# Computed linear and circular polarization rates of solar spectral lines after Delbouille's atlas in the frame of the weak field theory from $\lambda$ 3700 Å to $\lambda$ 8800 Å

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### Abstract

We present in this paper a computation of the polarization rates of solar spectral lines from  $\lambda$  3000 Å to  $\lambda$  8800 Å using Delbouille's atlas (at disk centre) and the weak field theory of the Zeeman effect. Linear and circular polarization profiles and rates are calculated in the frame of this theory using equivalent Lande factors g<sup>\*</sup>. Lines are identified by the Moore table.

### **Keywords**

Solar spectrum, visible, disk centre, linear polarization, circular polarization.

## **Description of the spectra**

We used the solar atlas of Delbouille *et al* (1973), from  $\lambda$  3000 Å to  $\lambda$  10000 Å (step 2 mÅ) at disk centre ( $\mu = 1.0$ ), taken at the Jungfraujoch station (Switzerland, a very high and dry site). We restricted the wavelength range to  $\lambda$  3700 - 8800 Å for which we have the line identification provided by the Moore table (Moore *et al*, 1966) and the equivalent Lande factors g\*. We quantified the sensitivity to the Zeeman effect using the weak field theory (Landi, 1992, Stenflo, 1994). In that frame, the Stokes V and (Q<sup>2</sup>+U<sup>2</sup>)<sup>1/2</sup> profiles are given by:

for a longitudinal field (along the line of sight):

$$V(\lambda) = -\Delta\lambda_B (dI/d\lambda)$$

for a transverse field (orthogonal to the line of sight):

 $(Q(\lambda)^2 + U(\lambda)^2)^{1/2} = 1/4 \Delta \lambda_B^2 |d^2 I/d\lambda^2|$ 

where  $\Delta\lambda_B = [e / (4\pi \text{ m C})] \lambda^2 g^* B = 4.67 \ 10^{-13} \lambda^2 g^* B$  (numerically with B in Gauss and  $\lambda$  in Angström) is the Zeeman splitting (which must be small in comparison to the Doppler width of the considered line).

The circular polarization rate is V/I; it is maximum (in absolute value) at the inflexion points of the line profiles. The linear polarization rate is  $(Q^2+U^2)^{1/2}/I$ ; it is maximum in the line centre.

The spectra are displayed by pages of 100 Å, each displaying bands of 10 Å. Delbouille's spectrum is shown in **black**. Intensities are normalized to the adjacent continuum I<sub>c</sub>. The blue numbers are equivalent Lande factors  $g^*$ . The line identification follows the convention of the Moore *et al* (1966) table (slash for main contributors in case of a blend, dash for blends, parenthesis for masked lines, p for predicted line, see page XVIII of their book for details). The circular polarization spectrum V/I is drawn in red ; it was calculated using the first formula above for  $B = 1000 \text{ G} (10^{-4} \text{ T})$  and for  $g^*=1.0$ ; the red vertical bars provide the minima and the maxima of V/I (located at line inflexion points) for B = 1000 G and take into account the equivalent Lande factor  $g^*$  of each line (V/I is proportional to  $g^*$  and to B). The linear polarization spectrum ( $Q^2+U^2$ )<sup>1/2</sup>/I is drawn in green ; it was computed using the second formula above for  $B = 1000 \text{ G} (10^{-4} \text{ T})$  and for  $B = 1000 \text{ G} (10^{-4} \text{ T})$  and for  $g^*=1.0$ ; the green vertical bars

provide the maxima of  $(Q^2+U^2)^{1/2}/I$  (located at line centre) and use the equivalent Lande factor g\* of each line ;  $(Q^2+U^2)^{1/2}/I$  is proportional to g\*<sup>2</sup> and to B<sup>2</sup> and is, in general, much smaller than V/I. For a given magnetic field B, the maximum polarization rates of V/I and  $(Q^2+U^2)^{1/2}/I$  can be easily deduced from the plots : just multiply by the factors (B/1000) or (B/1000)<sup>2</sup>, respectively.

This PDF document is based on 2280 x 3324 pixel images and must be zoomed to see the details. Original plates (GIF format) are available here:

https://www.lesia.obspm.fr/perso/jean-marie-malherbe/spectrevisible/spectreZE/index.html

The spectra are displayed below from 3700 Å to 8800 Å, by pages of 100 Å bandpass, each page showing 10 bands of 10 Å.

Wavelength intervals  $[\lambda 1, \lambda 2]$  (in Å), see page number :

3700-3800 : **3** / 3800-3900 : **4** / 3900-4000 : **5** 

4000-4100 : **6** / 4100-4200 : **7** / 4200-4300 : **8** / 4300-4400 : **9** / 4400-4500 : **10** 

4500-4600 : **11** / 4600-4700 : **12** / 4700-4800 : **13** / 4800-4900 : **14** / 4900-5000 : **15** 

5000-5100 : **16** / 5100-5200 : **17** / 5200-5300 : **18** / 5300-5400 : **19** / 5400-5500 : **20** 

5500-5600 : 21 / 5600-4700 : 22 / 5700-5800 : 23 / 5800-5900 : 24 / 5900-6000 : 25

6000-6100 : **26** / 6100-6200 : **27** / 6200-6300 : **28** / 6300-6400 : **29** / 6400-6500 : **30** 

6500-6600 : **31** / 6600-6700 : **32** / 6700-6800 : **33** / 6800-6900 : **34** / 6900-7000 : **35** 

7000-7100 : **36** / 7100-7200 : **37** / 7200-7300 : **38** / 7300-7400 : **39** / 7400-7500 : **40** 

7500-7600 : 41 / 7600-7700 : 42 / 7700-7800 : 43 / 7800-7900 : 44 / 7900-8000 : 45

8000-8100 : 46 / 8100-8200 : 47 / 8200-8300 : 48 / 8300-8400 : 49 / 8400-8500 : 50

8500-8600 : **51** / 8600-8700 : **52** / 8700-8800 : **53** 

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01.0 1.0 1.0 1.0	-S	<u>8</u>					z ż	3				5	-Sun	<u></u>		-cn ATMH2C	ATMH2	ZHMTA	CIN
s 1// 0.5			<u>~ -</u>																
-0.5	7920			7921	792	22	7923		7924		7925 WELENGTH (Å)	792	5	7927		7928		7929	7930
1.5 1.0	ATMH20	Atlas f	rom D	elbouille e	t al (µ=1.0).	, V/I & SQRT	(Q <sup>2</sup> +U <sup>2</sup> )/I for	g=1 & B:	=1000 G,	polarizatio	n rates for B	=1000 G (bar	s), line iden Ş	tification (Mo	ore table), Sj	Lande fac	tors, from	7930 Å to 7	'940 Å
0.5 N/I 20KI						$\bigvee$	V							$\sim$	C				
0.0 -0.5	7070			7071		8	7011		7074		7075	707		7017		7078		7010	7040
1.5	7930	Atlas f	rom D	elbouille e	$t al (\mu=1.0),$ $\stackrel{\scriptstyle if}{\underset{\scriptstyle \pm}{\overset{\scriptstyle if}{\overset{\scriptstyle \pm}{\overset{\scriptstyle \pm}}}} = \underbrace{\underset{\scriptstyle \pm}{\overset{\scriptstyle \pm}{\overset{\scriptstyle \pm}}}}$	. <u>V/I &amp; SQRT</u>	/955 (Q <sup>2</sup> +U <sup>2</sup> )/I for	g=1 & B		w polarizatio -	WELENGTH (Å) n rates for B	=1000 G (bar	s), line iden	tification (Mo	ore table),	Lande fac	tors, from	7940 Å to 7	7940 1950 Å
1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0				$\sqrt[4]{}$	<u> </u>	~	<u>5 </u>		۳ آ	<u>ģ</u>	<u>.</u>		<i></i>	5	<u> </u>			1	
nsity I/Ic, V,				-√∕- ≣												-		~ ~	-
<u></u> <u></u>	7940	Atlas f	rom D	o 7941 Velbouille e	794 t al (µ=1.0),	12 , V/I & SQRT	7943 (Q²+U²)/I for	g=1 & B:	7944 =1000 G,	w/ polarizatio	7945 WELENGTH (Å) n rates for B	7941 =1000 G (bar	s), line iden	7947 tification (Mo	ore table),	7948 Lande fac	tors, from	7949 7950 Å to 7	7950 '960 Å
08T(02+U2)/		NO T		ATMH20	- Zq		<u>Fer</u>	ND - VILY	CN CN	<u>S</u>	- Let		DZHWLY	E S	Ę	- S			3
s 1//s 0.5							-											~~	-
-0.5	7950			7951	795	52	7953		7954		7955 WELENGTH (Å)	795	5	7957		7958		7959	7960
1.5 1.0		Atlas f	TOM D	elbouille e	t al (µ=1.0),	, V/I & SQRT	(Q <sup>2</sup> +U <sup>2</sup> )/I for ozhwuy Vozhwuy	g=1 & B ਤ੍	=1000 G,	polarizatio RHNU	n rates for B	=1000 G (bar	s), line iden	tification (Mo हु	ore table),	Lande fac	tors, from CHMLE	7960 Å to 7	1970 Å
0.5 N/l' 20KI			~								-								
0.0	7960			7961			7063		7064		7065	7061		7067		7068		7959	7970
1.5		Atlas f	rom D	elbouille e	$t al (\mu=1.0),$	. V/I & SQRT	(Q²+U²)/I for	g=1 & B:	=1000 G,	w/ polarizatio	NELENGTH (Å)	=1000 G (bar	s), line iden	tification (Mo	ore table),	Lande fac	tors, from	7970 Å to 7	4 080°
1.0 1.0 1.0 0.5		<u>_</u>	<u> </u>		<u> </u>	<u>q</u>		0 	<u>- 4</u>	<u> </u>	<u> </u>	<u></u>	<u> 14</u>	<u></u>		٩	5	5	<u>9</u> .5
>'0/  0.0		~~													-			<u>~~</u>	
<u>e</u> t	7970	Atlas f	rom D	7971 Velbouille e	797	72 , V/I & SQRT	7973 (Q²+U²)/I for	g=1 & B:	7974 =1000 G,	w/ polarizatio	7975 WELENGTH (Å) n rates for B	7971 =1000 G (bar	s), line iden	7977 tification (Mo	ore table),	7978 Lande fac	tors, from	7979 7980 Å to 7	7980 '990 Å
	XHMUA	Тинас		201	NR		Ę	MLY	ATMH2X	-CN			-CN	NIS	NUY	-CN ATMH26			
s 1/1° /1/1°										<u>~ ~</u>				_					
-0.5	7980			7981	798	32	7983		7984		7985 WELENGTH (Å)	798	5	7987		7988		7989	7990
I∕(±∩+zð)		Atlas f	rom D	elbouille e	t al (µ=1.0),	, V/I & SQRT 즉	(Q²+U²)/I for	g=1 & B ਰ	=1000 G, 02HWLY	polarizatio	n rates for B 장	=1000 G (bar	s), line iden	tification (Mo	ore table),	Lande fac	tors, from	7990 Å to 8	3000 Å
c, V/I, SQRT.										V								$\bigvee_{\mathbf{\Lambda}}$	
0.0 -0.5				7001						<u>√``</u>									
	7990			/991	799	92	7993		7994		7995 VELENCTH (1)	7996	5	7997		7998		7999	8000

1.5	Atl	as from	Delbouille	et al (µ=	:1.0), V/I	& SQRT(Q <sup>:</sup> हुद्दि	+U <sup>2</sup> )/I for	g=1 & 1	<u>3=1000 G</u> , ਤ੍	polarizo	ation rates	for B=1	000 G (b	ars), lin	e identifi NNS	cation (M	oore table	e), Lande Othur	factors, fr ह	om 8000 Å	<u>to 8010 Å</u>	
0.5	V																					
-0.5	,		8001		8002		8003		8004		8005		80	206		8007		8008		8009		8010
1.5	Atl	<u>as from</u>	Delbouille	et al (µ=	:1.0), V/I	<u>&amp; SQRT(Q</u> : 중	+U <sup>2</sup> )/I for	g=1 & 1	3=1000 G,	, polarizo	wavelength ation rates	for B=1	000 Ç (b	ars), lin	e identifi	cation (M	oore table	e), Lande	factors, fr	om 8010 Å	<u>to 8020 Å</u>	
0.5	1		. <u>)                                    </u>		<u> </u>			<u>э.</u>	<u>حراجہ د</u>	-	<u> </u>						<u></u>					
0.0													-									
1.5 E	o Atl	as from 옵	8011 Delbouille	et al (µ=	8012 :1.0), V/I	& SQRT(Q'	8013 +U <sup>2</sup> )/I for	g=1 & I	8014 3=1000 G,	, polarizo	8015 WAVELENGT	H (Å) for B=1	80 000 G (b	ars), lin	e identifi	B017	oore table	8018 e), Lande	factors, fr	8019 om 8020 Å	to 8030 Å	8020
0.5		- Per	<u> </u>	<u>z</u>		MIN	MIN MIN		Mar Har	~~			MIX-		5		5	S.E.		N. C.	100 FF	
0.0																		~	Å-			
1.5	c Atl	as from	8021 Delbouille	et al (µ=	8022 1.0), V/I	& SQRT(Q	8023 +U <sup>2</sup> )/l for	g=1 & 1	8024 3=1000 G,	. polarizo	8025 WAVELENGT ation rates	H (Å) for B=1	80 000 G (b	026 ars), lin	e identifi	8027 cation (M	oore table	8028 a), Lande	factors, fr	8029 om 8030 Å	to 8040 Å	8030
1.0	S	<u>8</u>			MA			ATMH2		- NII		LATMH2			ATMH2			ATMH2	<u>.</u>		LATMH2	<u>×</u>
0.0			-							_												
-0.5	c	as from	8031 Delbouille	et al (u=	8032 :1.0) V/I	& SORTIO	8033	a=1 & 1	8034 3=1000 G	nolarizo	8035 WAVELENGT	H (Å)	80 000 G (b		e identifi	8037	oore table	8038	factors fr	8039 om 8040 å	to 8050 Å	8040
1.5	5		Ę	<u></u>			TO // IOI	VIIIIH20		- E		DCHWLY		Ę	- ATMH20	<u> </u>	Ę	<u> </u>		UT UT UT	No coco A	594
0.5														V 1				<u> </u>				
-0.5	0		8041		8042		8043		8044		8045 WAVELENGT	н (Å)	80	046		8047		8048		8049		8050
1.5	Ati	as from	Delbouille 3	et al (µ=	:1.0), V/I	& SQRT(Q	+U²)/I for 롱 봉	g=1 & 1	3=1000 G,	polarizo	ation rates	for B=1	000 G (b	ars), lin	e identifi	sation (Mi	oore table	ə), Lande	factors, fr	om 8050 A	to 8060 A	
0.5																						
-0.5	5		8051		8052		8053		8054		8055 WAVELENGT	н (Å)	80	556		8057		8058		8059		8060
1.5	Atl	as from	Delbouille F	et al (µ=	1.0), V/I	& SQRT(Q	+U <sup>2</sup> )/I for IHZ IHAP	g=1 & 1	3=1000 G, ਤ੍	, polarizo	ation rates	for B=1	000 G (b	ars), lin	e identifi	cation (M	oore table E	e), Lande	factors, fr	om 8060 Å	to 8070 Å	SUN
0.5																						
-0.5			8061		8062		8063		8064		_8065		80	266		8067		8068		8069		8070
1.5	Atl	as from	Delbouille	et al (µ=	<u>:1.0), V/I</u> E	& SQRT(Q <sup>1</sup>	±+U²)/I for ₹	g=1 & 1	3 <u>=1000 G</u> , 3	, polarizo	wavellengti ation rates	H (A) for B=1 E = = = =	000 G (b	ars), lin	e identifi	cation (M	oore table	e), Lande ( 5 5	factors, fr	<u>∾m 8070 Å</u>	to 8080 Å	·
0.5		~~~			~~~			-			>							<u>.</u>				
-0.5											 	 }						-				
1.5	o Atl	as from	8071 Delbouille	et al (µ=	8072 :1.0), V/I	& SQRT(Q	8073 +U <sup>2</sup> )/I for	g=1 & I	8074 3=1000 G,	, polarizo	8075 WAVELENGT	H (Å) for B=1	80 000 G (b	ars), lin	e identifi	8077 pation (M	oore table	8078 e), Lande	factors, fr	8079 om 8080 Å	to 8090 Å	8080
0.5		ξ. Ψ. ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	<u>, 5</u>	<u> </u>	Ę		<u> 8 8</u>		5			<u>۳</u>	<u> </u>	<u>5</u>			<u></u>		<u> </u>		<u></u>	<u> </u>
0.0		~~										<u> </u>										
808/ 1.5	o Ati	as from	8081 Delbouille	et al (μ=	8082 1.0), V/I	& SQRT(Q	8083 +U²)/I for	g=1 & j	8084 3=1000 G,	, polarizo	8085 WAVELENGT ation rates	H (Å) for B=1	80 000 G (b	ars), lin	e identifi	8087 cation (M	oore table	8088 e), Lande	factors, fr	8089 om 8090 Å	to 8100 Å	8090
1.0		<u> </u>	HMLY	<u></u>	<u> </u>		-//si				Nns	HMIY			HMIN	-		<u>ş</u>		-//M	R.	<u>5</u>
0.0									<u>~</u>							<b>√</b> ∕∽ ≧						
-0.5	0		8091		8092	2	8093		8094		8095		80	396		8097		8098		8099		8100







WAVELENGTH (Å)



	1.5 0ZHWUY NNS	Auds from Delbouille	<u>ει αι (μ=1.0), ν/1 α</u>	- 100 g = 1	<u>a b-1000 G, pc</u> <u>5</u>			entrication (moore	tuble), Lunde Tuctors,		Ę
	0.5		V V								
	.0			<u> </u>	_						
	8500	8501 Atlas from Delbouille	8502 et al (μ=1.0), ∨/1 &	8503 : SQRT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1	8504 & B=1000 G, pc	8505 WAVELENGTH (Å) plarizati⊙n rates for B=10	8506 OO G (bars), line id	8507 entification (Moore	8508 table), Lande factors,	8509 from 8510 Å to 8520	85 ) Å
	1.0		Amhac	- CN			CHWUY	-ror-	<u> </u>	<u> </u>	ATMH20
	0.5				V	V					
$ \frac{1}{10^{2}} = 1$	).0 ).5				- The						
$ \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1$	8510 A	8511 Atlas from Delbouille	8512 et al (μ=1.0), V/I &	8513 850RT(Q <sup>2</sup> +U <sup>2</sup> )/I for q=1	8514 & B=1000 G, pc	8515 WAVELENGTH (Å) plarization rates for B=10	8516 00 G (bars), line id:	8517 entification (Moore	8518 table), Lande factors,	8519 , from 8520 Å to 8530	85 Å
$ \frac{1}{10^{10}} \frac{1}{10^{10}}$	.0	N				CN	- CA1 - CA1 - CA1	FEI N	-EELE		N NNS
Image: second	.5							V			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	.0		-	-						-	
$ \frac{1}{1} = 1$	8520	8521	8522	8523	8524 & B=1000.C. pc	8525 WAVELENGTH (Å)	8526	8527	8528	8529 from 8530 Å to 8540	8
$ \frac{1}{2} = 1$	.5 NN NO NO			<u>ę</u>		Sun Sun	<del>وه و (ديارو), اساه او</del>		표 공		ATMH20
$ \frac{1}{100} = 1$	).5						$\sim$		$\sim$		
	.0								~~-		
1         1	8530	8531	8532	8533	8534 & B=1000.C. pc	8535 WAVELENGTH (Å)	8536	8537	8538	8539 from 8540 Å to 8550	8
Adap form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 & B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A Max form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 & B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A Adap form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 & B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A and a form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 & B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A and a form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 A B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A and a form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 A B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A and a form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 A B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A and a form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 A B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A and a form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 A B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A and a form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 A B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A and a form Debuelle et al (pr-1.0), V/J & SORT(P+V)/J for q=1 A B=1000 G, pointizion may for B=1000 G (poin), line (entification (Moore table), Longe topion, from 500 A to 8500 A and a form form form for B=1000 G, pointicion may for B=1000 G (poin),	.5 CYLWH20		<u>er ar (µ=1.0), v/1 x</u>		<u>a D- 1000 0, p</u>	Ē		entification (moore	š E	<u>ğ</u>	NINS
0         0	.5								_		
2         3	.0	_		<u>&gt;</u>							
Alber from Debouille et al. (µ=1.0), V/L & SQPT(0 <sup>+</sup> +U <sup>2</sup> )/L for g=1 & B=1000 C, publicition rotes for B=1000 C (barr), line (leptification (Moore table), Londe factore, from SSOP A to SSOP A	8540	8541	8542	8543	8544	8545 WAVELENGTH (Å)	8546	8547	8548	8549	85
30       400       80	1.5	Atlas from Delbouille 홈 듀 - 쥼	et al (µ=1.0), V/I &	: SQRT(Q2+U2)/I for g=1	& B=1000 G, pc	plarization rates for B=10	OD G (bars), line id 등 북북	entification (Moore	table), Lande factors,	from 8550 A to 8560	) A 
$\frac{1}{2} = \frac{1}{2} = \frac{1}$	).5							$\bigvee$			
850       851       852       853       854       WNEXXMIL(3)       855       857       858       859         Atlas from Delpoulle et al. (µ=1.0), V/1 & SORT(0*+U*)/1 for g=1 & B=1000 G, polorization rates for B=1000 G (bars), line identification (Moore table), Londe factors, from 8550 Å to 8570 Å       858       859	x.0						-				
Allas from Debouille et al (µ=1.0), V/1 & SORT(0 <sup>+</sup> +U <sup>5</sup> )/1 for g=1 & B=1000 C, polarization rates for B=1000 C (bars), line identification (Moore table), Londe factors, from B500 A to 8500 A 4 4 4 4 4 (µ=1.0), V/1 & SORT(0 <sup>+</sup> +U <sup>5</sup> )/1 for g=1 & B=1000 C, polarization rates for B=1000 C (bars), line identification (Moore table), Londe factors, from B570 A to 8500 A 5070 5071 5072 5073 5074 www.EDX6H (4) 5077 5077 8077 8077 8077 8077 8077 8077	8550	8551	8552	8553	8554	8555 WAVELENGTH (Å)	8556	8557	8558	8559	8
$\frac{1}{1000} = \frac{1}{1000} = 1$	.5 <u></u>	Atlas from Delbouille 중	<u>et al (μ=1.0), ∨/1 &amp;</u>	SQRT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1	& B=1000 G, pd	alarization rates for B=10	00 G (bars), line id	entification (Moore	table), Lande factors,	from 8560 Å to 8570	F.
	.5										
$\frac{1}{8560}$ $\frac{1}{8560}$ $\frac{1}{8561}$ $\frac{1}{8562}$ $\frac{1}{8572}$ $\frac{1}{857}$ $\frac{1}{8}$	.0	-									
Atlas from Delbouille et al. (µ=1.0), V/I & SQRT(Q <sup>2</sup> +U <sup>2</sup> )/I for q=1 & B=1000 G, polorization rates for B=1000 G (bars), line identification (Moore table). Lande factors, from 8570 Å to 8580 Å         a<	8560	8561	8562	8563	8564	8565 WAVELENGTH (Å)	8566	8567	8568	8569	8
$\frac{1}{5}$ $\frac{1}$	.5	Atlas from Delbouille	et al (μ=1.0), ∨/ι &	: SQRT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1	& B=1000 G, p	plarization rates for B=10 동 붕	00 G (bars), line idi	entification (Moore	table), Lande factors,	, from 8570 Å to 8580	A
$\frac{1}{9} = \frac{1}{9} = \frac{1}$	.5									<u></u>	
$s_{1} = \frac{1}{1000} \frac$	.0										
Atlas from Delbouille <i>et al</i> ( $\mu$ =1.0), V/I & SQRT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 & B=1000 G, polarization rates for B=1000 G (bars), line identification (Moore table), Lande factors, from 8580 Å to 8590 Å a $a$ $a$ $a$ $a$ $a$ $a$ $a$ $a$ $a$	.5	8571	8572	8573	8574	8575 WAVELENGTH (Å)	8576	8577	8578	8579	8
$ \begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\$	.5	Atlas from Delbouille	<i>et al</i> (μ=1.0), ∨/1 &	z 5QRT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1	& B=1000 G, po	plarization rates for B=10	00 G (bars), line id #	entification (Moore 5 ≧ z	table), Lande factors,	from 8580 Å to 8590	) Å 5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	.0		<u> </u>	<u> </u>	<u>j_</u>	<u> </u>	<u>, z</u>	<u>9. <u>49.</u></u>	<u>9 3</u>		<u></u>
1.5     5       8550     8581       8550     8581       8550     8581       8550     8581       8550     8581       8550     8581       8550     8582       8585     8586       8586     8587       8586     8587       8586     8587       8586     8587       8586     8587       8586     8587       8586     8587       8586     8587       8587     8588       8586     8587       8587     8588       8586     8587       8587     8588       8587     8588       8587     8588       8587     8588       8587     8586       8587     8586       8587     8586       8587     8586       8587     8586       8587     8586       8587     8586       8587     8586       8587     8587       8587     8587       8587     8587       8587     8587       8587     8587       8587     8587       8590     8590	x.0			<u> </u>							
Atlas from Delbouille <i>et al</i> ( $\mu$ =1.0), V/I & SQRT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 & B=1000 G, polarization rates for B=1000 G (bars), line identification (Moore table), Lande factors, from 8590 Å to 8600 Å	.5 8580	8581	8582	8583	8584	8585	8586	8587	8588	8589	8
	.5	Atlas from Delbouille	<i>et al</i> (μ=1.0), ∨/1 &	$SQRT(Q^2+U^2)/I$ for g=1	& B=1000 G, po	waveLENGTH (Å) plarization rates for B=10	00 G (bars), line id	entification (Moore	table), Lande factors,	from 8590 Å to 8600	) Å
	.0	<u>5</u>							<u> </u>	-V	
	).5 ).0			- <del></del>				<u>~~</u>			
	λ.5									* 	

1.5	Atlas from	Delbouille et al ( $\mu$ =	: <u>1.0), V/I &amp; SQ</u> I 素	$\frac{RT(Q^2+U^2)/I \text{ for } g=1}{\frac{1}{3}}$	& B=1000 G, pok	arization rates for B=1	000 G (bars), line identi 록 듕 둘	E	table), Lande faci	tors, from 8600 Å to 8610 Å	
5) 1.0 1.0 1.0 1.0								~~~			
/ 1/1 / 0.0		-		-				~~~		<u>.                                    </u>	
-0.5	8600	8601	8602	8603	8604	8605	8606	8607	8608	8609	8610
1.5	Atlas from	Delbouille et al ( $\mu$ =	1.0), V/I & SQ	$RT(Q^2+U^2)/I$ for g=1	& B=1000 G, pok	arization rates for B=1	000 G (bars), line identi	ication (Moore	table), Lande fact	tors, from 8610 Å to 8620 Å	
1.0.			ſ	Ę		1787		<u> </u>		<u>Š</u>	
0.5 0.0		\ 			~~~		<u> </u>				
-0.5		¥	P				8				
- 15	8610 Atlas from	B611 Delbouille <i>et al</i> ( $\mu$ =	8612 1.0), V/I & SQ	8613 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1	8614 & B=1000 G, pok	8615 WAVELENGTH (Å) arization rates for B=1	8616 DOD G (bars), line identi	8617 ication (Moore	8618 table), Lande fact	8619 tors, from 8620 Å to 8630 Å	8620
1.0	-	Ę		NDS		<u></u>	<u>8 8</u>			<u> </u>	
uhe 1/A		V									
ຍິ 0.0- ໂລຍ -0.5		And And				-					
0.0	8620	8621	8622	8623	8624	8625 WAVELENGTH (Å)	8625	8627	8628	8629	8630
1.5	Atlas from	Delbouille et al $(\mu =$	a E	RI(Q'+U')/I tor g=1	<u>रू B=1000 G, pok</u> ह ह	anzation rates for B=1	<u>UOU G (bars), line identi</u> E	E	table), Lande fact	tors, from 8630 A to 8640 A	
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ຳ 0.0 ໂ											
-0.5	8630	8631	8632	8633	8634	8635 WAVELENGTH (Å)	8636	8637	8638	8639	8640
1.5	Atlas from	Delbouille et al ( $\mu$ =	1.0), V/I & SQ	$\frac{RT(Q^2+U^2)/I \text{ for } g=1}{\Sigma}$	& B=1000 G, pok	arization rates for B=1	000 G (bars), line identi	ication (Moore	<u>table), Lande fac</u> i ≊	tors, from 8640 Å to 8650 Å	
+ 1.0	-		<u></u>	<u> </u>			<u>n</u>		<u></u>	й 	
1/A 0.0										- 	
-0.5											
5 1.5	Atlas from	Delbouille et al ( $\mu$ =	1.0), V/I & SQ	$\frac{8643}{RT(Q^2+U^2)/I \text{ for } g=1}$	8644 & B=1000 G, pok	WAVELENGTH (Å) arization rates for B=1	000 G (bars), line identi	ication (Moore	table), Lande fact	8649 tors, from 8650 Å to 8660 Å	8650
1.0	- 	New John Street			NRS E		E.		5		
ne 1/4 5											
0.0 51900 -0.5											
E 1	8650 Atlas from	8651 Delbouille <i>et al.</i> ( <i>u</i> =	8652 :1.0) V/L& SDI	8653 RT( $O^2 + U^2$ )/L for $q = 1$	8654	8655 WAVELENGTH (Å)	B656	8657	8658	8659 tors from 8660 Å to 8670 Å	8660
1.5 1.0 1.0			E 3		E	a É		diameter dia			
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- '0.0 0.0			ŢŢ <u>Ţ</u>				_				
5 -0.5	8660	8661	8662	8663	8664	8665				8669	8670
1.5	Atlas from	Delbouille et al ( $\mu$ =				WAVELENGTH (Å)	8666	8667	8668		
	E 75 75		1.0), V/I & SQI	$RT(Q^2+U^2)/I$ for g=1	& B=1000 G, pok	WAVELENGTH (Å) arization rates for B=1 E =	8666 DOO G (bars), line identi	8667 Tication (Moore	8668 table), Lande fact	tors, from 8670 Å to 8680 Å	
7) 1.0. 100 100 100 1.0.	<u>5</u>	<u></u>	1.0), V/I & SQ	RT(Q²+U²)/l for g=1	& B=1000 G, pok	WAVELENGTH (Å) arization rates for B=1 E	8666 200 G (barş), line identi	8667 Tication (Moore	8668 table), Lande faci	tors, from 8670 Å to 8680 Å ق	
1.0.5 0.5 0.1/1 / 1/1 /	<u> </u>	<u> </u>	1.0), V/I & SQ	RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1	& B=1000 G, pok	WAVELENGTH (Å) anization rates for B=1-	8666 DOO Ç (bars), line identi	B667 Tication (Moore	sees table), Lande fact	tors, from 8670 Å to 8680 Å	-15-
1.0. 0.5 0.0 -0.5	<u> </u>	<u>6</u> 6	8672	RT(Q <sup>3</sup> +U <sup>3</sup> )/I for g=1	& B=1000 G, pok	wwellEkiGH (Å) arization rates for B=1 <sup>4</sup> <sup>4</sup> <sup>5</sup> <sup>6</sup> <sup>6</sup> <sup>6</sup> <sup>6</sup> <sup>6</sup> <sup>7</sup> <sup>6</sup> <sup>6</sup> <sup>6</sup> <sup>8</sup> <sup>8</sup> <sup>8</sup> <sup>8</sup> <sup>8</sup> <sup>8</sup> <sup>8</sup> <sup>8</sup>	8666 2000 C (bars), line identi	8667 "ication (Moore 	8668 table), Lande fact	tors, from 8670 Å to 8680 Å	
1.0. 0.5 0.0 0.0 1.5 1.5	B670 Atlas from	ק 8671 Delbouille et al (μ=	8672 1.0), V/I & SO	RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 8673 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1	& B=1000 G, pol 8674 & B=1000 G, pol	WAVELENGTH (Å) arization rates for B=1-	8666 2000 C (bars), line identi  8676 2000 C (bars), line identi	8667 fication (Moore 8677 fication (Moore	8668 table), Lande fact	579 5679 A to 8690 A	1 1 2 1 2 3 680
1.0. 1.0. 1.0. 1.5 1.5	in         in           B670         Atlas from           in         in	ק 8671 Delbouille et al (μ=	8672 1.0), V/I & SQ 8672 1.0), V/I & SQ	RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 8673 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 	& B=1000 G, pok в574 & B=1000 G, pok	WAVELENGTH (Å) arization rates for B=1	8666 000 G (bars), line identi 8676 000 G (bars), line identi	BEE7	8668 table), Lande fact 8678 table), Lande fact	5075, from 8670 Å to 8680 Å	
1.0. 0.5 0.0 0.5 1.5 1.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0	n     n       8670     Atlas from       1     n       1     n	5671 Delbouille et αl (μ=	8672 1.0), V/I & SQI	RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 8673 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 <u>E</u> <u><u><u><u></u><u></u><u><u></u><u><u></u><u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u></u></u></u></u></u>	& B=1000 C, pok 8674 & B=1000 C, pok	WAVELEXISTH (Å) anization rates for B=1	8666 000 G (bars), line identi 8676 000 G (bars), line identi	8667	8668 table), Lande fact 8678 table), Lande fact	tors, from 8670 Å to 8680 Å	
1.0, $1.0$ , $0.5$ , $0.0$ , $0.5$ , $0.0$ , $0.5$ , $0.0$ , $1.5$ , $1.5$ , $0.0$ , $0.0$ , $0.5$ , $0.0$ , $0.0$ , $0.5$ , $0.0$ ,	6670 Atlas from	ة 8671 Delbouille <i>et al (μ</i> =	8672 1.0), V/I & SQ 8672 1.0), V/I & SQ 66	RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 8673 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 <u><u><u></u></u></u>	& B=1000 C, pok 8674 & B=1000 C, pok	WAVELÉRIĞIH (Å) aprization rates for B=1	8666 000 C (bars), line identi 	BEE7	8668 table), Lande fact 8678 table), Lande fact	tors, from 8670 Å to 8680 Å	-1 27 8680 
1.0 0.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	n     n       B670     Atlas from       1     n       1     n       2     E       8680     Atlas from	η       8671       Delbouille et al (μ=       8681       Delbouille et al (μ=	8682 1.0), V/I & SQ 8672 1.0), V/I & SQ 3 3 6882 1.0), V/I & SQ	RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 8673 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 <u><u><u></u></u> <u><u></u></u> <u><u></u> <u></u> <u></u> <u></u> <u></u> <u></u> </u></u>	& B=1000 G, pok s674 & B=1000 G, pok	WAVELEXIGTH (A) arization rates for B=1	8666 2000 C (bars), line identi 8676 2000 C (bars), line identi <sup>6</sup> 7 8686 8686 2000 C (bars), line identi	ی ازدوازی (Moore 8677 ازدوازی (Moore موجع ازدوازی (Moore موجع ازدوازی (Moore	8668 table), Lande fact 	tors, from 8670 Å to 8680 Å	105 8680 41 8680
1.0 0.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	in     in       in	5 8671 Delbouille et al (μ= 8681 Delbouille et al (μ=	8672 1.0), V/I & SQ 8672 1.0), V/I & SQ 3 3 5682 1.0), V/I & SQ 5 5 5 5 5 5 5 5 5 5 5 5 5	RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 8673 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1	& B=1000 С. рок в674 & B=1000 С. рок в684 & B=1000 С. рок ц	WAVELENGTH (Å) prization rates for B=1	8666 000 C (bars), line identi 8676 000 C (bars), line identi 5 8686 8686 000 C (bars), line identi	8667           Tication (Moore           8677           Tication (Moore           4           5           8687           Tication (Moore           4           5           8687           Tication (Moore	8668 table), Lande fact 8678 table), Lande fact g	57. from 8670 Å to 8680 Å 57. Here 8679 8679 57. Here 8689 57. Here 8689 5689 5689 Å to 8690 Å 5689 5689 Å to 8700 Å	100 8680 8680 8690
1.0 0.5 0.0 0.0 0.0 1.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0	n     n       8670     Atlas from       1     n       1     n       2     6890       Atlas from	5671 Delbouille et al (μ= 8681 Delbouille et al (μ=	8672 1.0), V/I & SQI 8672 1.0), V/I & SQI 8682 1.0), V/I & SQI E	RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 8673 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 F,	& B=1000 C, pok 8674 & B=1000 C, pok 8684 & B=1000 C, pok	WAVELEXIGTH (Å) arization rates for B=1	8666 000 G (bars), line identi 8676 000 G (bars), line identi \$686 8686 000 G (bars), line identi	BEE7	8668 table), Lande fact 8678 table), Lande fact 호 명 중 동688 table), Lande fact	tors, from 8670 Å to 8680 Å 5 8679 8679 tors, from 8680 Å to 8690 Å E 8689 tors, from 8680 Å to 8700 Å E 8689 tors, from 8690 Å to 8700 Å	8680 8680
1.0. 0.5 0.0 0.0 0.5 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 1.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	n     n       5670     Atlas from       1     n	5 8671 Delbouille et al (μ= 8681 Delbouille et al (μ=	8672 1.0), V/1 & SQ 8672 1.0), V/1 & SQ 6 6 8682 1.0), V/1 & SQ 6 6 6 6 8682	RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 8673 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 <u>E</u> <u>5</u> 8683 RT(Q <sup>2</sup> +U <sup>2</sup> )/I for g=1 <u>7</u>	& B=1000 G, pok 8674 & B=1000 G, pok 8684 & B=1000 G, pok	WAVELEXIGN (Å) arization rates for B=1 WAVELENGTH (Å) arization rates for B=1 WAVELENGTH (Å) arization rates for B=1	8666 000 C (bars), line identi 8676 000 C (bars), line identi 9 8686 8686	BEE7	8668 table), Lande fact 8678 table), Lande fact \$688 table), Lande fact	tors, from 8670 Å to 8680 Å	100 8680 8690 8690

