

Modelling the magnetic field
of the B-type N-rich star
 ζ Cassiopeiae

Maryline Briquet & Coralie Neiner

First studies

- Optical line-profile variability (Si III 4553) ~ day in this B2 IV star → proposed as 53 Per variable
- Indirect indicators of presence of a magnetic field:
 - Surface chemical peculiarities (N-rich)
 - Variability in UV wind-sensitive resonance lines

Study by Neiner et al. 2003

- IUE data →

accurate rotation period

$$P_{\text{rot}} = 5.37045 \text{ days}$$

- Musicos data →

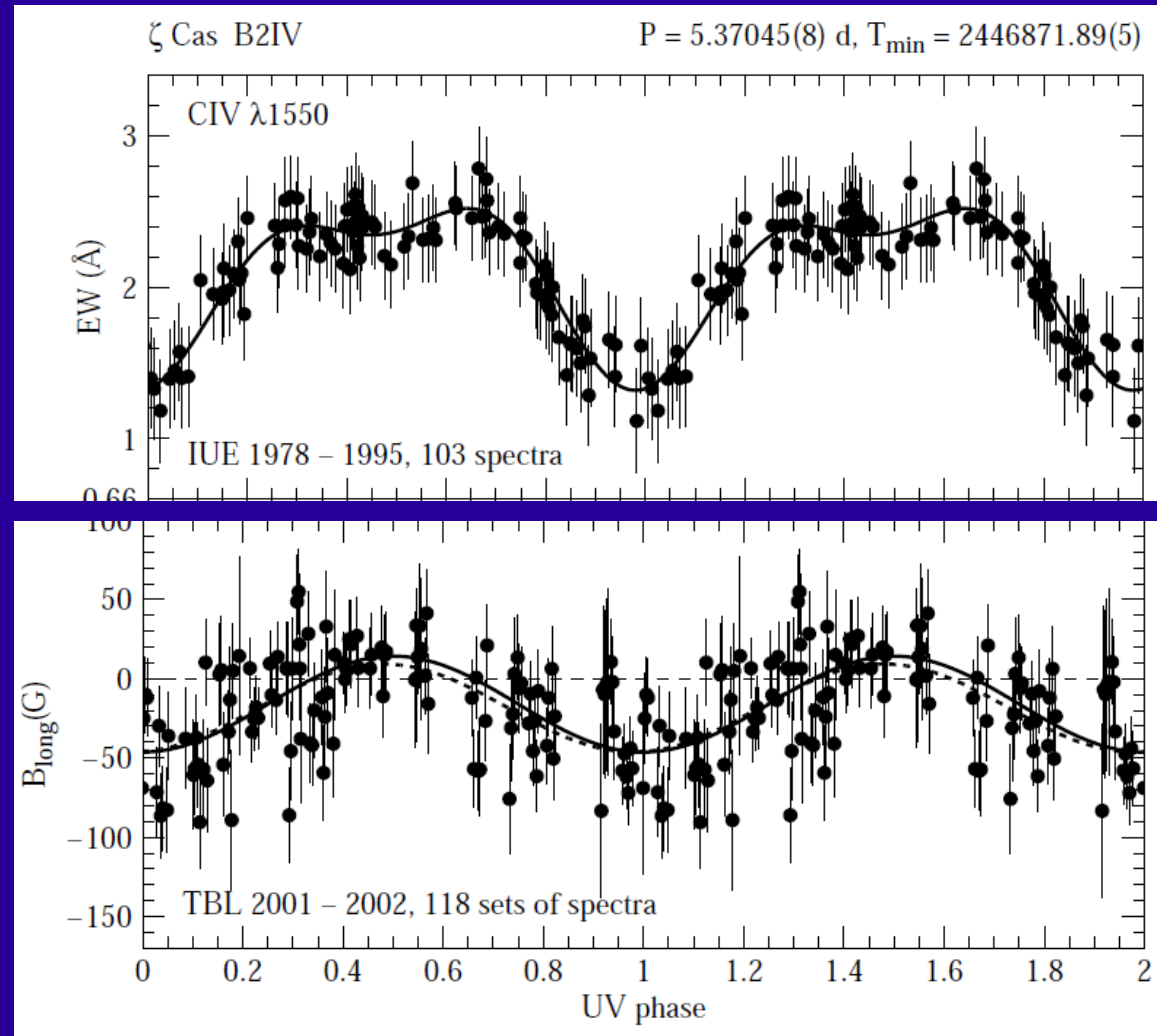
Oblique magnetic dipole

$$i = 18^\circ [14 - 22]$$

$$\beta = 77^\circ [71 - 83]$$

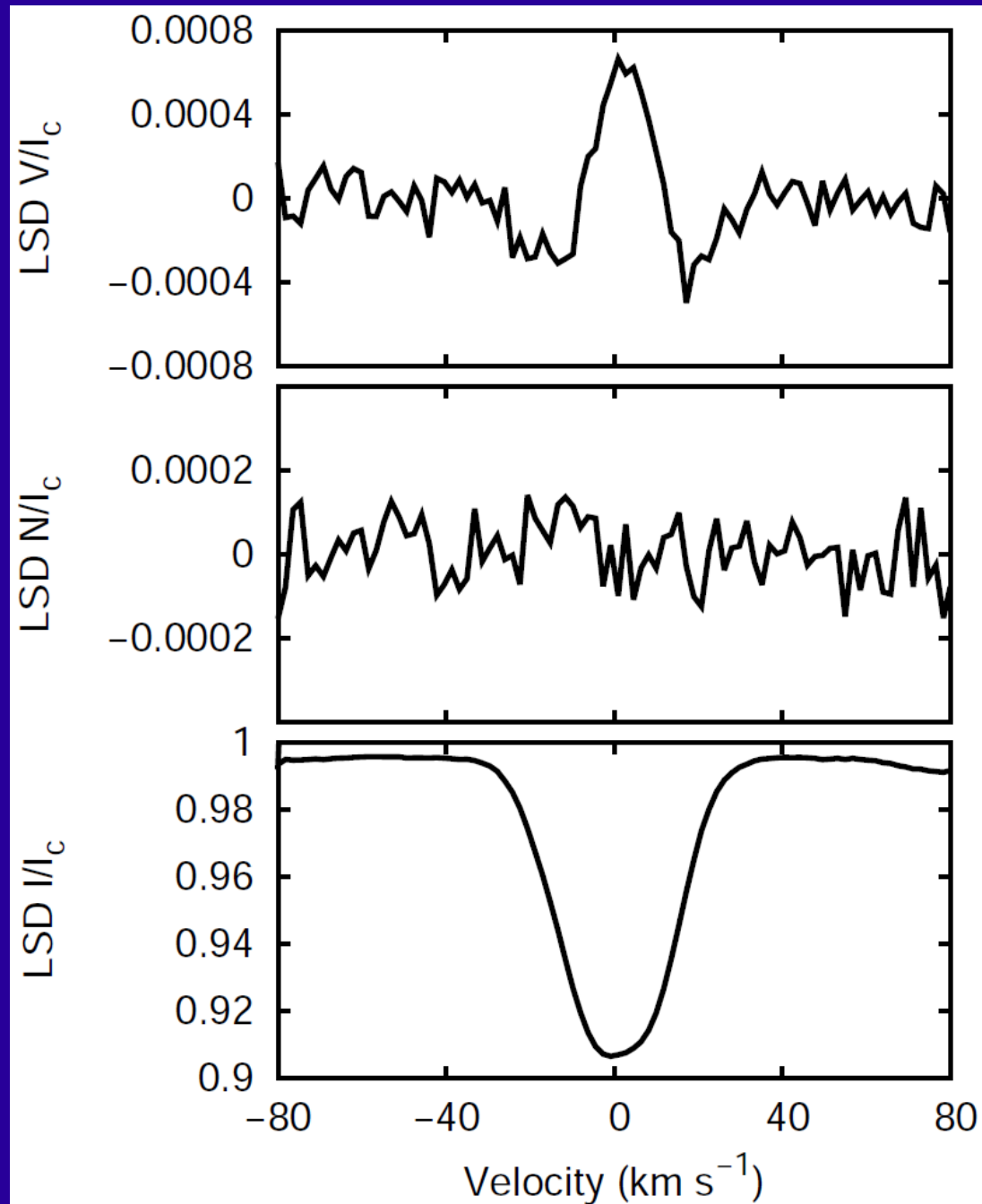
$$B_{\text{pol}} = 335 \text{ G} [270 - 455]$$

- confirmed as N-rich (also in Nieva & Przybilla 2012)

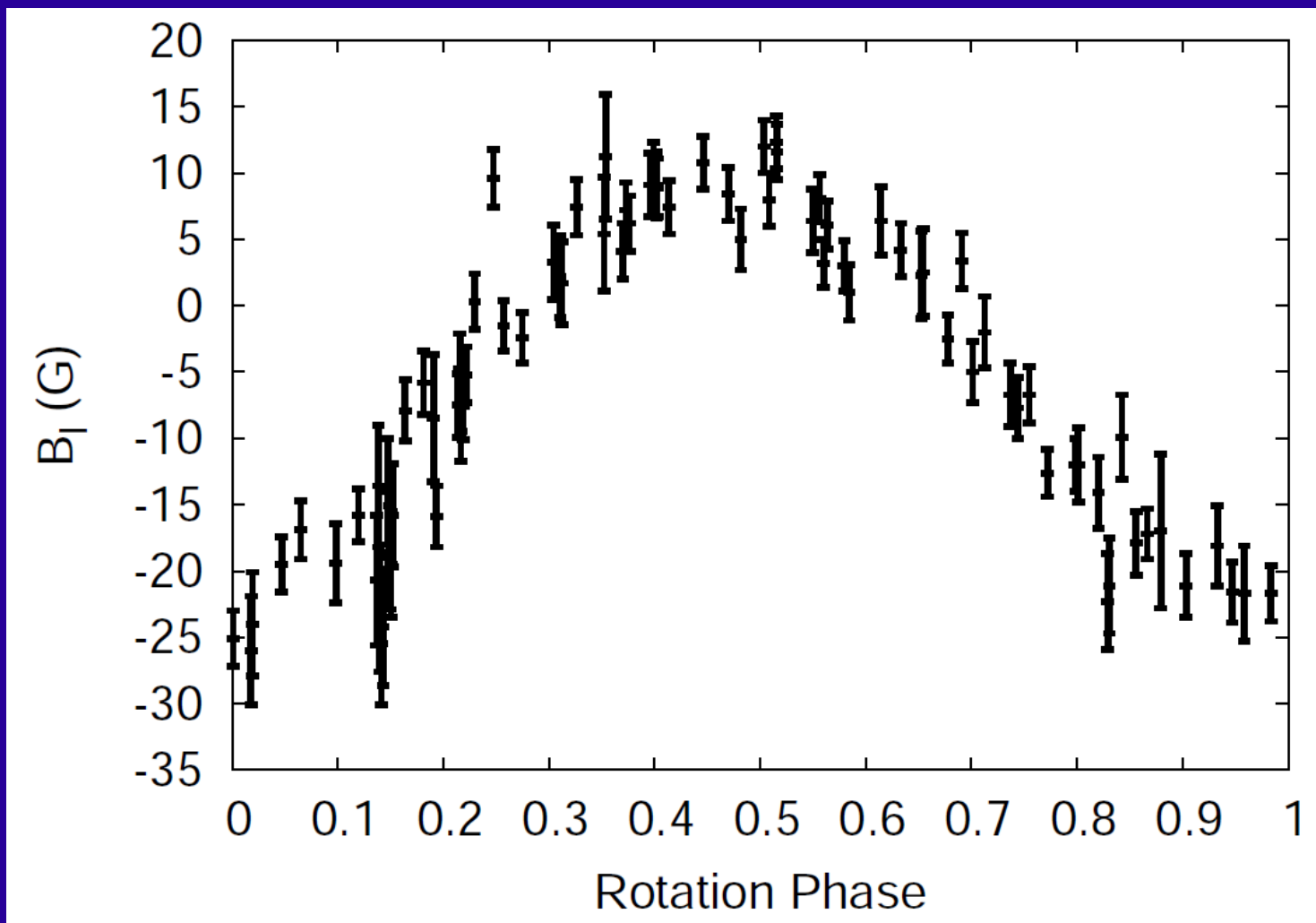


Our new study

- 82 Narval data covering well the various phases of rotation
- LSD profiles for a mask
 - with all photospheric lines
 - with only N lines

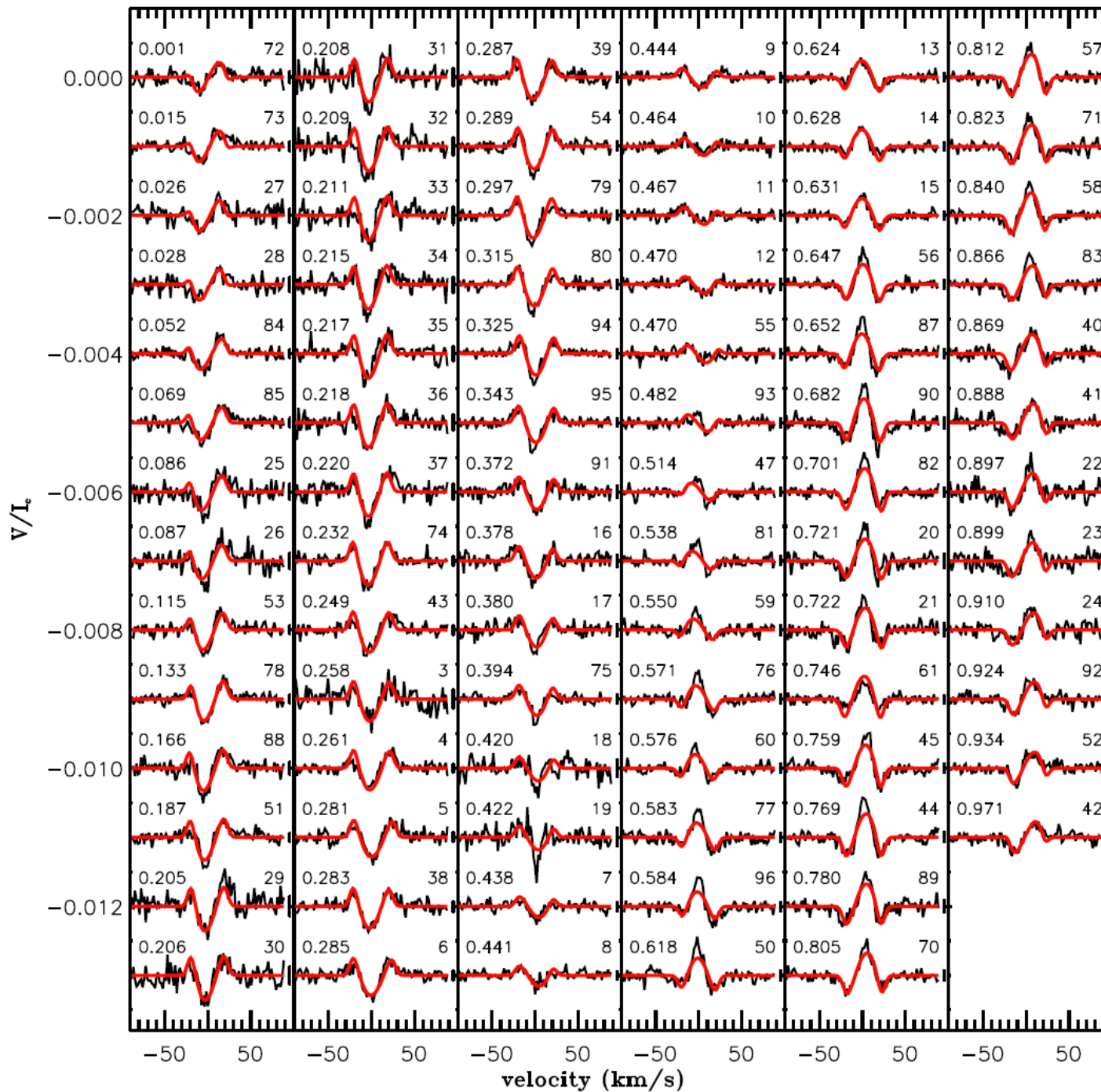


Longitudinal magnetic field



off-centered dipole model

LSD Stokes V – all lines



off-centered

$$i = 34.5^\circ [33.6 - 35.4]$$

$$\beta = 104.5^\circ [103.7 - 105.2]$$

$$B_{\text{pol}} = 56.0 \text{ G} [55.5 - 56.5]$$

$$d = 0.04145 [0.03784 - 0.04564]$$

$$\Phi = 0.06795 [0.06662 - 0.06928]$$

$$\text{chi}^2 = 1.337$$

centered

$$i = 35.2^\circ [34.3 - 36.1]$$

$$\beta = 108.2^\circ [107.6 - 108.8]$$

$$B_{\text{pol}} = 55.3 \text{ G} [54.8 - 55.8]$$

-

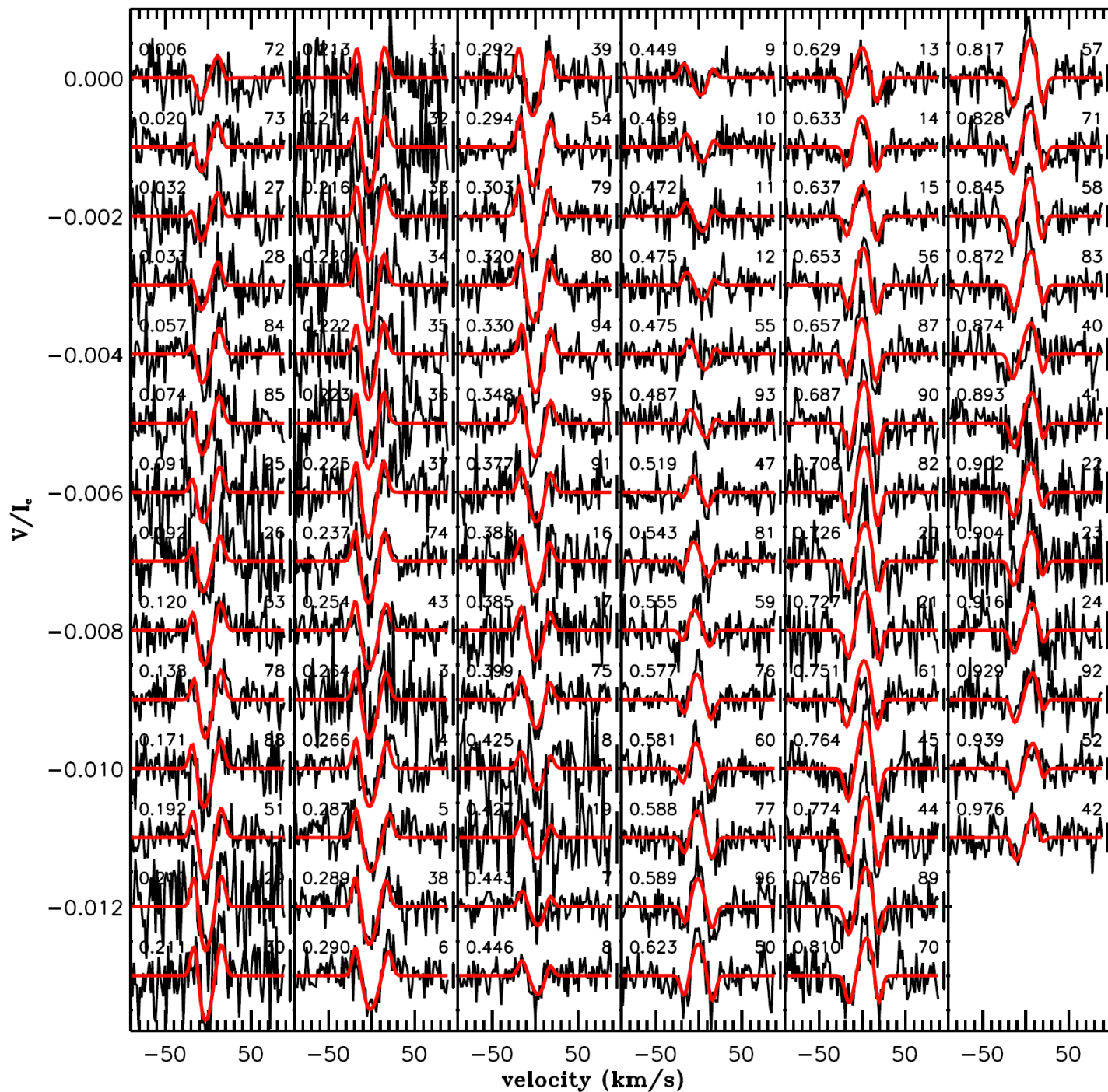
$$\Phi = 0.0695 [0.06791 - 0.07065]$$

$$\text{chi}^2 = 1.363$$

B_{pol} below the 300 G threshold (Aurière et al. 2007)

off-centered dipole model

LSD Stokes V – N lines



N lines

$$i = 30.8^\circ [29.3 - 32.3]$$

$$\beta = 102.6^\circ [101.5 - 103.7]$$

$$B_{\text{pol}} = 91.9 \text{ G} [90.5 - 93.3]$$

$$d = 0.068 [0.061 - 0.075]$$

$$\Phi = 0.07307 [0.07078 - 0.07535]$$

$$\text{chi}^2 = 1.148$$

All lines

$$i = 34.5^\circ [33.6 - 35.4]$$

$$\beta = 104.5^\circ [103.7 - 105.2]$$

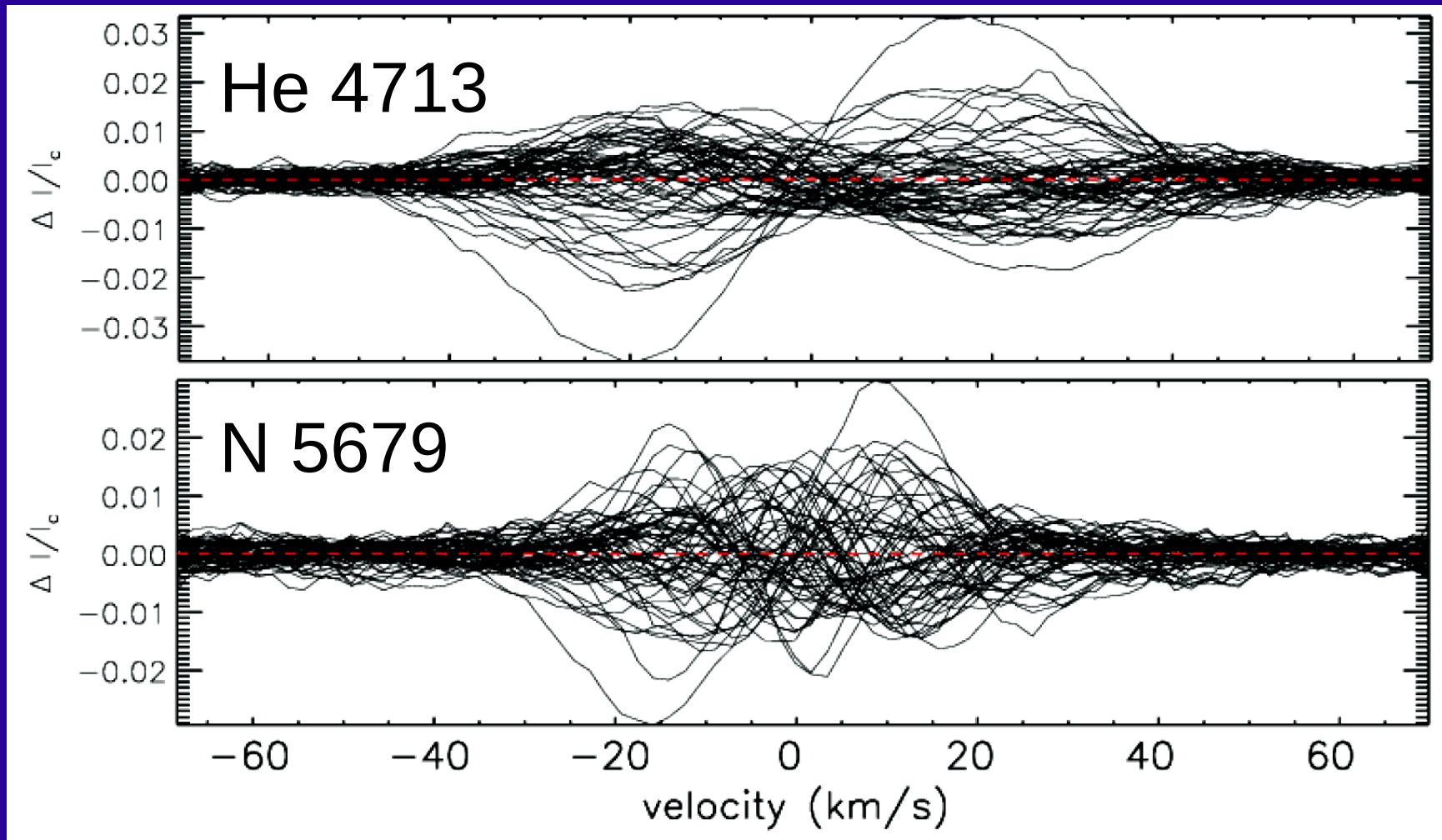
$$B_{\text{pol}} = 56.0 \text{ G} [55.5 - 56.5]$$

$$d = 0.04145 [0.03784 - 0.04564]$$

$$\Phi = 0.06795 [0.06662 - 0.06928]$$

$$\text{chi}^2 = 1.337$$

Line-profile variability



Only rotation period found \leftrightarrow chemical spots
No stellar pulsation detected
although in β Cep/SPB instability strip

Modelling the magnetic field
of the B-type N-rich star
 ζ Cassiopeiae

Maryline Briquet & Coralie Neiner