

Nova Delphinus 2013 (V399 Del) in the visible

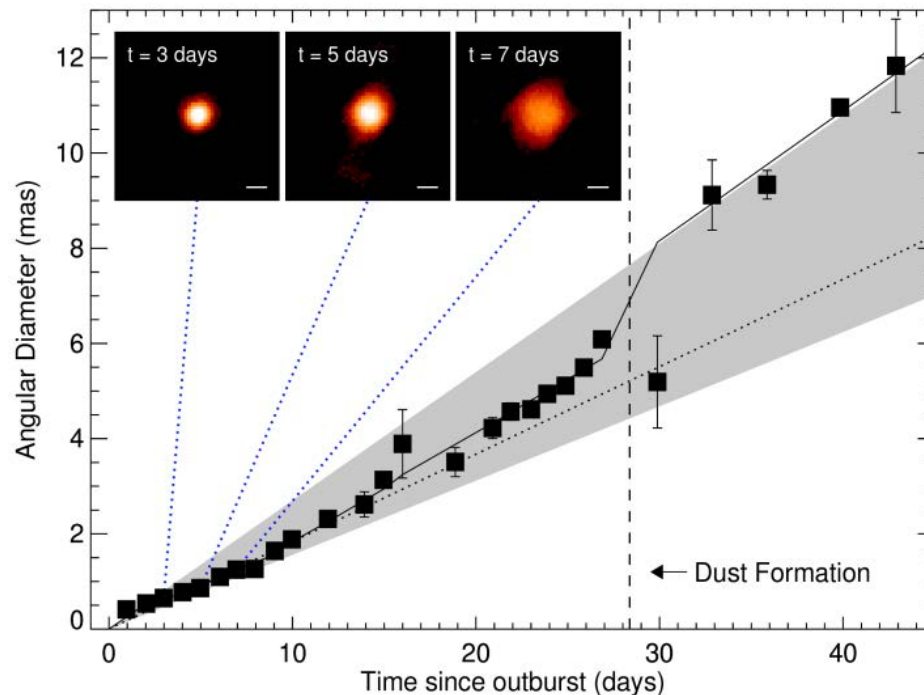
VEGA observations initiated by Olivier
& conducted by Denis
data processed by Isabelle

+ PAVO observations by Vincente Maestro, PhD of P. Tuthill

CLASSIC/CLIMB & MIRC observations in H, K
→ paper of Gail Schaefer et al.
in Nature, nov. 2014

The expanding fireball of Nova Delphini 2013

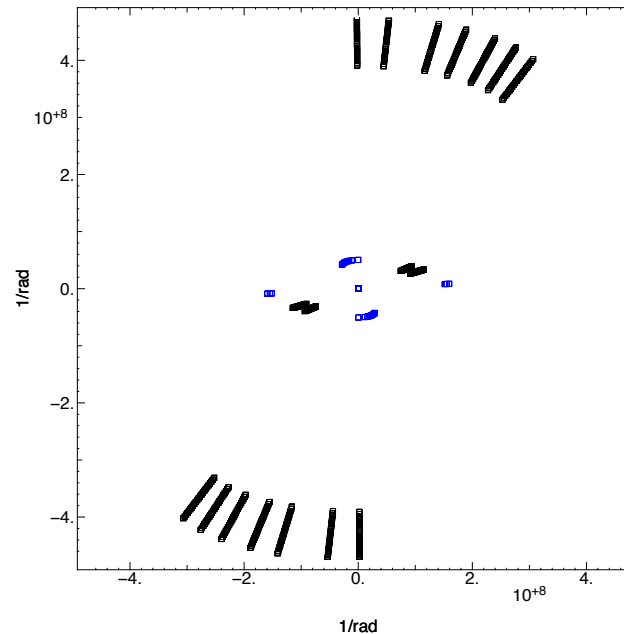
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VEGA & PAVO observations

UT Date	MJD	t [days]	Comb*	Config.	Projected Baseline Length [m] PA [°]		Cal ⁺	$\lambda(\Delta\lambda)nm$	θ_{UD} (mas)	χ_{red}^2
2013-08-16		1	P	S1E1			1,3	656.5(-)	0.43 ± 0.02	
2013-08-20	56524.322	5	V	W1W2	105	90	1	637.5 & 670 (15)	0.92 ± 0.01	1.07
2013-08-20	56524.322	5	V	W1W2	105	90	1	656.5(15)	1.04 ± 0.01	1.25
2013-08-22		7	P	W1W2			1,3	720(60)	1.286 ± 0.013	
2013-08-22		7	P	W1W2			1,3	[648 - 659]	1.386 ± 0.019	
2013-08-25	56529.351	11	V	S1S2	34	154	1	656.5 (15)	2.25 ± 0.04	0.7
2013-08-26	56530.232	12	V	S1S2	33	180	1,2	656.5 (15)	2.43 ± 0.13	5.1
2013-08-30	56534.400	16	V	S1S2	33	146	1	656.5 (15)	3.3 ± 0.1	–

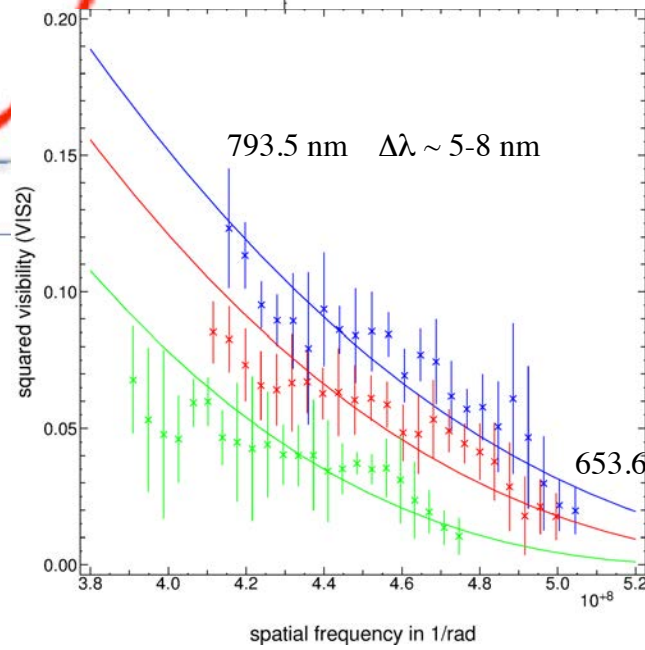
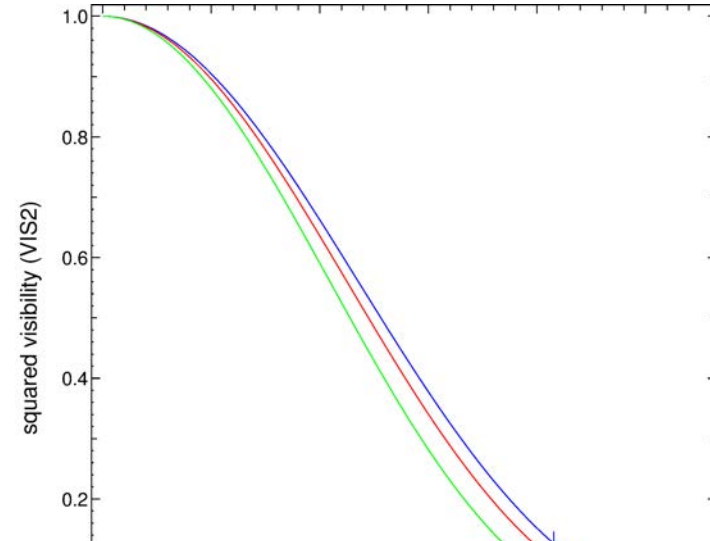
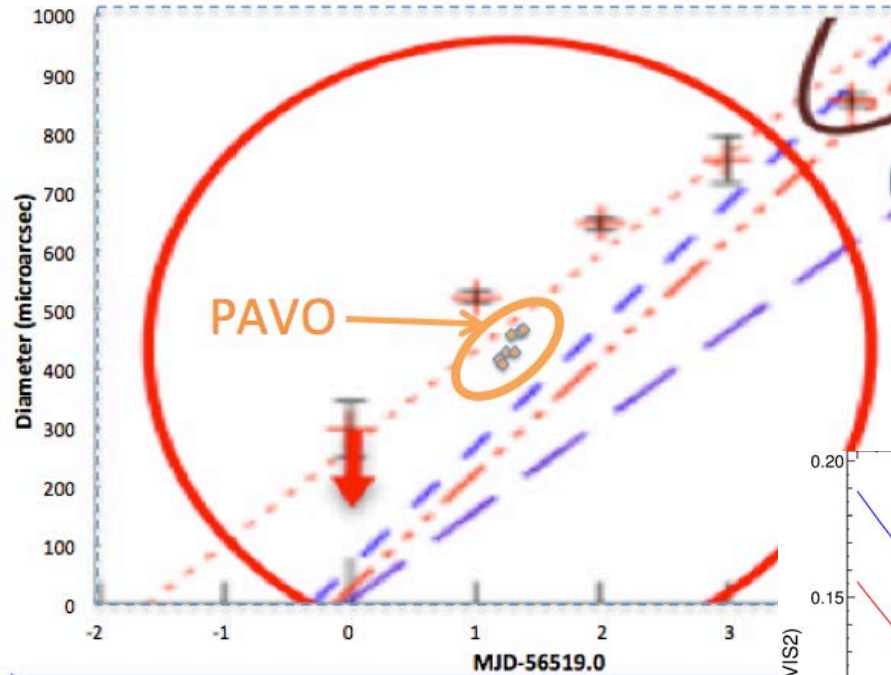
Table 1. Journal of observations and angular diameters measurements of Nova Del 2013 in the visible spectral domain. *Beam combiner codes: V=VEGA, P=PAVO. ⁺ Calibrator codes: 1= HD 190993 $\theta_{UD} = 0.158 \pm 0.011mas$, 2= HD 206860 $\theta_{UD} = 0.515 \pm 0.037mas$, 3= HD 196740 $\theta_{UD} = 0.176 \pm 0.012mas$.



uv-coverage
VEGA in blue
PAVO in black

PAVO results

at $t \sim 1.3$ day since outburst



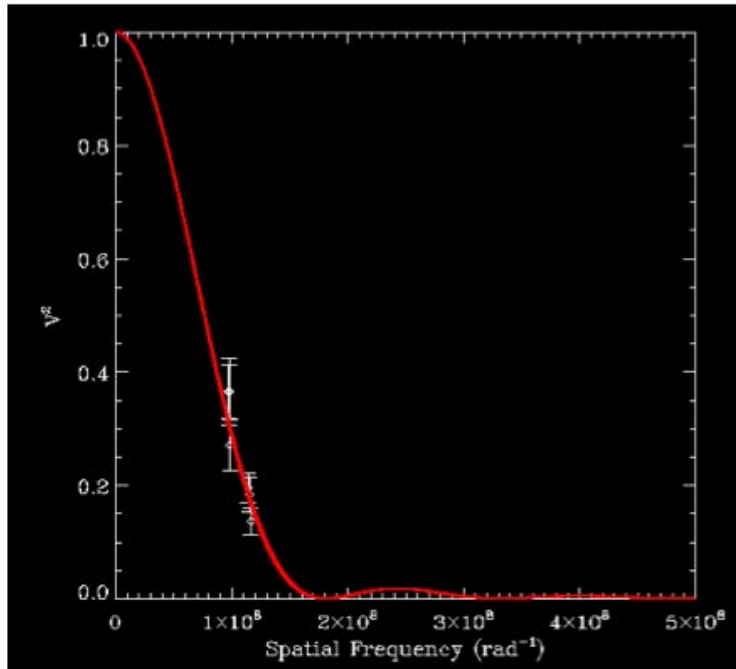
$$\theta_{UD} = 0.433 \pm 0.002 \text{ mas}$$



PAVO results

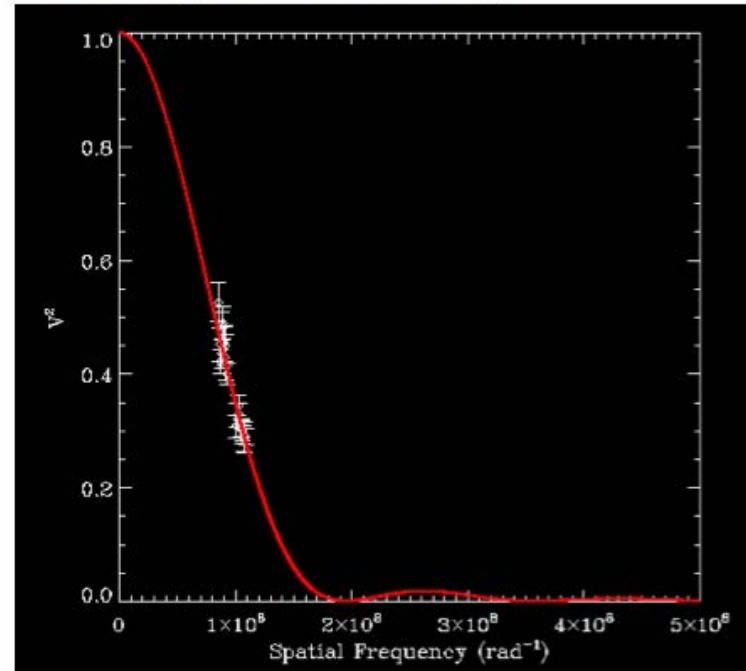
at $t \sim 7.5$ days since outburst

H-alpha (narrow:[0.648-0.659 microns])



diam(Halpha)= 1.386 ± 0.019 mas

Continuum ([0.69-0.75 microns])



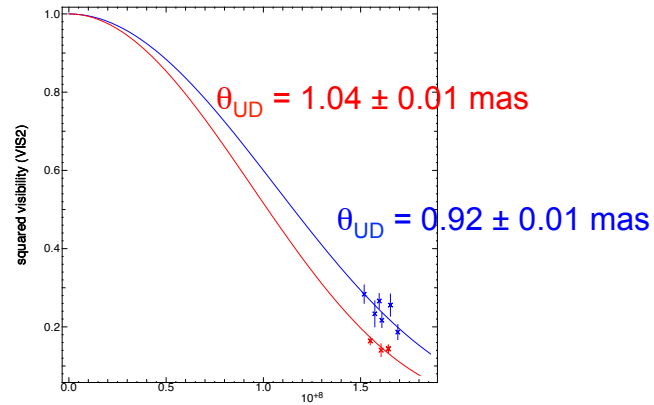
diam(cont)= 1.286 ± 0.013 mas

V. Maestro

different diameters in H α and in the continuum, in good agreement with VEGA measurements

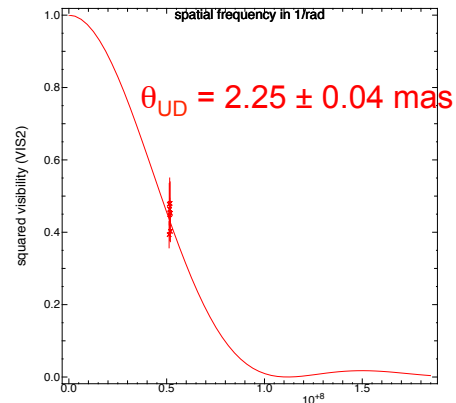
VEGA results

at $t \sim 5$ days since outburst

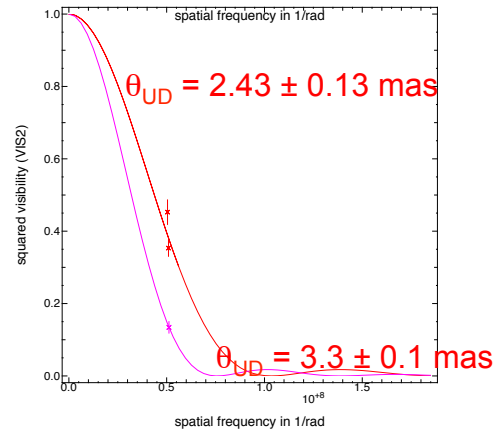


bandwidths for calculation:
656.5 nm ($\Delta\lambda$ 15nm)
637.5 & 670 nm ($\Delta\lambda$ 15nm)

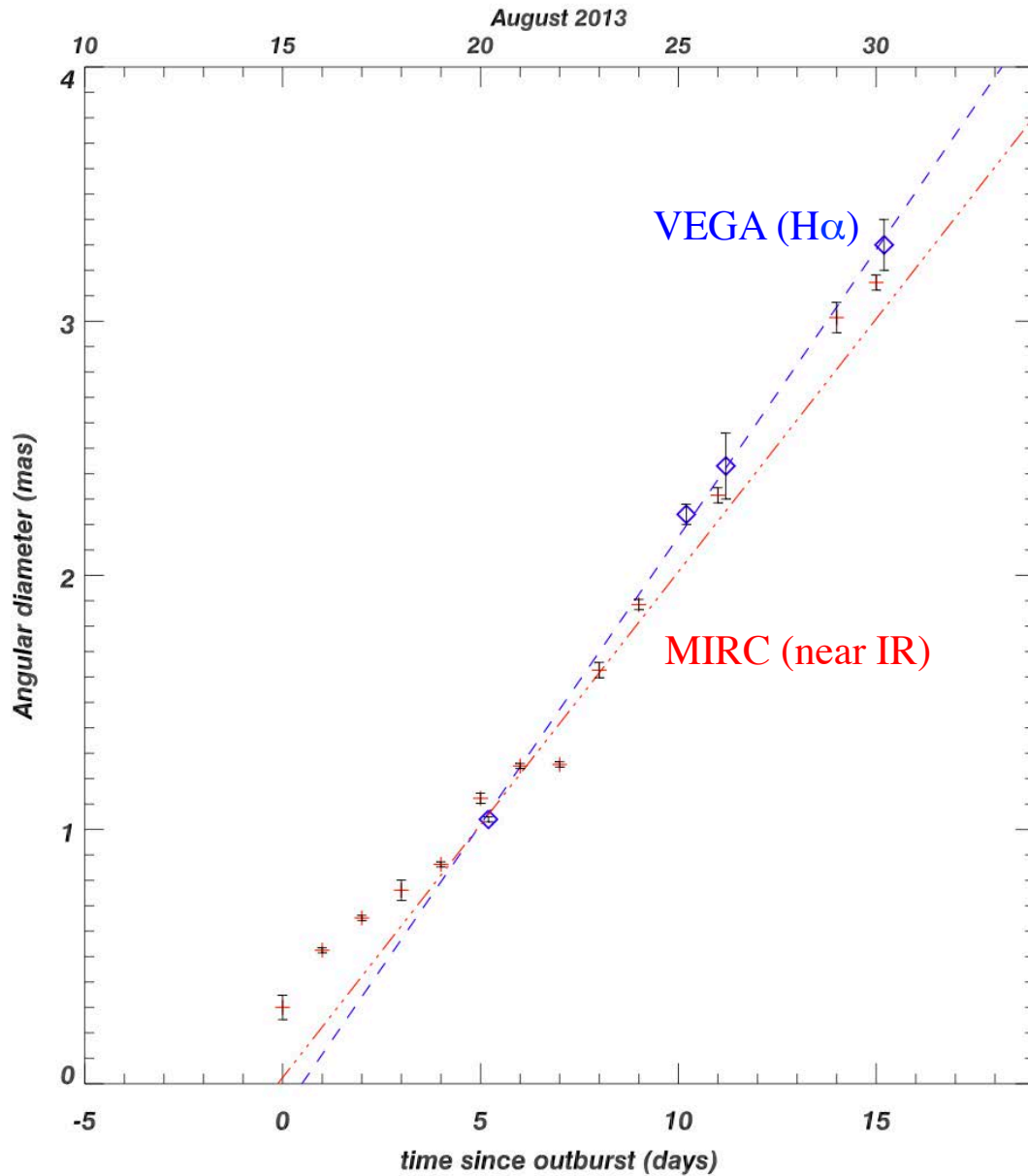
at $t \sim 11$ days



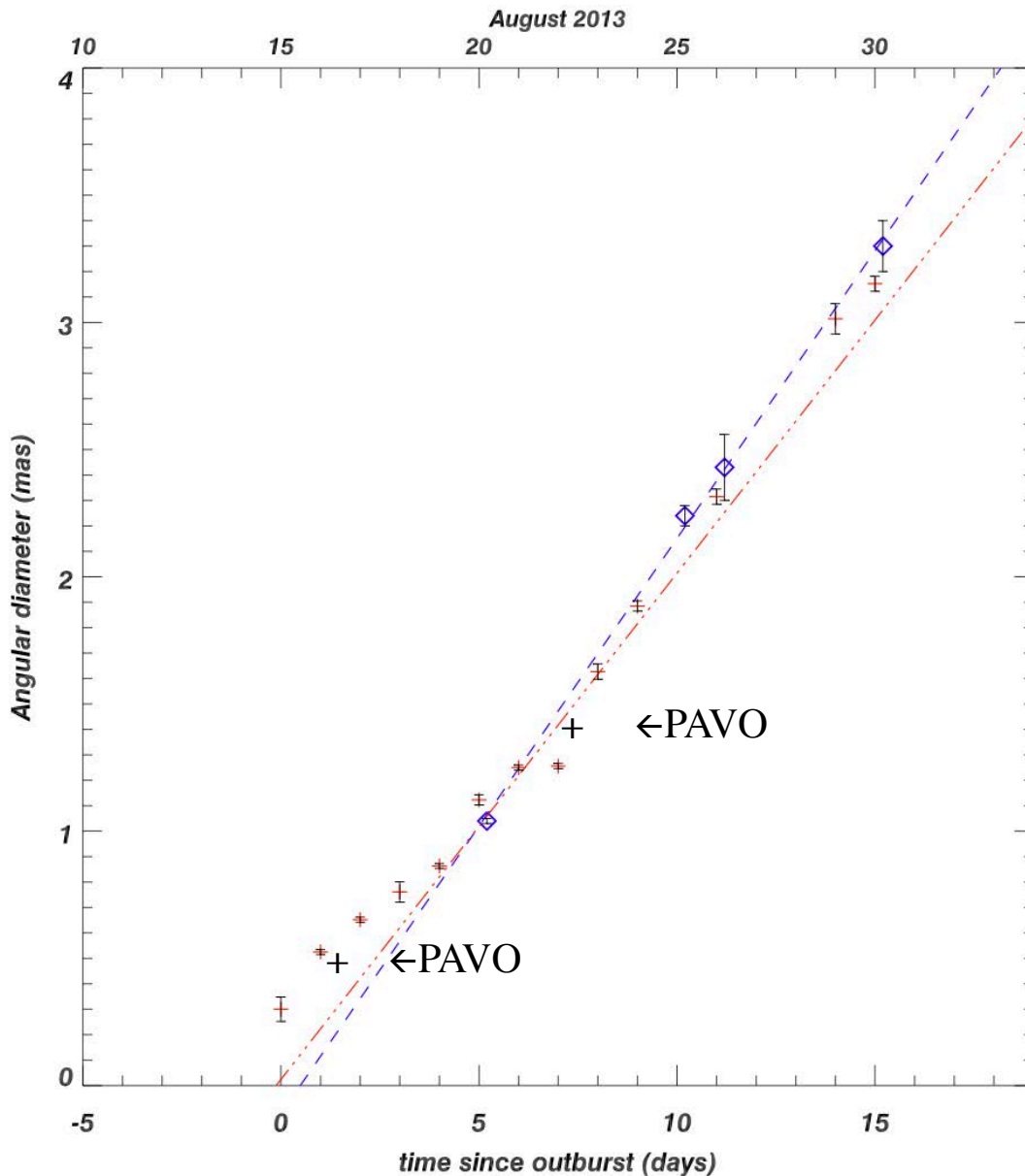
at $t \sim 12$ & 16 days



VEGA results



VEGA points + PAVO points



expansion curve apparently
comparable between H and H α

Is it an interesting result ?

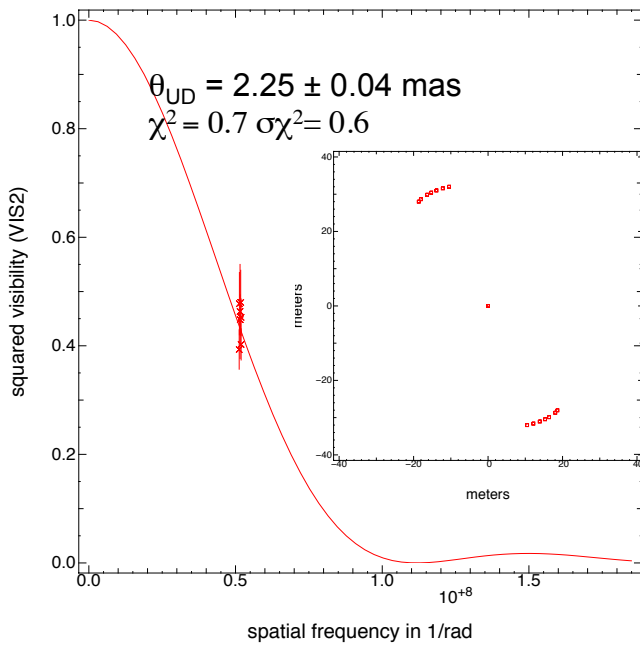
*first 'real-time' expansion of the
fireball of a nova in the visible*

*probably more 'astrophysical results'
needed for publication*

*with MIDI data (mid-IR)
at $t \sim 65$ days after the outburst
- dust forming event -?*

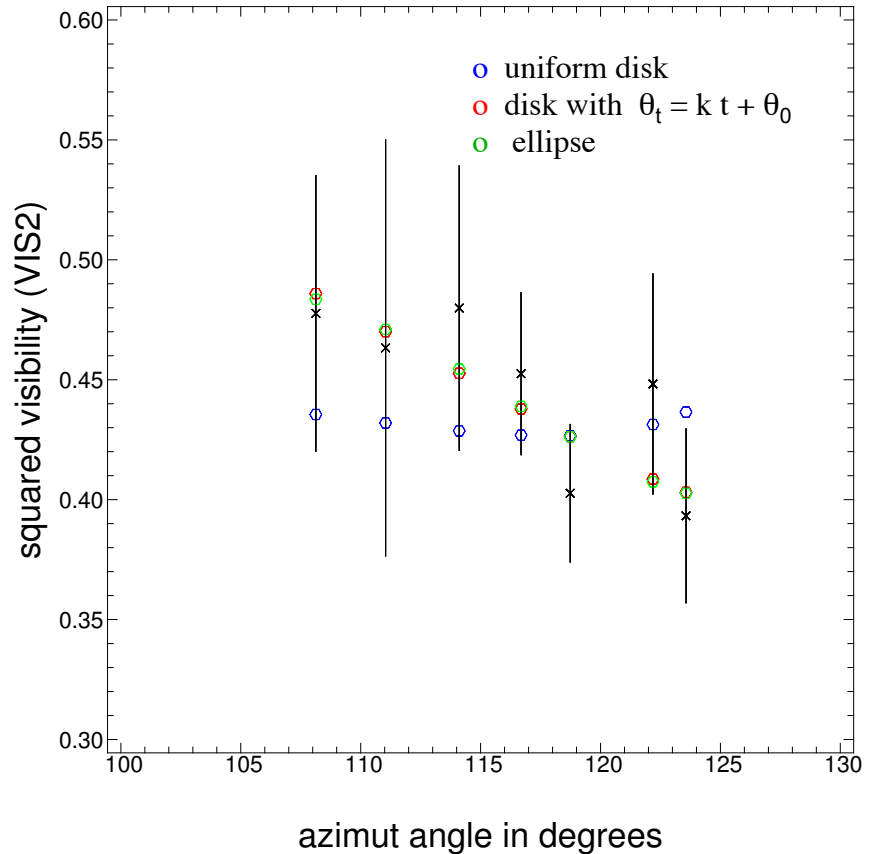
VEGA results

at $t \sim 11$ days since outburst

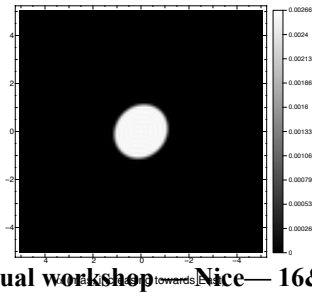
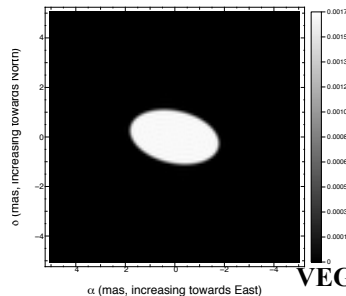


Fit by a linearly increasing diameter:
 $k = 2.06 \pm 0.84 \text{ mas/day}$ no realistic (x10)
 $\theta_0 = 1.5 \pm 0.3 \text{ mas}$ $\chi^2 = 0.38$ $\sigma\chi^2 = 0.63$

Fit by an ellipse: $\chi^2 = 0.48$ $\sigma\chi^2 = 0.71$
 $\theta_{\min} = 2.09 \pm 0.27 \text{ mas}$
 $PA_{\text{maj-axis}} = 77.5 \pm 30.1^\circ$
 $\text{along_ratio} = 1.73 \pm 1.$



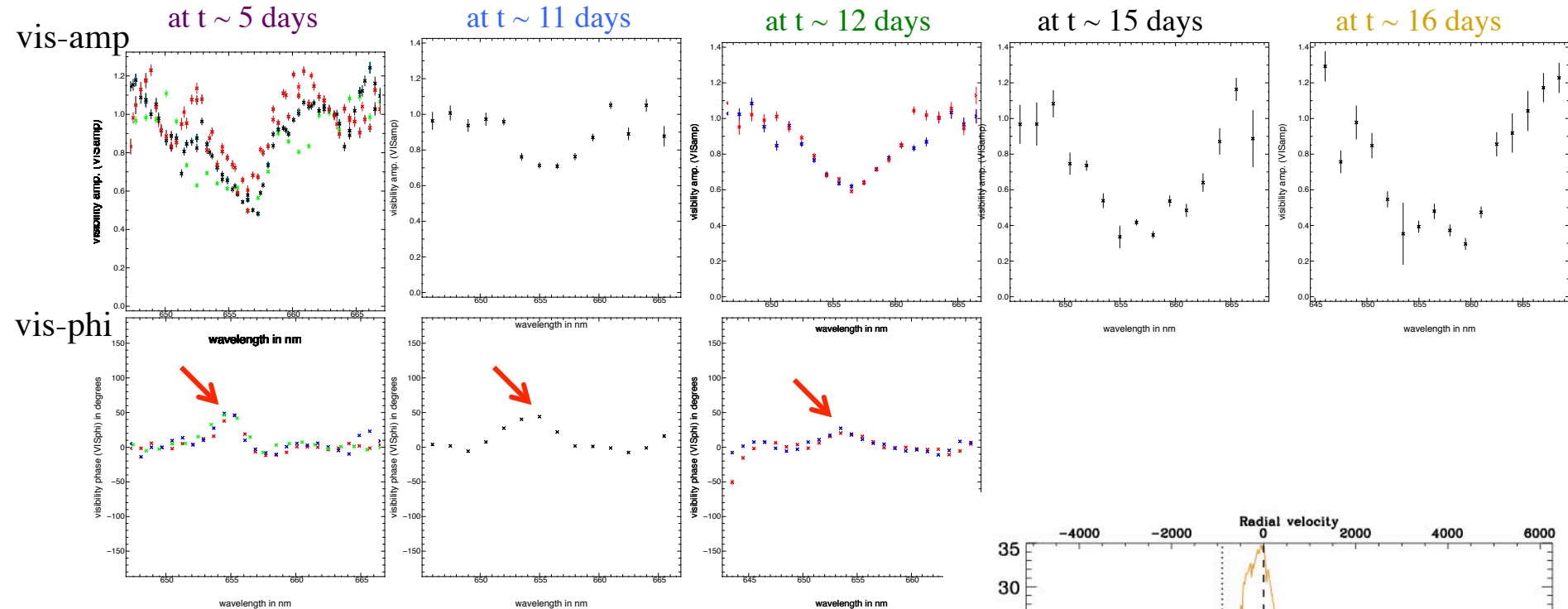
no best model
 → no more result on this set of data



'MIRC' ellipse

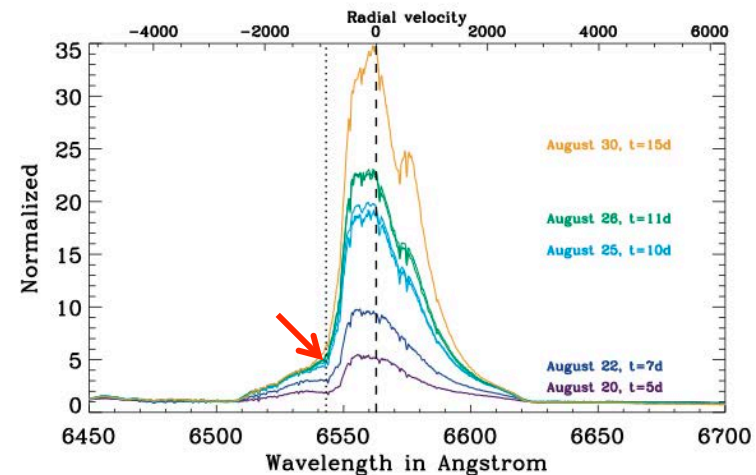
VEGA results

Differential visibilities



differential amplitude = $f(\lambda)$ symmetrical /center of the line
 +probably strong effect of the saturation

at 655nm jump of the differential phase of ~ 50 degrees



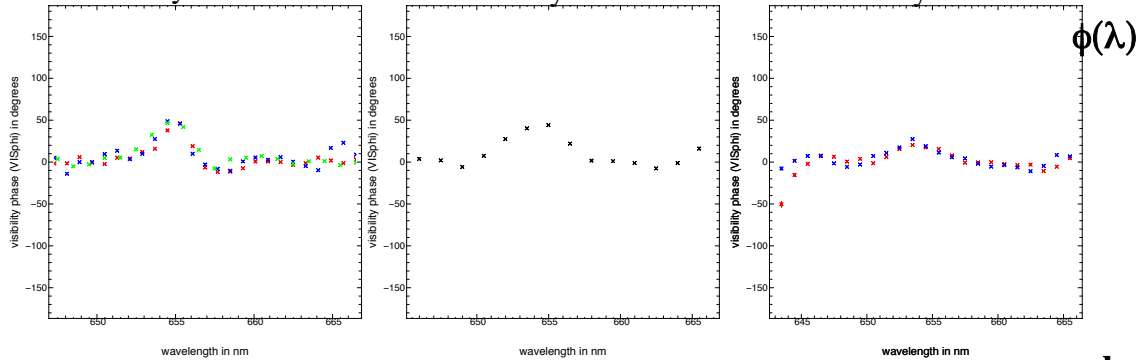
VEGA results

Differential visibilities

at $t \sim 5$ days

at $t \sim 11$ days

at $t \sim 12$ days



$\phi(\lambda)$

at λ

$$\phi(\mathbf{b}, \lambda) = 2\pi/\lambda \beta(\lambda) \cdot \mathbf{b}$$

β = angle on the sky

$\beta \mathbf{b}$ = projection of β on the baseline

Equation / baseline:

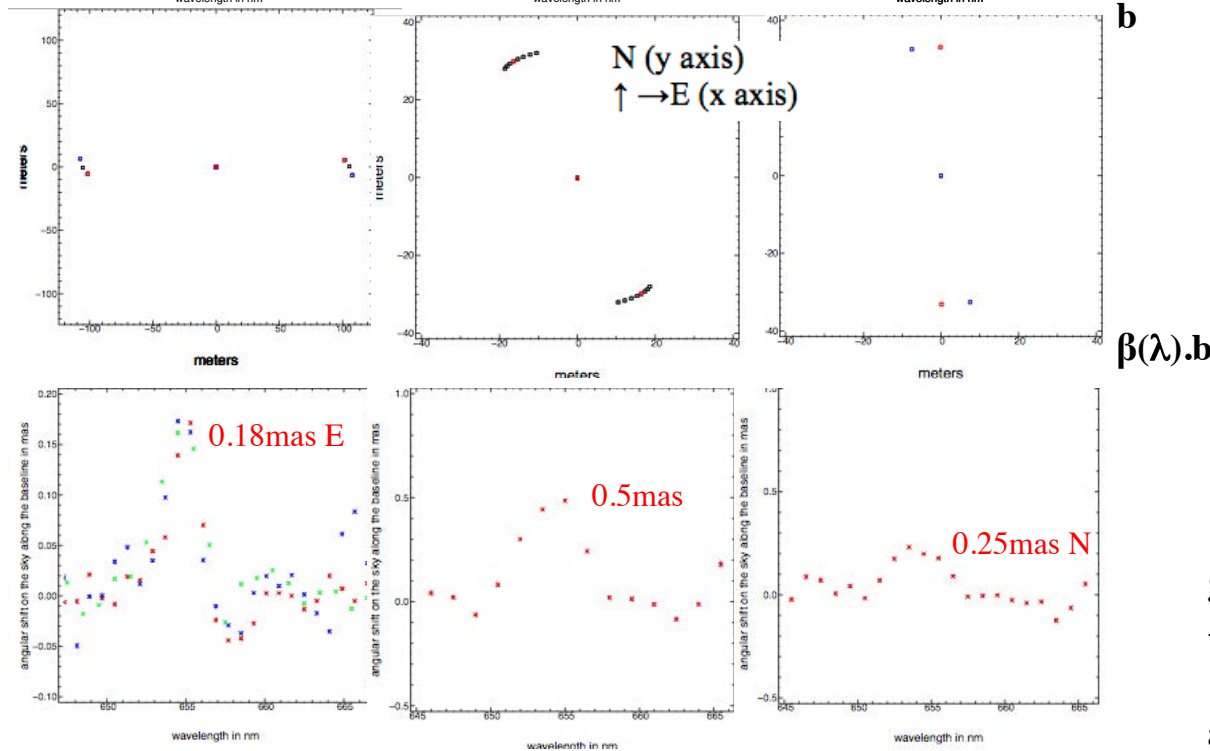
$$\beta_x b_x + \beta_y b_y = \lambda/2\pi \phi$$

at $\lambda=655\text{nm}$

angular shift of the order of:

0.001mas E

0.01mas S



\mathbf{b}

$\beta(\lambda) \cdot \mathbf{b}$

go further:

- model for the nova, e.g.:

disk (diameter(λ), $x(\lambda)$, $y(\lambda)$)

and fit this model on the data (VIS)

Conclusions

- VEGA + PAVO square visibilities → expansion curve
- VEGA differential visibilities:
 - qualitative result with the jump of the phase at 655nm
 - indication of a bipolar ejection
 - need of model to quantify
- MIDI observations: ?

Publishable ?