3588.483	4p $^4D_4$ — 4d $^4F_5$	L.	(**0.05**) (0.14) (0.24) (0.33) **1.00** 1.10 1.19 1.29 1.38 1.48	10)
			obs.	(**0.00**) **1.14** [1.57 1.67	
	3582.397	4p $^4D_2$ — 4d $^4F_3$	L.	(**0.09**) (0.26) **0.77** 0.94 1.11 1.29	11)
			obs.	**0.86** (0.00) 0.98	
	3581.652	4p $^4D_1$ — 4d $^4F_2$	L.	(**0.20**) 0.20 **0.60**	12)
			obs.	(**0.31**^{5}) 0.31^5 **0.93**	
			calc.	(**0.31**) 0.31 **0.93**	
	3576.658	4p $^4D_3$ — 4d $^4F_4$	L.	(**0.07**) (0.20) (0.33) **0.90** 1.04 1.17 1.30 1.44 1.57	13)
			obs.	(**0.00**) **1.10**	
	3548.530	4p $^4D_2$ — 4d $^4F_2$	L.	0.00 (0.40) (**1.20**) **0.80** 1.60	14)
			obs.	**0.88**	
			calc.	(0.29) 0.33 (**0.87**) **0.91** 1.49	
	3520.041	4p $^4D_3$ — 4d $^4F_3$	L.	(0.17) (0.51) 0.51 (**0.86**) 0.86 **1.20** 1.54 1.89	15)
			obs.	**0.77**	
18.	3565.071	4p $^4D_1$ — 4d $^4P_2$	L.	(**0.87**) 0.87 **2.60**	16)
			obs.	(**0.75**^{5}) 0.75^5 **2.26**^{5}	
			calc.	(**0.75**^{5}) 0.75^5 **2.26**^{5}	
16.	3979.391	4p $^4S_2$ — 4d $^4P_1$	L.	(**0.33**) **1.66** 2.33	17)
			obs.	(**0.31**) **1.69** 2.29	
			calc,	(**0.31**) **1.69** 2.31	
	3932.567	4p $^4S_2$ — 4d $^4P_2$	L.	(0.13) (**0.40**) 1.60 **1.87** 2.13	18)
			obs.	(**0.73**) 1.26 **1.75** 2.25	
			calc.	(0.24^5) (**0.73**^{5}) 1.26^5 **1.75**^{5} 2.24^5	

REMARKS.

1) Diffuse triplet.
2) Diffuse triplet.
3) Diffuse doublet.
4) Completely diffuse.
5) Diffuse doublet.
6) "Pseudotriplet". Central component enlarged; in both the other large components decrease of intensity clearly to the outside. Partial coincidence with 3491.290 ($4p\,^4P_2$—$4d\,^4D_2$).
7) Partial coincidence with 3491.573 ($4p\,^4P_3$—$4d\,^4D_4$).
8) Asymmetric quartet.
9) Asymmetric quartet, coincidence with 3466.383 ($4p\,^4D_4$—$4d\,^4F_3$).
10) "Pseudotriplet". Central component enlarged; in both the other large components decrease of intensity clearly to the outside.
11) Diffuse, asymmetric triplet.
12) Sharp quartet. Calculation with $g4p\,^4D_1 = 0$ and $g4d\,^4F_2 = 0.62$.
13) "Pseudotriplet". Central component enlarged; in both the other large components decrease of intensity clearly to the outside.
14) Diffuse doublet. Calculation with $g4p\,^4D_2 = 1.20$ and $g4d\,^4F_2 = 0.62$.
15) Diffuse doublet.
16) Sharp quartet. Calculation with $g4p\,^4D_1 = 0$ and $g4d\,^4P_2 = 1.51$.
17) Sharp sextet. Calculation with $g4p\,^4S_2 = 2.00$ and $g4d\,^4P_1 = 2.62$.
18) Octet. Calculation with $g4p\,^4S_2 = 2.00$ and $g4d\,^4P_2 = 1.51$. See photogram 14.

MULTIPLETS 21, 27, 13 and 14.

	λ	Termcomb.		ZEEMAN-effect	Remarks
21.	3946.140	4p $^2D_2$ — 4d $^2D_3$	L	(**0.20**) (0.60) 0.60 1.00 1.40 **1.80**	1)
			obs.	**1.17** (**0.00**) **1.09**	
	3925.753	4p $^2D_2$ — 4d $^2D_2$	L	(0.00) 0.80	2)
			obs.	(0.00) 0.86	
27.	3559.545	4p $^2D_3$ — 4d $^2F_4$	L	(**0.03**) (0.09) (0.14) **1.00** 1.06 1.11 1.17 1.23 1.29	3)
			obs.	(**0.00**) **1.04**^{5}	
	3545.642	4p $^2D_2$ — 4d $^2F_3$	L	(**0.03**) (0.09) 0.77 0.83 0.89 **0.94**	4)
			obs.	(**0.00**) **0.94**	
13.	3388.566	4p $^2S_1$ — 4d $^2P_2$	L	(**0.33**) **1.00** 1.67	5)
			obs.	(**0.19**^{5}) **1.10** —	
			calc.	(**0.19**^{5}) **1.09**^{5} 1.48^5	
14.	3307.228	4p $^2P_1$ — 4d $^2P_1$	L	(0.00) 0.67	
			obs.	(0.12) 0.82	6)
	3293.628	4p $^2P_2$ — 4d $^2P_2$	L	(0.00) 1.33	
			obs.	(**0.00**) **1.26**	
			calc.	(0.03) (**0.07**) 1.20 **1.26** 1.32	7)

REMARKS.

1) Asymmetric triplet. Possible coincidence, therefore not exactly measurable.
2) Sharp triplet.
3) Strong, diffuse triplet.
4) Strong triplet. Coincidence with 3545.855 therefore not exactly measurable.
5) Calculation with $g4p\,^2S_1 = 1.68$ and $g4d\,^2P_2 = 1.29$.
6) Rather sharp quartet.
7) Calculation with $g4p\,^2P_2 = 1.23$ and $g4d\,^2P_2 = 1.29$.

INTERCOMBINATIONS.

λ	Termcomb.		ZEEMAN-effect	Remarks
4228.150	4s $^4P_2$ — 4p $^2D_3$	L	(**0.27**) **0.40** (0.80) 0.93 1.47 2.00	1)
		obs.	(**0.25**^{5})	
		calc.	(**0.25**) **0.50** (0.74) 0.99 1.49 1.98	
4201.946	4s $^4P_1$ — 4p $^2D_2$	L	**0.13** (**0.93**) 1.73	2)
		obs.	**0.00** (**0.88**)	
		calc.	**0.02** (**0.88**) 1.78	
3974.496	4s $^4P_2$ — 4p $^2P_2$	L	(0.20) (**0.60**) 1.13 **1.54** 1.93	3)
		obs.	(**0.73**) —	
		calc.	(0.25^5) (**0.75**^{5}) 0.97^5 **1.48**^{5} 1.98^5	
3650.991	4p $^4P_1$ — 5s $^2P_2$	L	(**0.67**) **0.67** 2.00	4)
		obs.	**0.77**	
		calc.	(**0.61**^{5}) **0.81**^{5} 2.04^5	

REMARKS.

1) Both components of the doublet enlarged, and decrease of intensity clearly to the outside. Calculation with $g4s\,^4P_2 = 2.67$ and $g4p\,^2D_3 = 1.24$.
2) Weak triplet. Calculation with $g4s\,^4P_1 = 2.67$ and $g4p\,^2D_2 = 0.90$.
3) Coincidence with 3974.496 ($4p\,^2P_1$—$4d\,^2D_2$). Calculation with $g4s\,^4P_2 = 1.73$ and $g4p\,^2P_2 = 1.23$.
4) Very weak doublet. Calculation with $g4p\,^4P_1 = 2.67$ and $g5s\,^2P_2 = 1.43$.

UNCLASSIFIED LINES.

λ	ZEEMAN-effect		Remarks	λ	ZEEMAN-effect		Remarks
4609.634	obs.	(0.00) 1.06	1)	4042.889	obs.	(0.00) 0.80	15)
4598.86	obs.	0.77^5	2)	3994.885	obs.	(0.61) 1.37	16)
4589.901	obs	(0.00) 0.90	3)	3803.231	obs.	(0.00) 1.17	17)
4481.833	obs.	(0.00) 1.19	4)	3766.136	obs.	(0.00) 1.32	18)
4474.998	obs.	(0.00) 0.84	5)	3753.572	obs.	(0.30) 0.94^5	19)
4448.953	obs.	1.05 (0.00) 1.32	6)	3724.547	obs.	0.82^5	20)
4439.369	obs.	(0.00) 0.83	7)	3718.253	obs.	(0.00) 0.91	21)
4433.867	obs.	(0.00) 1.06	8)	3660.485	obs.	1.29 (0.00) 1.21	22)
4385.07	obs.	(0.38) 0.87	9)	3639.872	obs.	(0.00) 1.05	
4370.758	obs.	(0.00) 0.80		3561.063	obs.	(0.00) 1.04	23)
4367.782	obs.	(0.54) 1.49	10)	3545.855	obs.	(0.00) 0.97	24)
4277.558	obs.	(0.00) 1.09	11)	3478.260	obs.	(0.00) 1.71	
4237.235	obs.	1.53^5 (0.77^5) (0.77^5) 1.60	12)	3376.468	obs.	(0.00) 1.12	
4131.763	obs.	(0.00) 0.77	13)	3350.972	obs.	(0.00) 0.80	
4072.009	obs.	(0.00) 1.18					
4052.961	obs.	(0.33) **1.00** 1.67	14)				

REMARKS.

1) Sharp triplet. See photogram 4.
2) Diffuse doublet.
3) Rather sharp triplet.
4) Sharp triplet.
5) Sharp triplet.
6) Asymmetric triplet. See photogram 7.
7) Sharp triplet.
8) Rather diffuse triplet.
9) Rather sharp quartet Calculation with $g = 2$ ($j = 1$) and $g = 1.25$ ($j = 2$) gives (0.37^5) 0.87^5. Perhaps combination with $^2S_1$.

10) Calculation with $g=2$ ($j=1$) and $g=0.94$ ($j=1$) gives (0.53) 1.47.
11) Diffuse strong triplet.
12) Diffuse quartet.
13) Diffuse triplet.
14) Calculation with $g^2S_1 = 2.00$ and $g^2P_2 = 1.33$ gives (0.33) 1.00 1.67 sharp sextet. Perhaps terms of the configuration upon basicterm ^1D or ^1S. See photogram 13.
15) Sharp triplet.
16) Sharp quartet. Calculation with $g^2S_1 = 2.00$ and $g^2P_1 = 0.76$ gives (0.62) 1.38. Perhaps terms of the configuration upon basicterm ^1D or ^1S.
17) Rather sharp triplet.
18) Coincidence with 3765.313 ($4p\,^4P_3$—$5s\,^4P_3$).
19) Quartet. Calculation with $g=0.65$ ($j=1$) and $g=1.25$ ($j=1$) gives (0.30) 0.95.
20) Diffuse doublet.
21) Strong, rather sharp triplet.
22) Diffuse asymmetric triplet.
23) Strong triplet.
24) Strong triplet. Coincidence with 3545.642.

5. *g-sums.*

In § 3 we showed that anomalous g-values can occur. According to theoretical considerations of HEISENBERG [1]), PAULI [2]) and LANDÉ [3]) one expects however, although the g-values of the individual terms deviate, that the g-sum of certain term groups will remain constant. The experimental data are not yet extensive; we refer to the notes of BACK [4]), GREEN and LORING [5]), SHENSTONE [6]). From the terms which arise from the coupling of one electron, one must join to groups the terms with equal j, then the sum of the g-values of the terms of such a group is constant and can be calculated beforehand. This sum is equal to the sum of LANDÉ's g-values for these terms.

In the following tables the theoretical g-values (g_L) and the observed g-values (g_{obs}) are given for the terms arising from the coupling of a $4s$, $4p$ and $5s$ electron. The last column shows the g-sums obtained from LANDÉ's values and the observed g-sums.

In the case of the *3d-terms* the g-sum rule cannot be checked because all terms are not yet found.

The terms of the $4s$-electron all have normal g-values and the g-sum rule is of course fulfilled.

Among the 13 terms arising from the coupling of the *4p-electron* there are 8 quartet terms of which 7 have normal g-values, while the 5 doublet

1) HEISENBERG, Zeitschr. f. Phys., **8**, 273, 1922.
2) PAULI, Zeitschr. f. Phys., **16**, 155, 1923.
3) LANDÉ, Zeitschr. f. Phys., **19**, 112, 1923; Ann. der. Phys., **76**, 273, 1925.
4) BACK, Ann. der Phys., **76**, 317, 1925.
5) GREEN and LORING, Phys. Rev., **30**, 574, 1927.
6) SHENSTONE, Phys. Rev., **30**, 255, 1927.

TERMS OF THE 4S-ELECTRON.

		$^4P_3$	$^4P_2$	$^4P_1$	$^2P_2$	$^2P_1$	
j = 1	g_L			2.67		0.67	Σg_L = 3.34
	$g_{obs.}$			2.67		0.67	$\Sigma g_{obs.}$ = 3.34
j = 2	g_L		1.73		1.33		Σg_L = 3.06
	$g_{obs.}$		1.73		1.33		$\Sigma g_{obs.}$ = 3.06
j = 3	g_L	1.60					Σg_L = 1.60
	$g_{obs.}$	1.60					$\Sigma g_{obs.}$ = 1.60

TERMS OF THE 5S-ELECTRON

		$^4P_3$	$^4P_2$	$^4P_1$	$^2P_2$	$^2P_1$	
j = 1	g_L			2.67		0.67	Σg_L = 3.34
	$g_{obs.}$			2.53		0.81	$\Sigma g_{obs.}$ = 3.34
j = 2	g_L		1.73		1.33		Σg_L = 3.06
	$g_{obs.}$		1.63		1.43		$\Sigma g_{obs.}$ = 3.06
j = 3	g_L	1.60					Σg_L = 1.60
	$g_{obs.}$	1.60					$\Sigma g_{obs.}$ = 1.60

TERMS OF THE 4P-ELECTRON.

		$^4P_3$	$^4P_2$	$^4P_1$	$^4D_4$	$^4D_3$	$^4D_2$	$^4D_1$	$^4S_2$	$^2D_3$	$^2D_2$	$^2P_1$	$^2P_2$	$^2S_1$	
j = 1	g_L			2.67				0.00				0.67		2.00	Σg_L = 5.34
	$g_{obs.}$			2.67				0.00				0.99		1.68	$\Sigma g_{obs.}$ = 5.34
j = 2	g_L		1.73				1.20		2.00		0.80		1.33		Σg_L = 7.06
	$g_{obs.}$		1.73				1.20		2.00		0.90		1.23		$\Sigma g_{obs.}$ = 7.06
j = 3	g_L	1.60				1.37				1.20					Σg_L = 4.17
	$g_{obs.}$	1.60				1.33				1.24					$\Sigma g_{obs.}$ = 4.17
j = 4	g_L				1.43										Σg_L = 1.43
	$g_{obs.}$				1.43										$\Sigma g_{obs.}$ = 1.43

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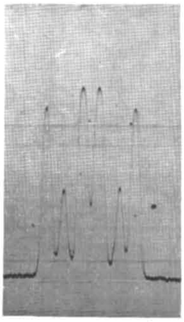
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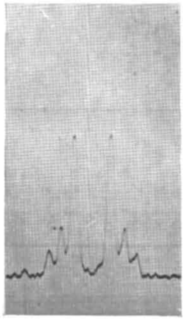
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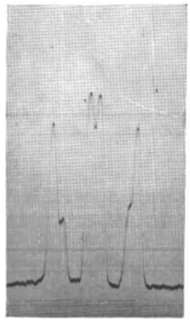
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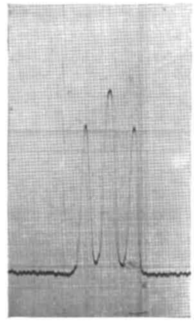
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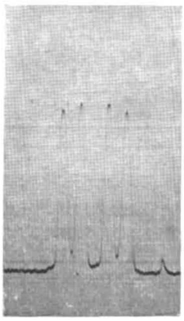
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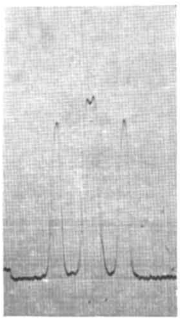
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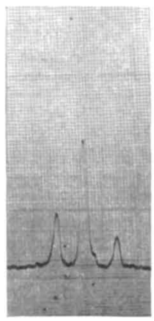
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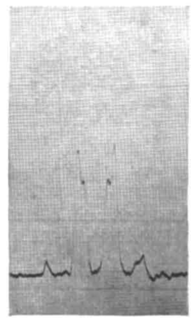
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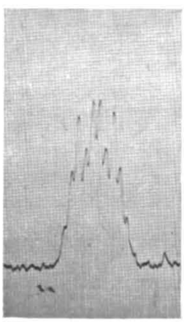
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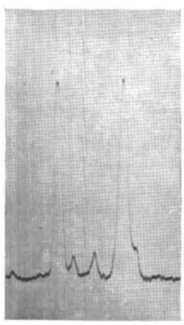
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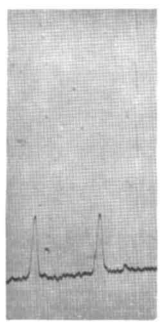
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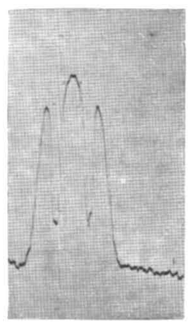
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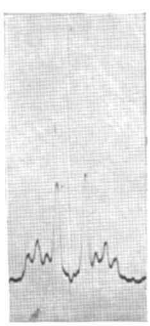
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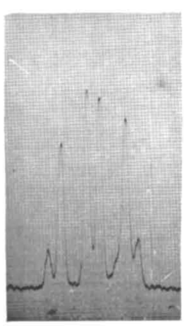
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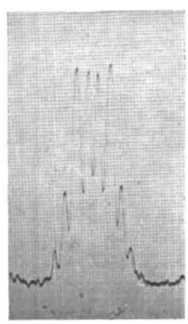
16

terms all have anomalous g-values. The agreement of the g-sums is excellent.

The terms of the *5s-electron* all have anomalous g-values in contradiction with the 4s-electron (thus Preston's rule does not hold here).

Some terms of the *4d-electron* are uncertain, thus it is impossible to check the g-sum rule in this case. The $^4F_5$-term is the only term with $j = 5$. According to the g-sum rule this term must have a normal g-value, which has been found.

The asymmetries of the ZEEMAN-pattern seem to be stronger when anomalous g-values appear. (See table.)

6. *Summary.*

The ZEEMAN-effect of 110 *Ar II* lines has been investigated. The analysis of the spectrum given by one of us (DE BR.) has been checked by the ZEEMAN-effect. The ZEEMAN-effect shows the existence of normal and anomalous couplings in the *Ar II* spectrum ; the coupling is anomalous in the higher energy levels. The g-sum rule has been checked for several term groups.

Laboratory „Physica" of the University of Amsterdam.

June 1928.

The photograms are made with a photometer (made by the firm of ZEISS), provided with photo-electric cell and electrometer.

Photograms.

1.	4764.848	$4s\,^2P_1$—$4p\,^2P_2$	9.	3729.300	$4s\,^4P_3$—$4p\,^4S_2$
2.	4726.846	$4s\,^2P_2$—$4p\,^2D_2$	10.	4379.675	$4s\,^4P_1$—$4p\,^4D_1$
3.	4657.889	$4s\,^2P_2$—$4p\,^2P_1$	11.	4352.198	$3d\,^4D_1$—$4p\,^4P_1$
4.	4609.634		12.	4348.062	$4s\,^4P_3$—$4p\,^4D_4$
5.	4579.347	$4s\,^2P_1$—$4p\,^2S_1$	13.	4052.961	
6.	4545.040	$4s\,^2P_2$—$4p\,^2P_2$	14.	3932.567	$4p\,^4S_2$—$4d\,^4P_2$
7.	4448.953		15.	3928.599	$4s\,^4P_1$—$4p\,^4S_2$
8.	4430.185	$4s\,^4P_1$—$4p\,^4D_2$	16.	4425.995	$4s\,^4P_2$—$4p\,^4D_3$