Linear and Circular Polarization in Diffuse Interstellar Bands

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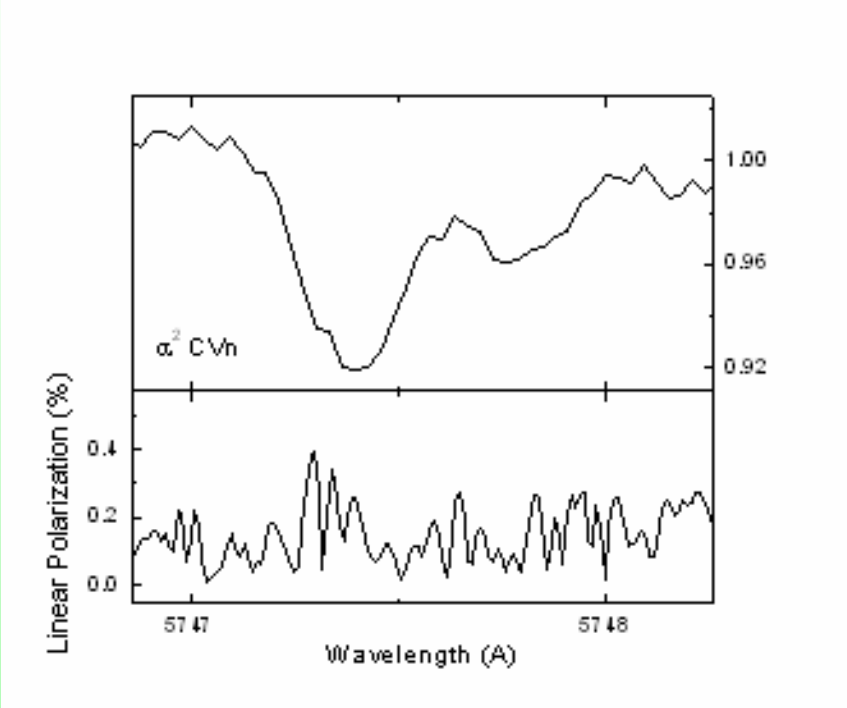
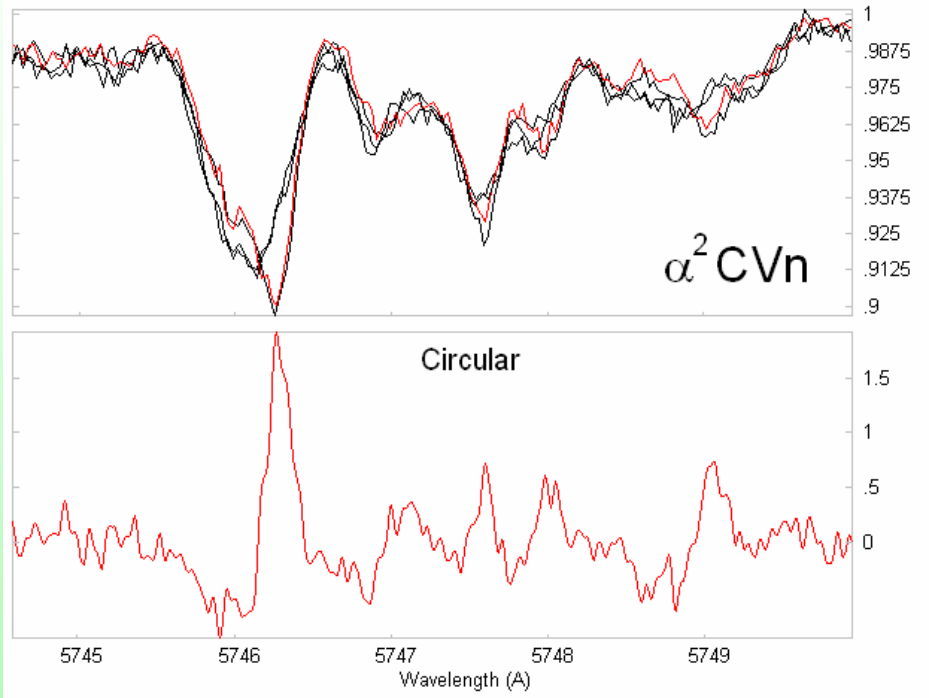
Bohyunsan Optical Astronomy Observatory

- 1.8-m telescope
- Fiber feed Echelle Spectrograph

  3,500 - 10,000 A, R= 35,000 - 90,000

Polarization





Polarimetry of DIBs (1972 – 2007)

	Sp	E(B-V)
• HD 13854	B1Iabe	0.5
• HD 21219	B9Ia	0.4
• HD 21389	A0Iab	0.55
• HD163472	B3V	0.25
• HD183143	B7Ia	1.25
• HD194279	B1.5I	1.2
• HD197770	B2IV	0.55
• HD198478	B3Ia	0.55

DIBs

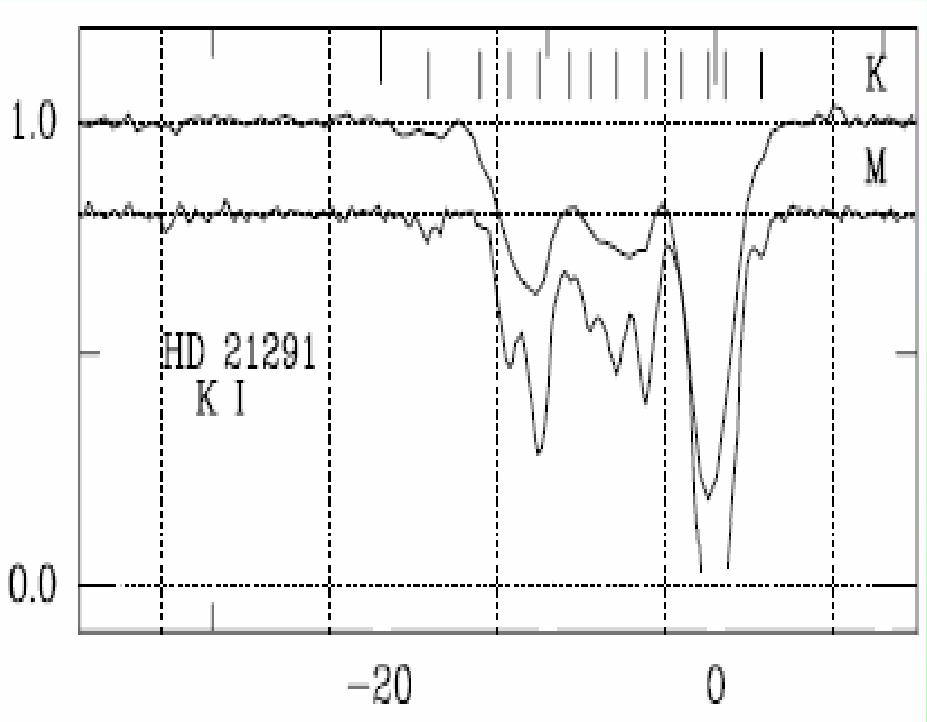
4430	*5780*	*5797*
6196	*6203*	*6284*
6376	*6379*	*6613*

BOAO data

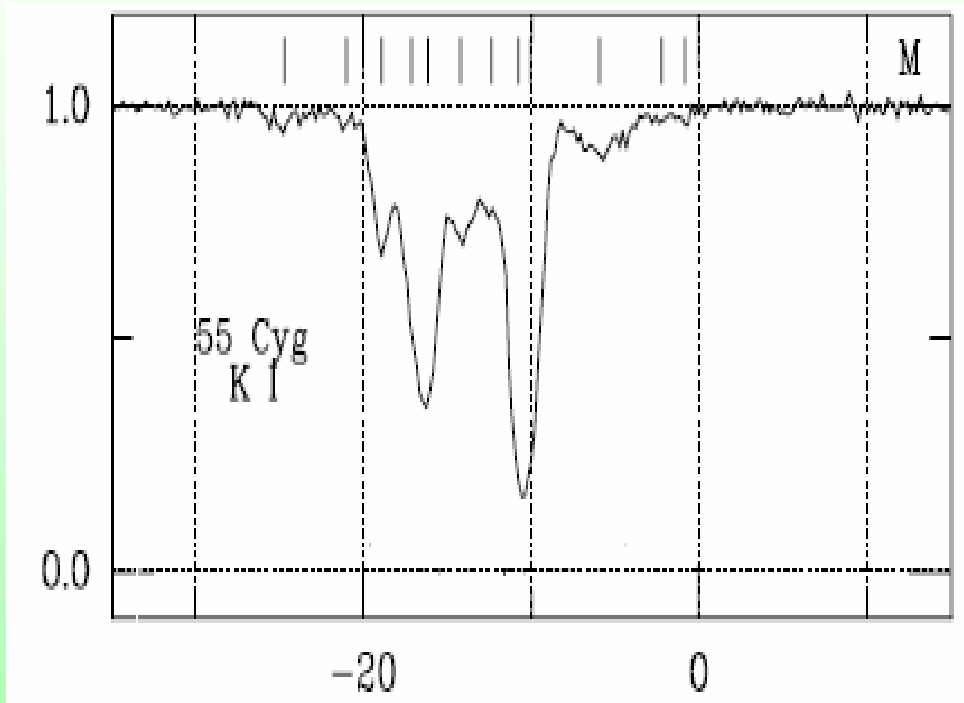
	Sp	E(B-V)
• HD 23180	B1III	0.28
• HD 24398	B1Iab	0.32
• HD 34078	O9.5V	0.5
• HD143275	B0.2IV	0.33
• HD144217	B0.5V	0.31
• HD147889:	B2III/IV	1.06
• HD226868:	O9.7Iab	1.03

+16 stars

HD 21291



HD198478



Welty & Hobbs, 2001, ApJS,133,345

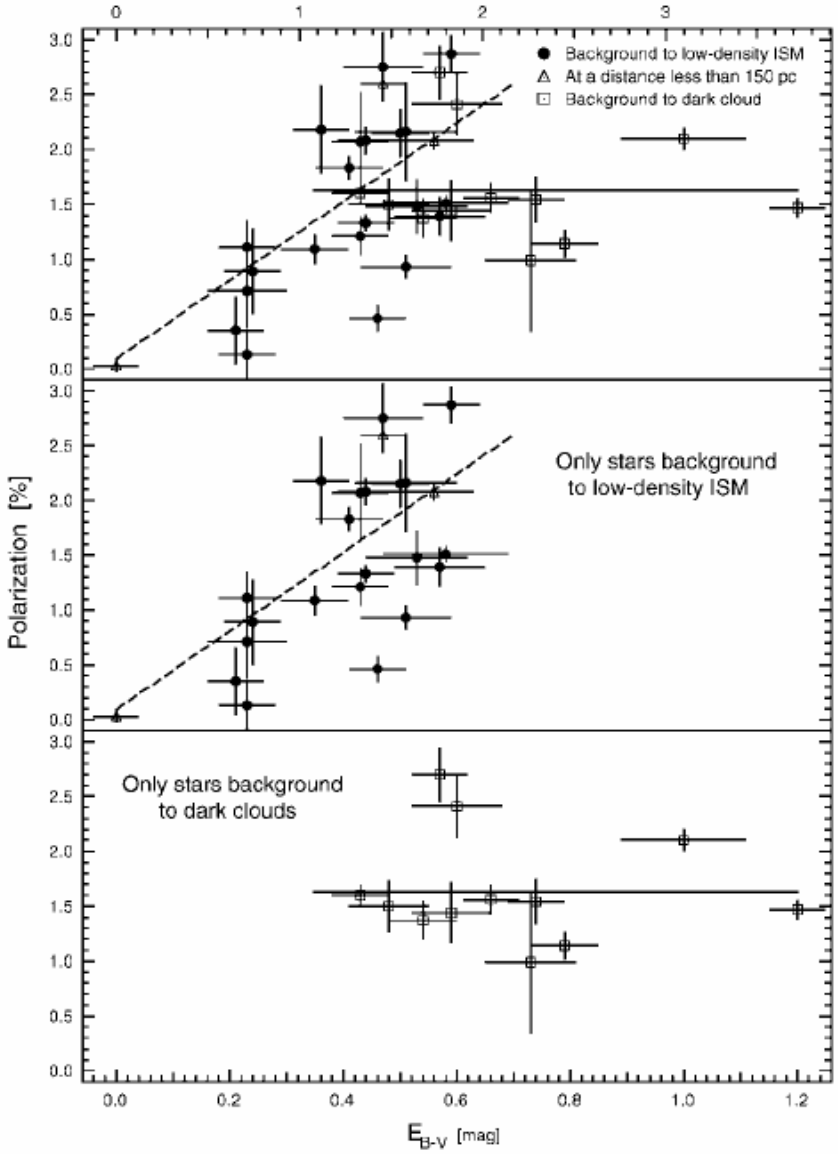


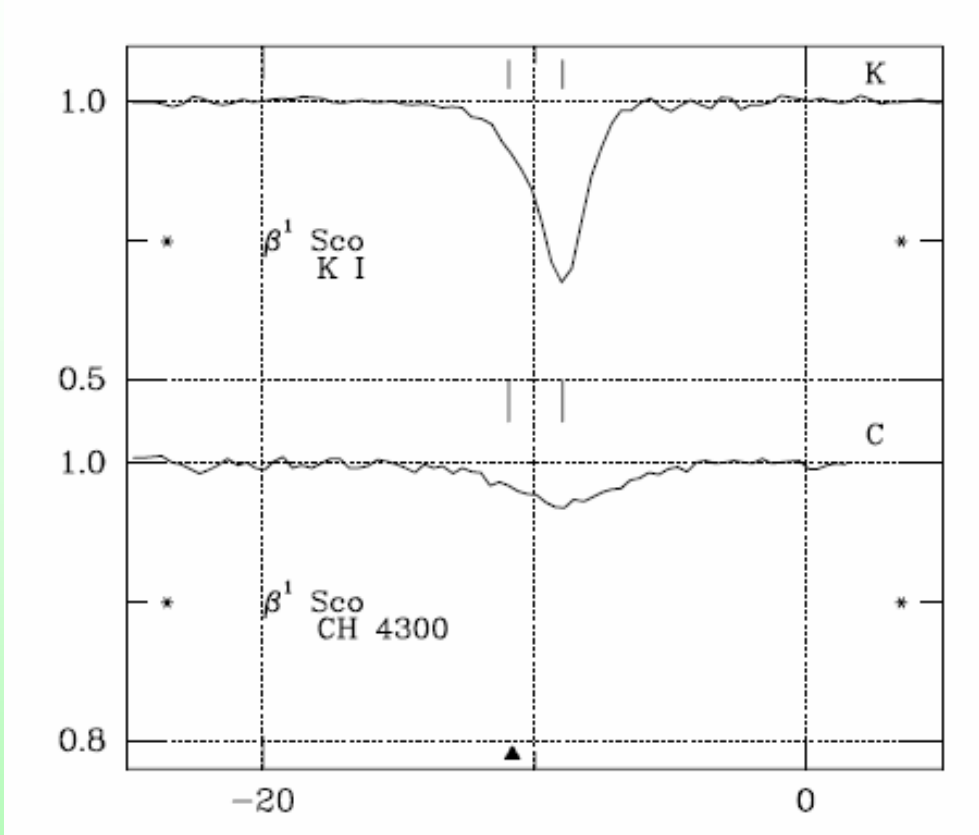
FIG. 2.—Observed relation between polarization and extinction, where $A_V = 3.1E_{B-V}$. The lines are least-square linear fits, weighted by the uncertainty in p. The dashed line is the fit to the points representing the stars background to the low-density ISM, which gives $p = (0.09 \pm 0.06) + (3.58 \pm 0.13)E_{B-V}$, with a correlation coefficient of 0.68. The solid line is the fit to the points representing the stars background to dark clouds, which gives $p = (1.61 \pm 0.13) + (0.03 \pm 0.15)E_{B-V}$, with a correlation coefficient of 0.79.

The polarizing power of dust

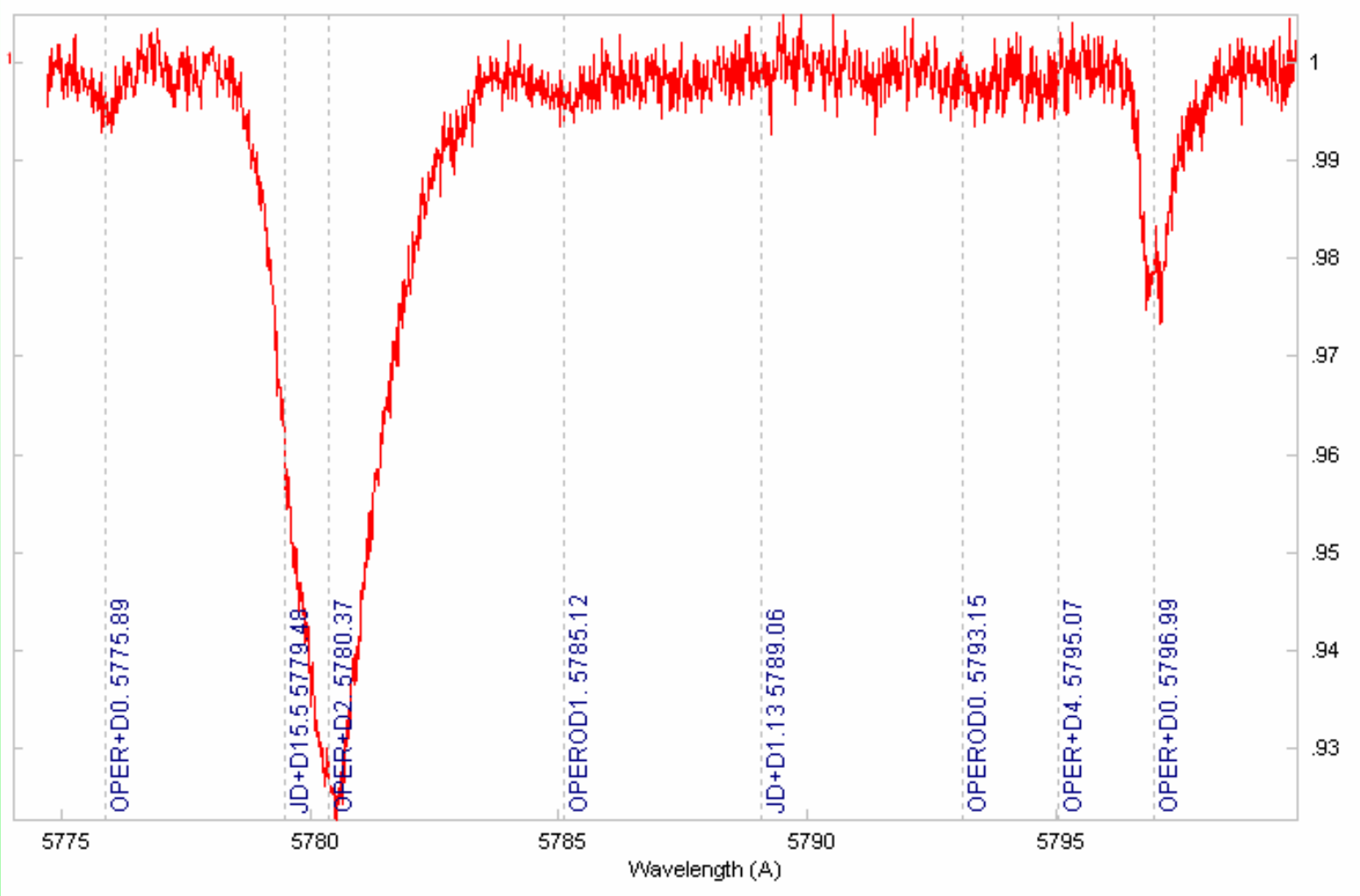
Arce et al. , 1998, ApJ, 499, L93

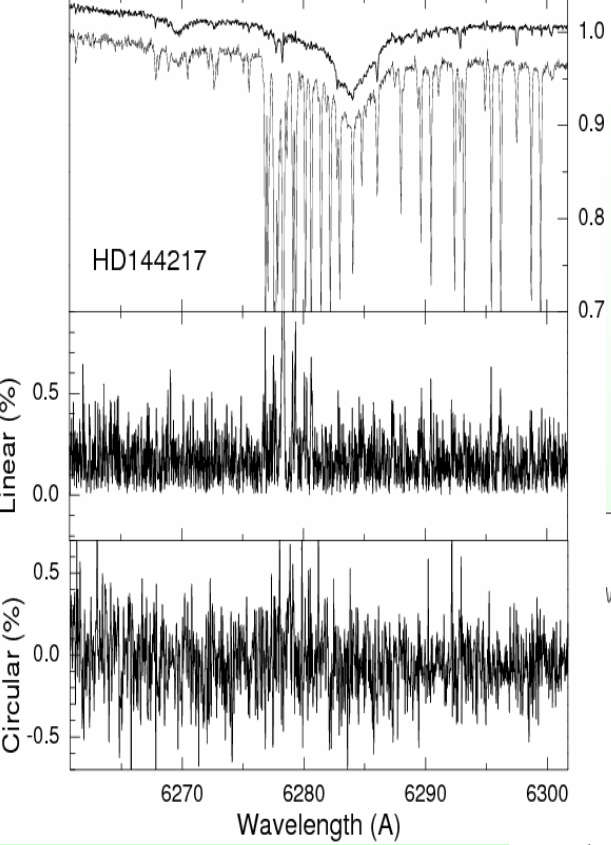
- 36 stars - Taurus dark clouds

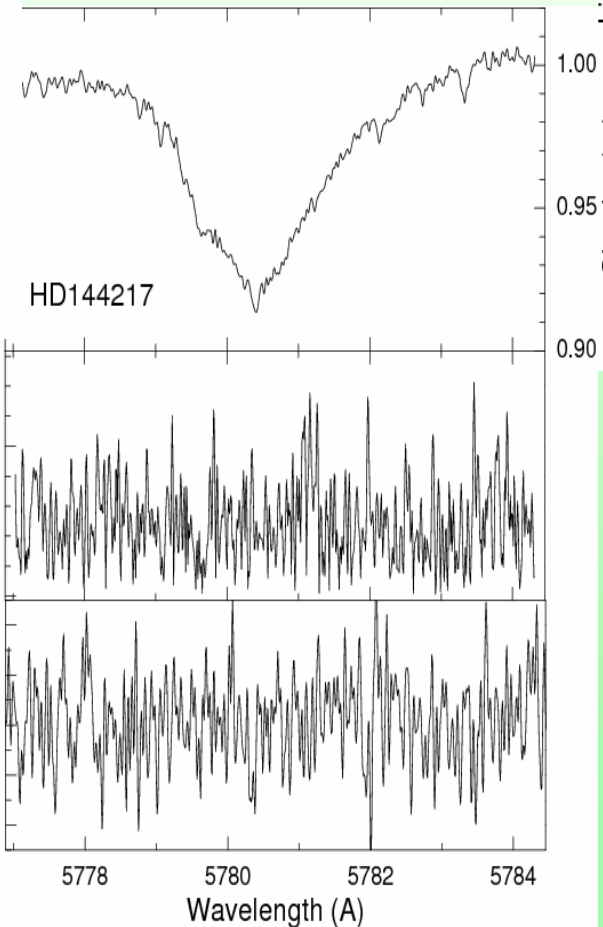
HD144217

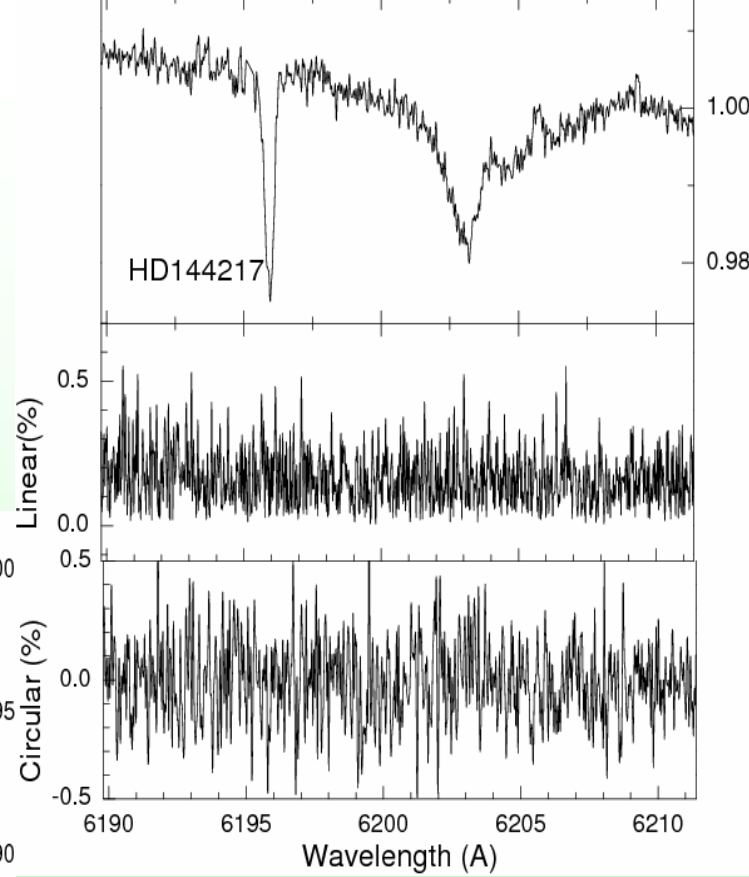


Welty & Hobbs, 2001, ApJS,133,345
R~200,000

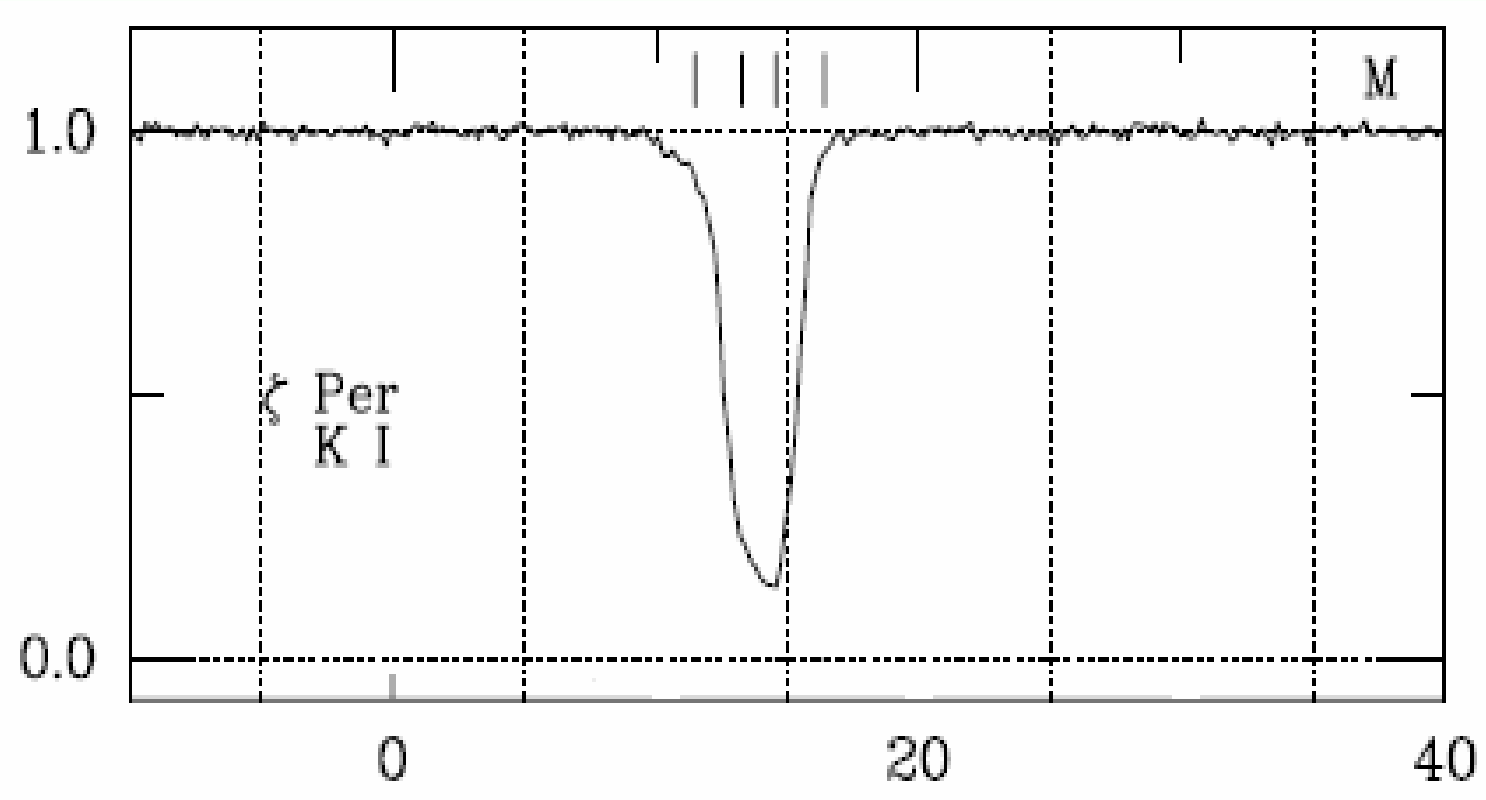

OPER+D0. 5775.89
JD+D15.5 5779.48
OPER+D2. 5780.37
OPEROD1. 5785.12
JD+D1.13 5789.06
OPEROD0. 5793.15
OPER+D4. 5795.07
OPER+D0. 5796.99
1
.99
.98
.97
.96
.95
.94
.93
5775
5780
5785
5790
5795
Wavelength (A)


HD144217
1.0
0.9
0.8
0.7
Linear (%)
0.5
0.0
Circular (%)
0.5
0.0
-0.5
6270
6280
6290
6300
Wavelength (A)


HD144217
1.00
0.95
0.90
Linear (%)
0.5
0.0
Circular (%)
0.4
0.2
0.0
-0.2
-0.4
5778
5780
5782
5784
Wavelength (A)

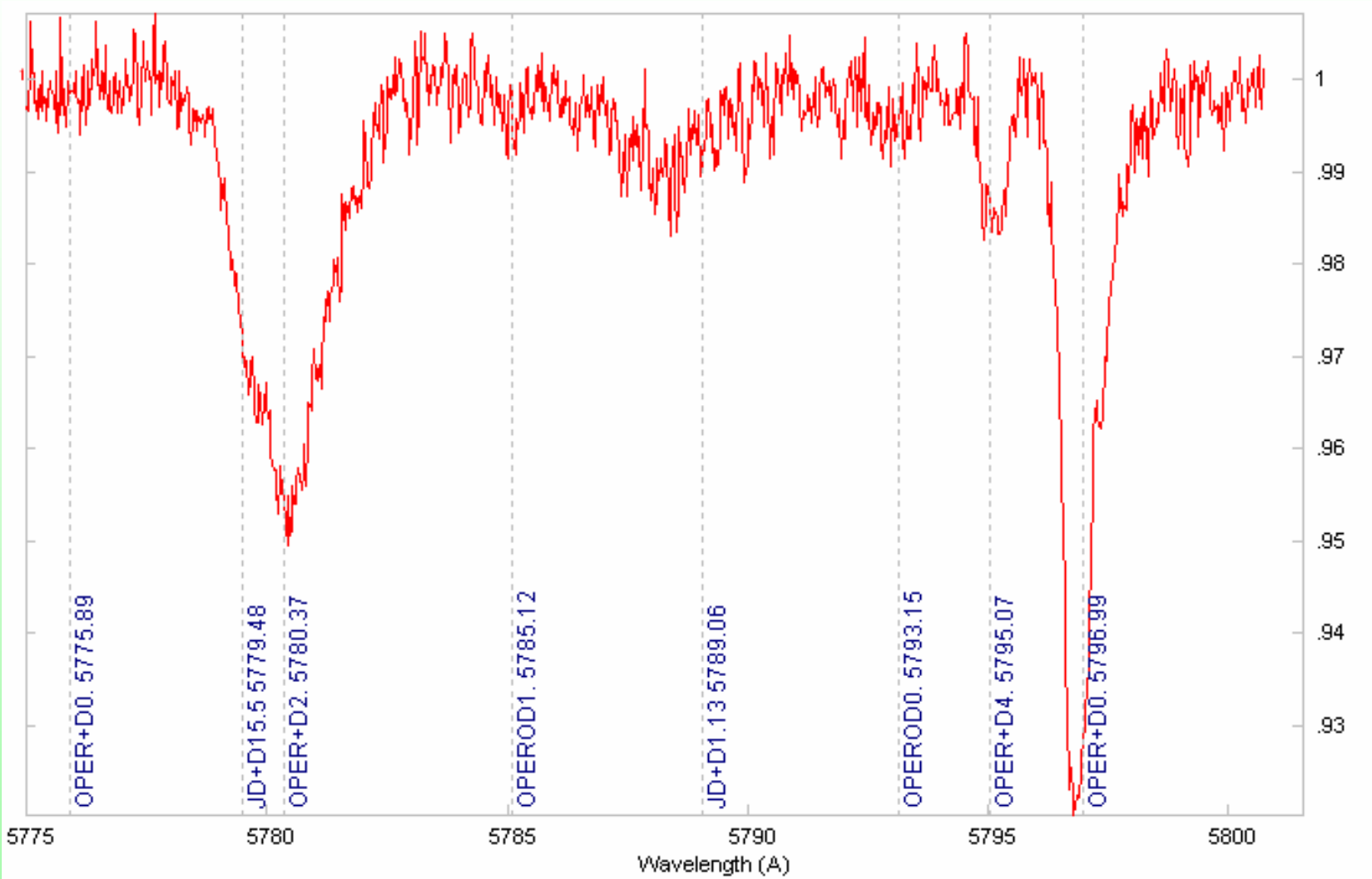

HD144217
1.00
0.98
Linear(%)
0.5
0.0
Circular (%)
0.5
0.0
-0.5
6190
6195
6200
6205
6210
Wavelength (A)

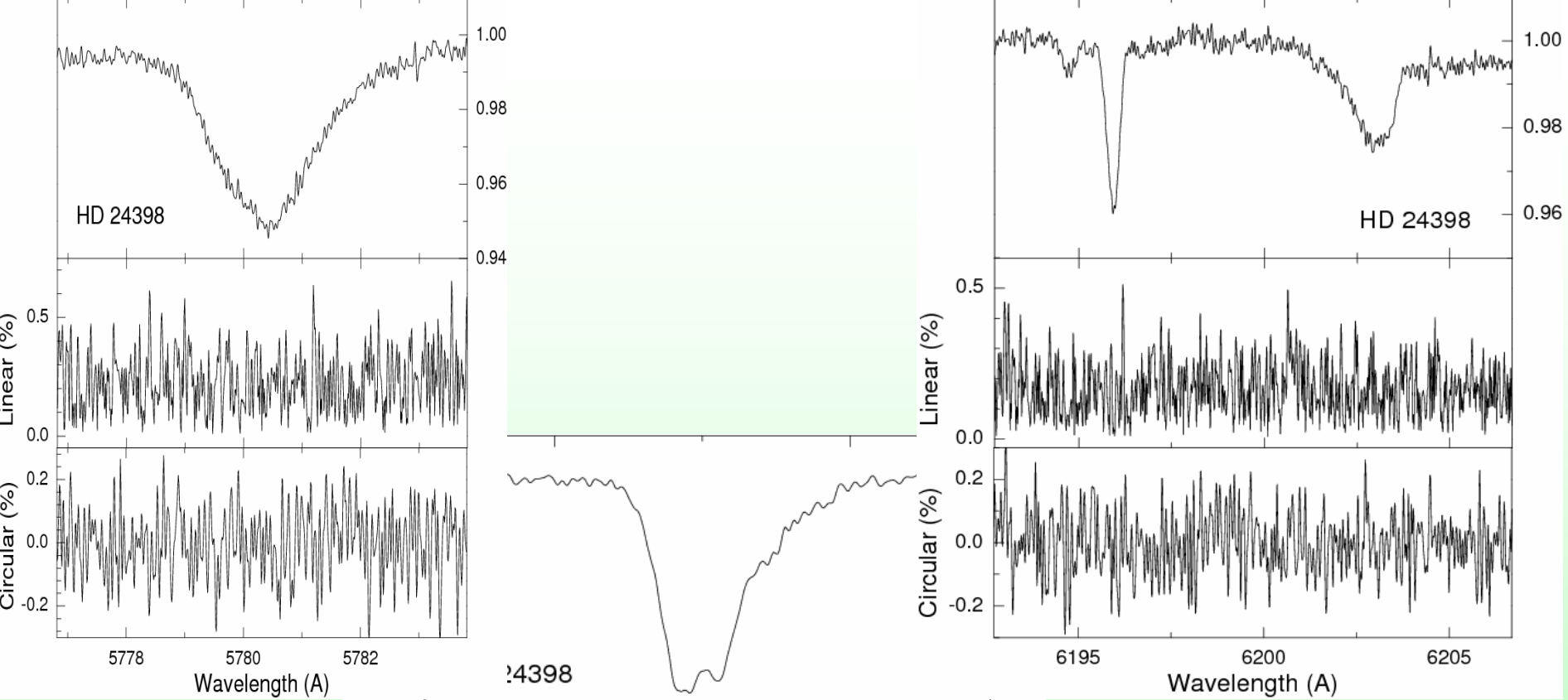
HD 24398

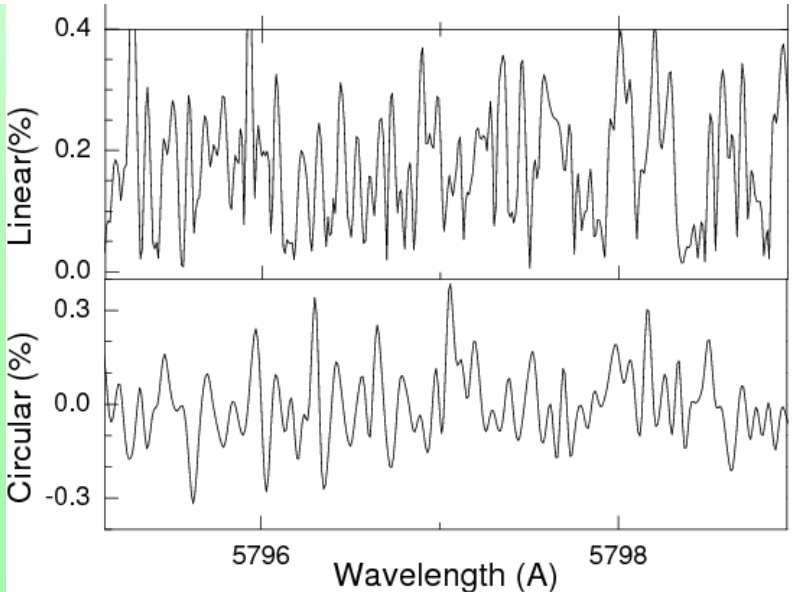


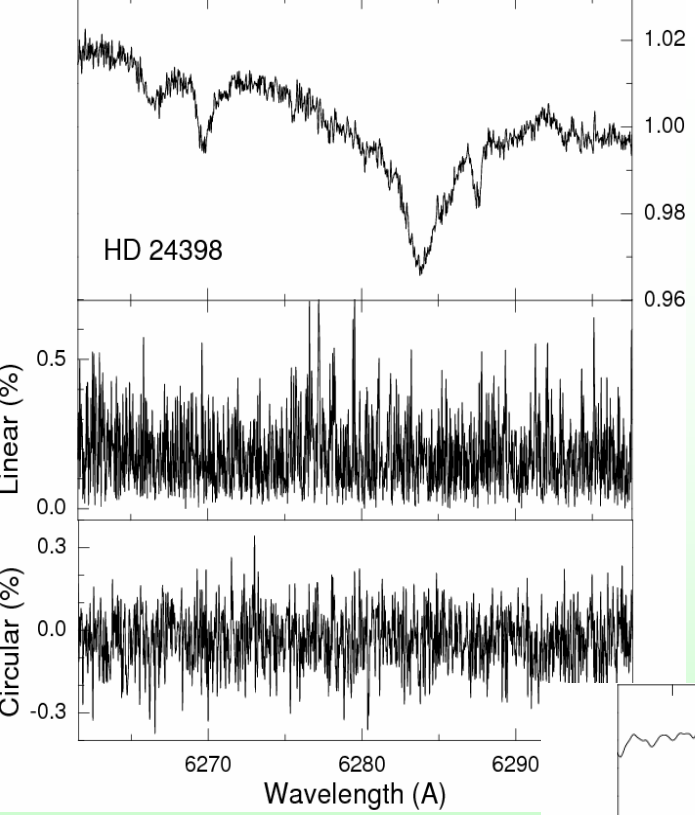
Welty & Hobbs, 2001, ApJS,133,345

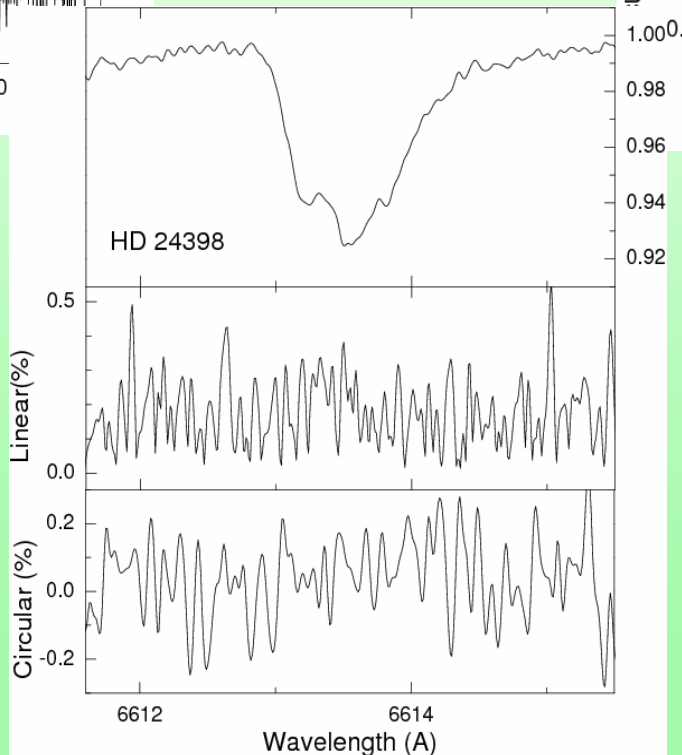
ζ-type cloud

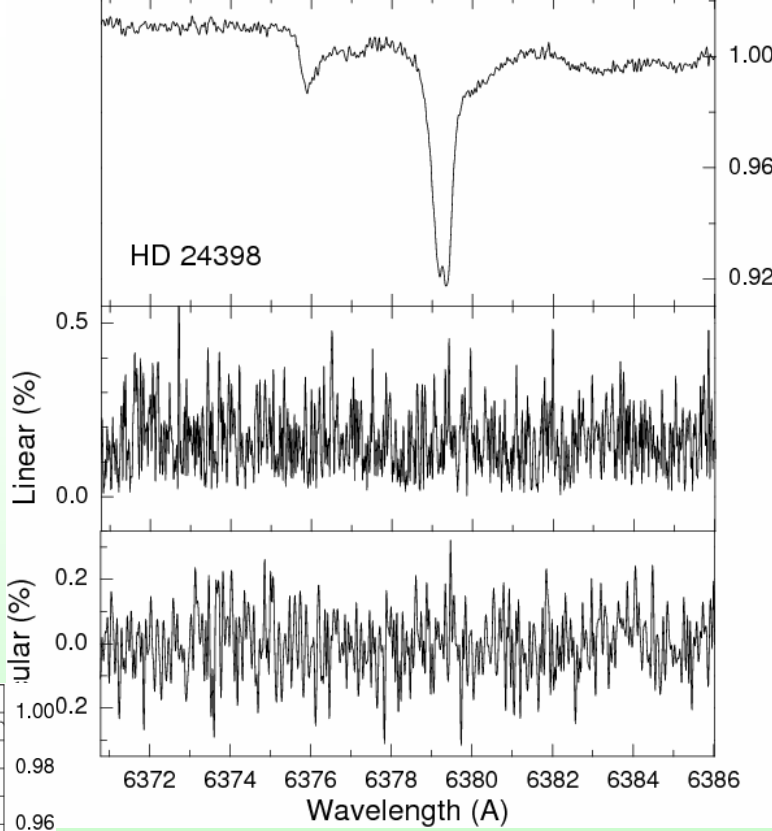

OPER+D0. 5775.89
JD+D15.5 5779.48
OPER+D2. 5780.37
OPEROD1. 5785.12
JD+D1.13 5789.06
OPEROD0. 5793.15
OPER+D4. 5795.07
OPER+D0. 5796.99
1
.99
.98
.97
.96
.95
.94
.93
5775
5780
5785
5790
5795
5800
Wavelength (A)


HD 24398
1.00
0.98
0.96
0.94
Linear (%)
0.5
0.0
Circular (%)
0.2
0.0
-0.2
5778
5780
5782
Wavelength (A)
HD 24398
1.00
0.98
0.96
Linear (%)
0.5
0.0
Circular (%)
0.2
0.0
-0.2
6195
6200
6205
Wavelength (A)

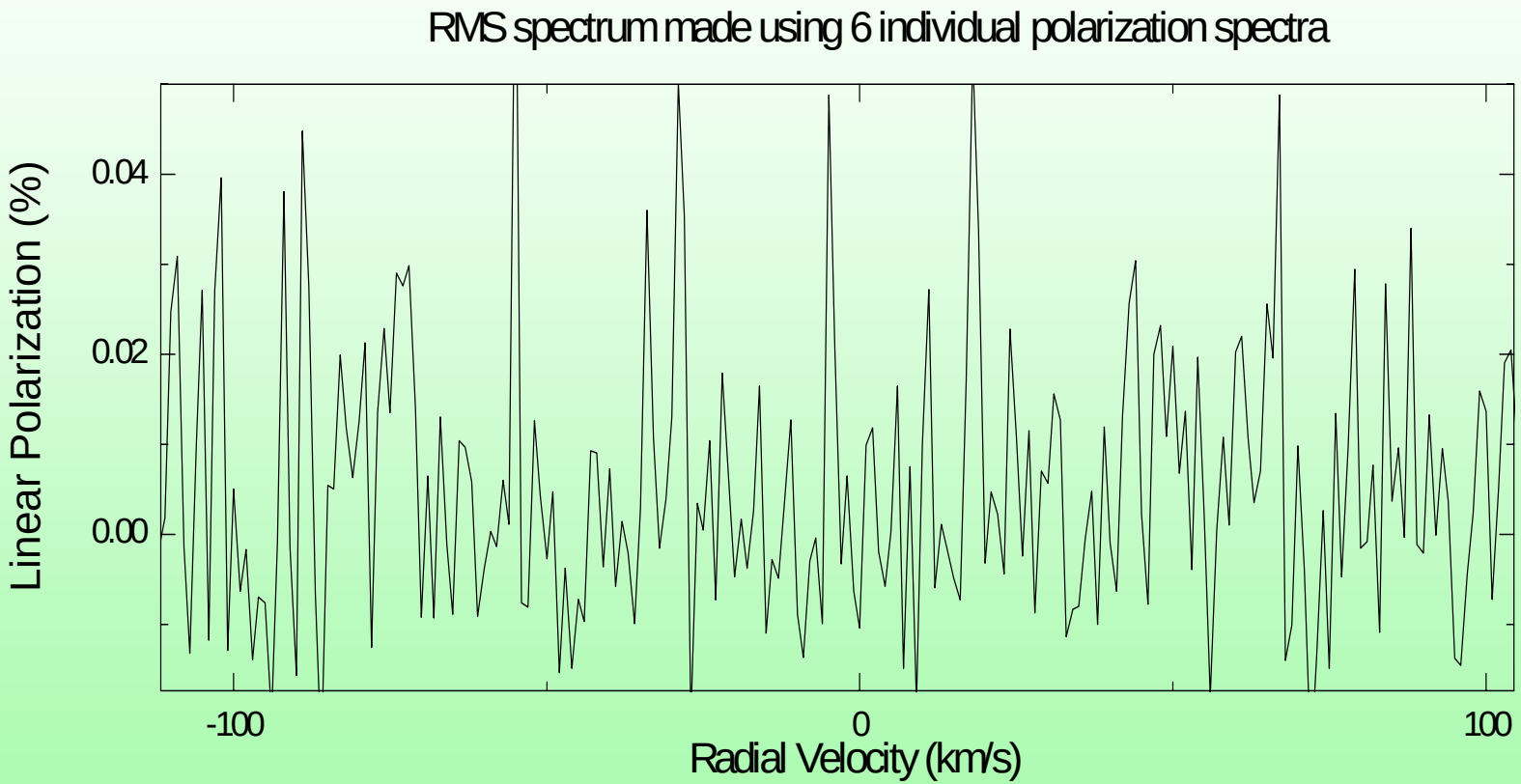

Linear(%)
0.4
0.2
0.0
Circular (%)
0.3
0.0
-0.3
5796
5798
Wavelength (A)


HD 24398
1.02
1.00
0.98
0.96
Linear (%)
0.5
0.0
Circular (%)
0.3
0.0
-0.3
6270
6280
6290
Wavelength (A)


HD 24398
0.98
0.96
0.94
0.92
Linear(%)
0.5
0.0
Circular (%)
0.2
0.0
-0.2
6612
6614
Wavelength (A)


HD 24398
1.00
0.96
0.92
Linear (%)
0.5
0.0
0.2
0.0
0.2
1.00
6372
6374
6376
6378
6380
6382
6384
6386
Wavelength (A)

HD 24398


RMS spectrum made using 6 individual polarization spectra
Linear Polarization (%)
0.04
0.02
0.00
-100
0
100
Radial Velocity (km/s)

THANK YOU!