V16 Executive summary
(ro)Ap stars

In 2016:

- 1 publication (HD 24712: Perraut et al. A&A, 590, A117)
- Fruitful collaboration with Porto for refining the modeling of the instability strip of roAp stars (1 talk and 1 poster presented by M. Cunha)
- New good VEGA data for the mini-survey on Ap stars for T_{eff} calibration
- Conclusions of the εUMa VEGA campaign for detecting spots

Revisiting the instability strip of roAp (1)

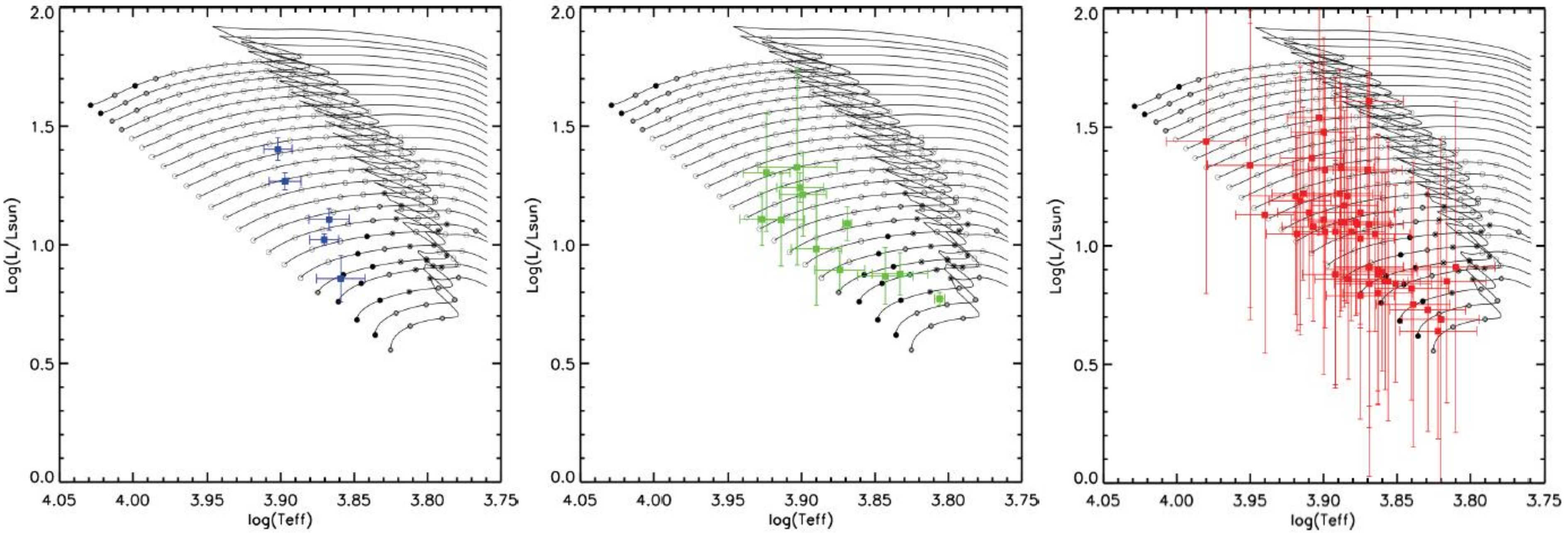


Fig 2. Position of known roAp stars in the HR diagram.
Left panel: stars for which interferometric data are available; Middle panel: Stars for which Hipparcos parallaxes, but not interferometric data, are available; Right panel: All stars from Smalley et al 2015

All 56 roAp stars considered are positioned within the theoretical instability strip, given the 1—sigma uncertainties

[M. Cunha et al. 2016]

Revisiting the instability strip of roAp (2)

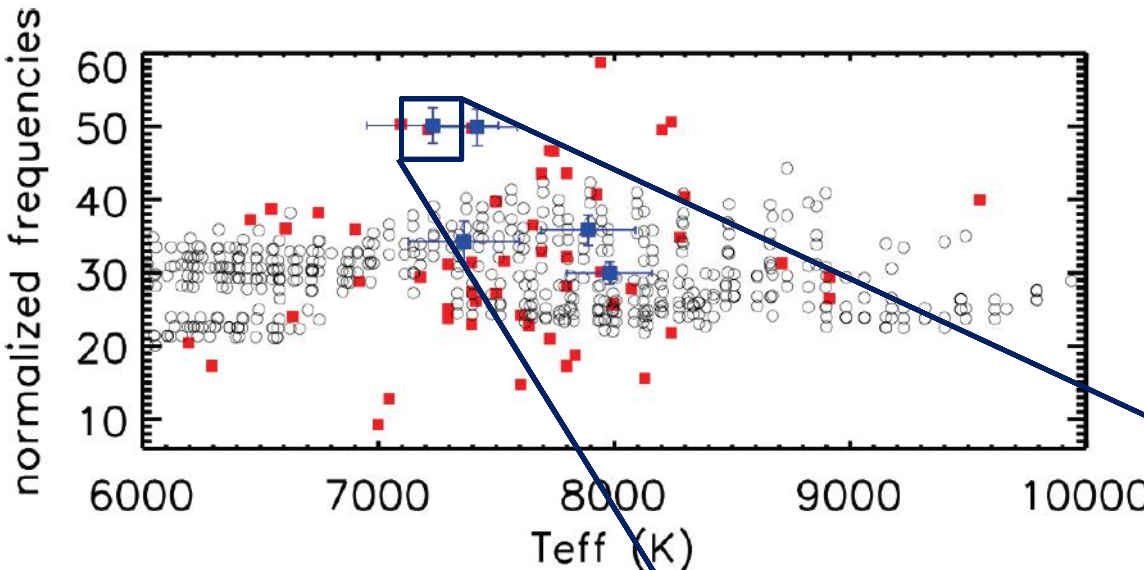
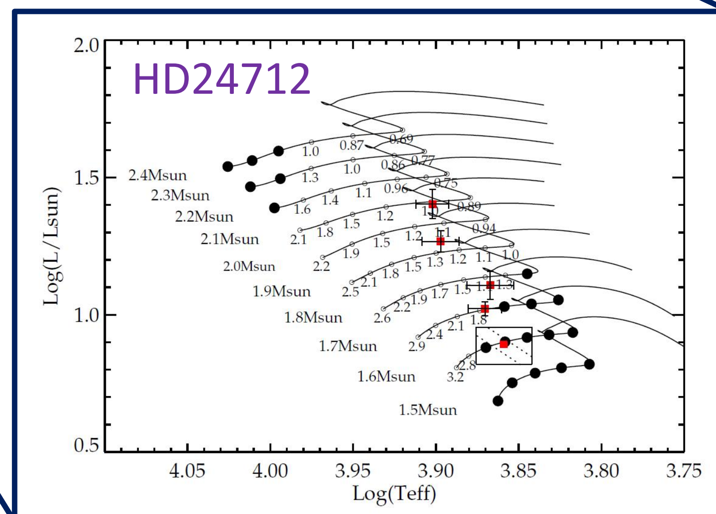


Fig 3: Comparison between the characteristic frequencies excited in the models and the observed frequencies. All frequencies are normalized by $M^{1/2}/(2\pi R^{3/2})$

Open circles: model results
Blue squares: stars with interferometry
Red squares: stars from Smalley et al. 2015.

Out of 5 stars with accurate global parameters, 2 pulsate in frequencies that are not in agreement with the model predictions.

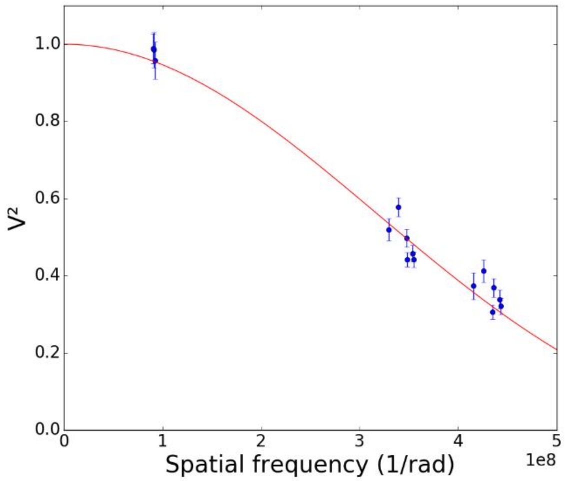
VEGA measurements
$R = 1.77 \pm 0.06\ R_\odot$
$L = 7.8 \pm 1.2\ L_\odot$
$T_{eff} = 7230 \pm 280$ K



[Perraut et al. 2016, A&A, 590, A117]

Fundamental parameters of the magnetic (rapidly oscillating) Ap stars

The VEGA mini-survey



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Sample of Ap stars

[OBJ1] Test the position of the blue edge of the instability strip

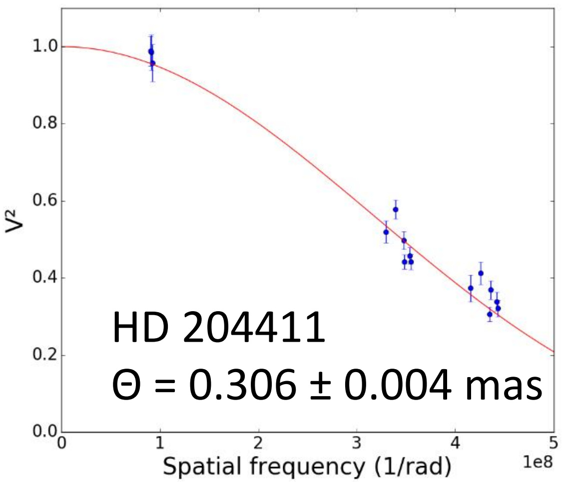
$\Rightarrow$ Ap stars with log L ~ 1.3-1.6 & log Teff ~ 4

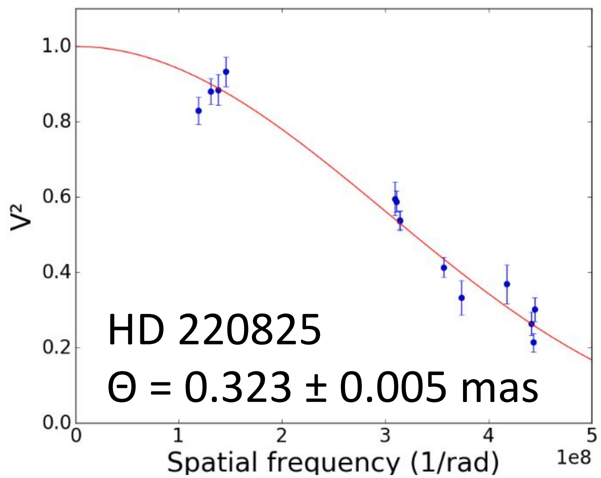
[OBJ2] Provide a Teff calibration law

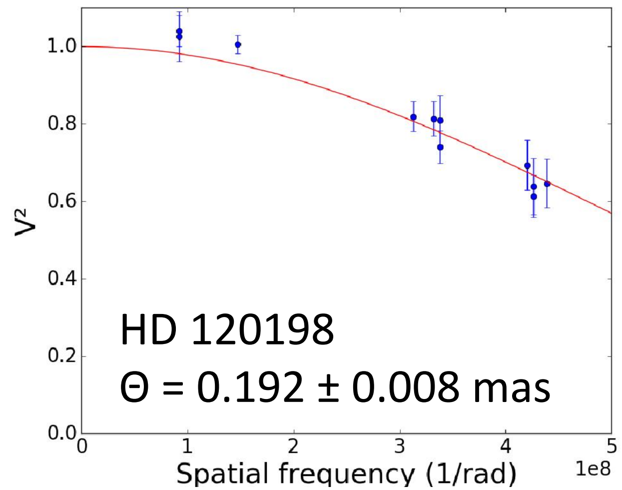
$\Rightarrow$ targets of different spectral types

HD	V	K	Sp. Type	Teff (K)	Log Teff (K)	Log L ($L_{\odot}$)	
42659	6.7	6.4	roAp	8000	3.900 ± 0.011	1.48 ± 0.09	★
62140	6.5	6.2	F0pe	7900	3.884 ± 0.011	1.13 ± 0.05	
108662	5.2	5.3	A0p	10500	4.021 ± 0.017	1.81 ± 0.04	
108945	5.4	5.3	A2pv	8950	3.952 ± 0.015	1.71 ± 0.07	
120198	5.7	5.8	B9pe	10500	4.023 ± 0.016	1.65 ± 0.06	★
148898	4.4	4.1	A7p	8400			
153882	6.3	6.2	B9p	8900	3.988 ± 0.013	2.00 ± 0.11	★
188041	5.6	5.5	A5p	8000	3.926 ± 0.010	1.55 ± 0.07	★
204411	5.3	5.1	A4pv	8750	3.942 ± 0.015	1.95 ± 0.06	★
220825	4.9	5.0	A2pv	9080	3.958 ± 0.014	1.35 ± 0.04	★

Complete VEGA data sets on 5 targets





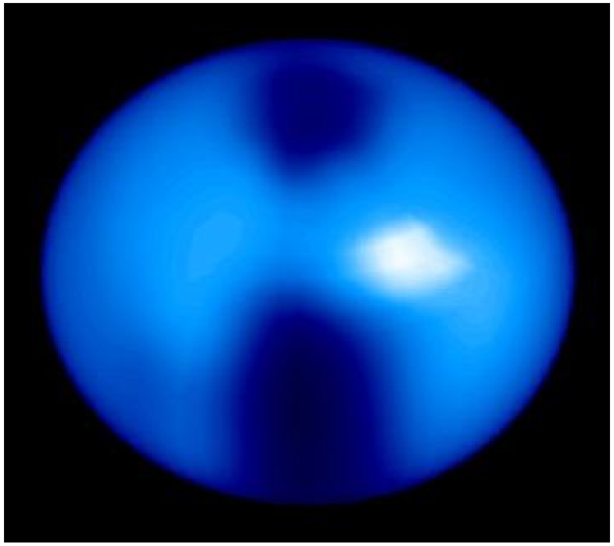


Need to continue the interferometric observations (VEGA Proposal in 2017).
Need for calibrated spectrophotometry to compute bolometric flux.

For HD 42659 (the last roAp reachable with VEGA) the first attempt seems to show that the target is of the same order (or even smaller than) the calibrator (i.e. 0.18 mas).

Looking for spots at the surface of (ro)Ap stars

εUMa 2016 VEGA campaign



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Observations

All observations are in High Spectral Resolution around FeI λ531.7 with long integration times (~40 minutes, i.e., 90 blocks of 2500 images of 10-ms exposures)

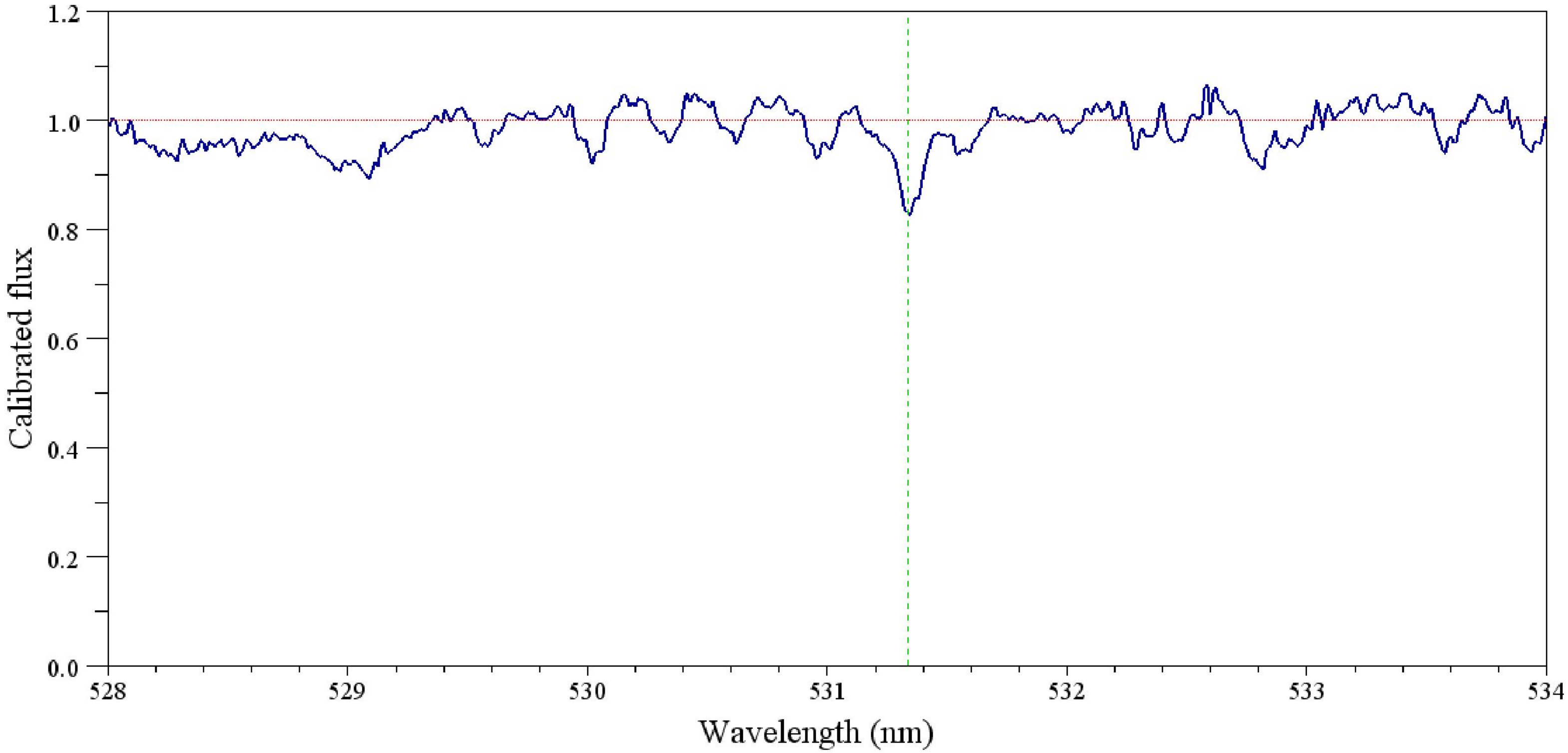
- June, 9th – E1E2W2 (but issues with fringe tracker)
- July, 25th – E1E2 (~ 65 m)
- July, 30th – W1W2 (~ 100 m)

Observations were difficult because we are far in the blue where the turbulence is stronger. They require excellent atmospheric conditions, which was the case on July, 25th only.

Only the E1E2 data set exhibits a clear fringe peak when processed.

Spectrum

The iron line is centered at 531.35 nm (slightly shifted due to the spectral calibration) and has a width of about 1A, and goes down to 0.82.



Visibility squared

We use k Dra as a calibrator and compute the visibility squared over the total spectral range of the camera [528 nm ; 534 nm].

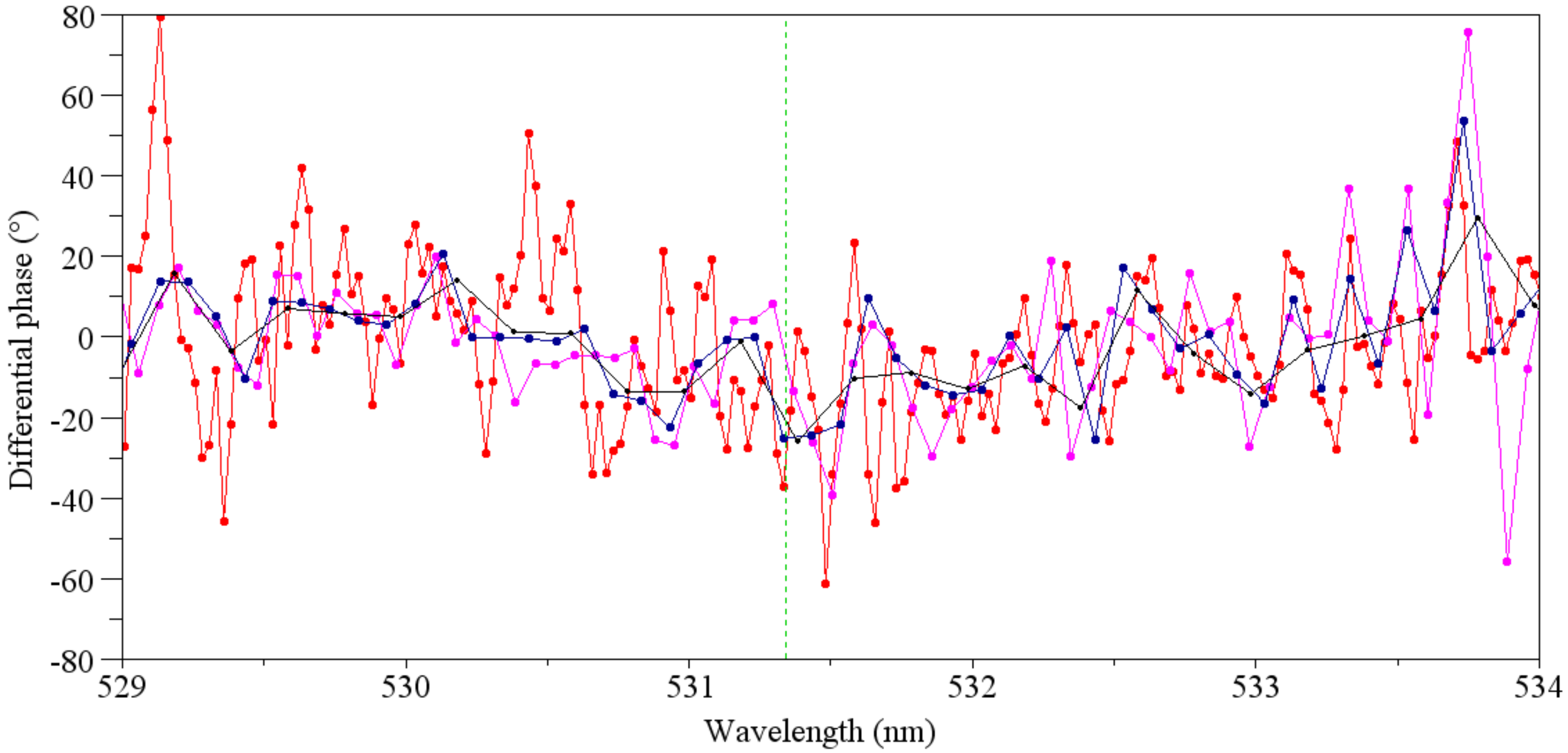
We obtain a calibrated visibility:

V^2_{cal} = 0.12 on a 65-m baseline

which corresponds to an angular diameter of about 1.7 mas.

Differential phase vs. channel width

Analysis channel of 0.5 A (red), 0.7 A (purple), 1 A (blue), 2 A (black)



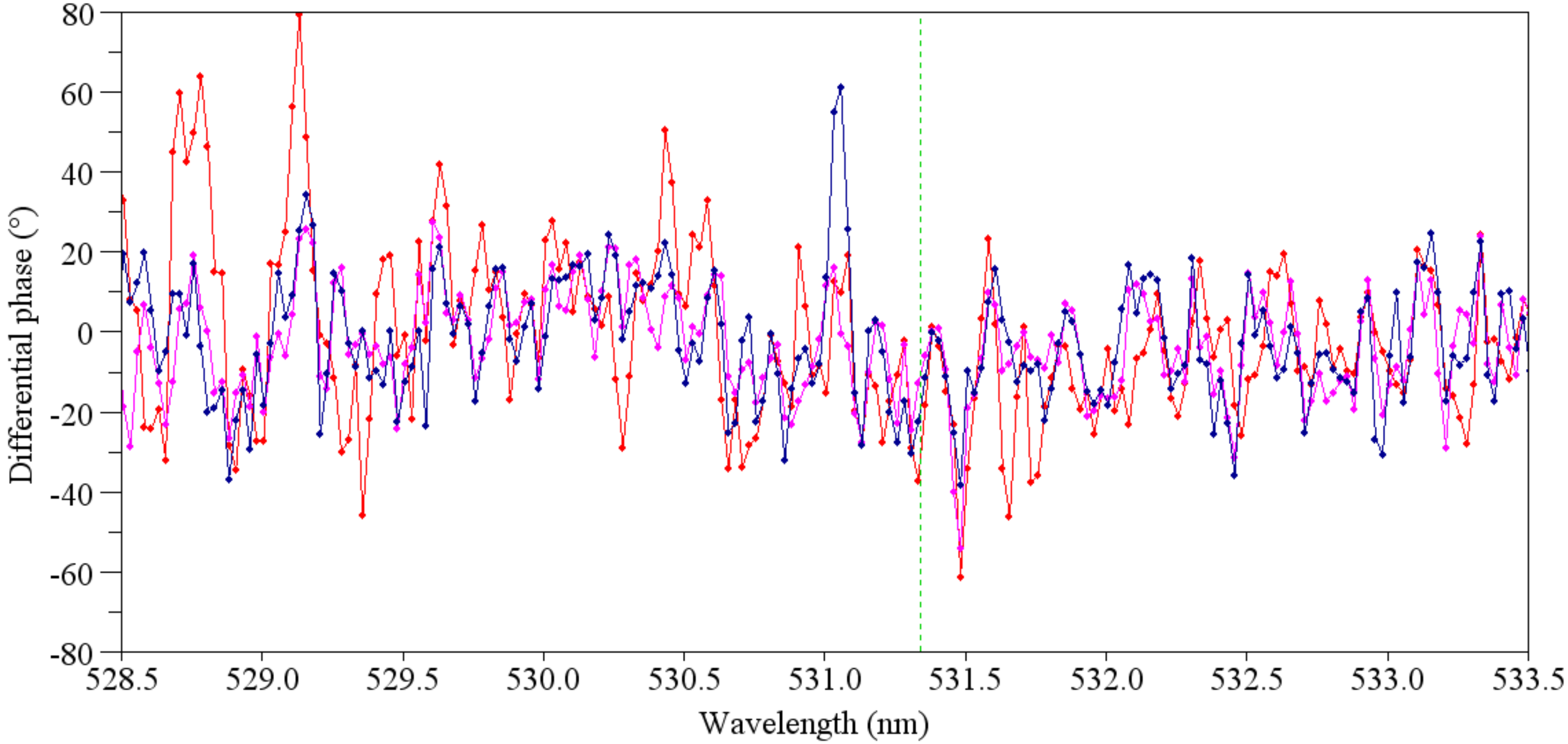
No clear signal is detected across the line (centered at 531.35 nm)

Note that the standard deviation standard in the continuum is about 14° for a channel of 0.5A.

Differential phase vs. binning number

To improve the SNR, we tried to bin 2 or 4 images of short exposures in the case of the narrowest analysis channel (0.5 A)

No binning (red), binning of 2 images (purple), of 4 images (blue)



Binning does not improve the signal, even if it decreases the fluctuations in the continuum

Conclusion on the εUMa attempt

Despite the good conditions, the satisfying number of photons, the good tracking of the fringes, we are not able to detect a clear signal across the FeI λ531.7 line.

In this spectral range, where the turbulence is strong, we are not able to reach an accuracy high enough for such small signals across very narrow and little deep lines.

Implementation of adaptative optics at CHARA in the near future would help for such challenging programs.