Differential Phases @ AMBER for Be shell stars

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Credit: ESO/H.H.

Intro + Science goals

- Interferometry measurements:

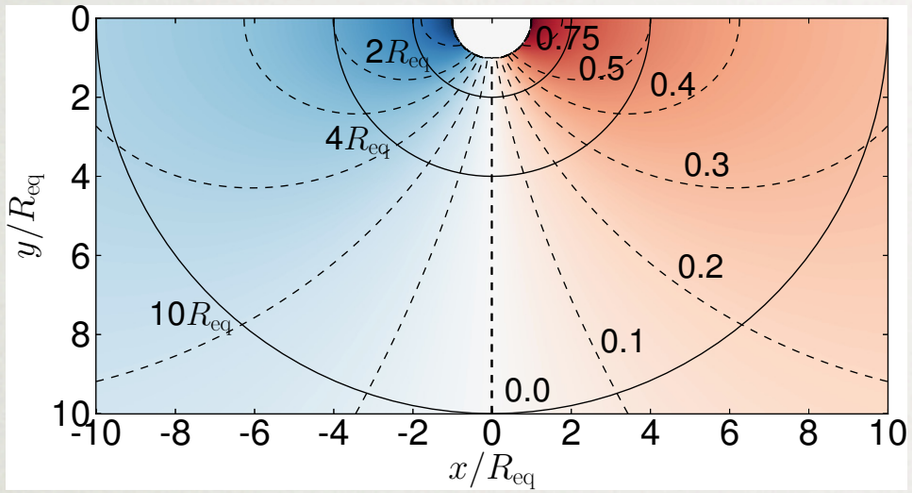
$$V(\boldsymbol{u}) = \frac{\iint I(\boldsymbol{r}, \lambda) \exp\left(-2\pi \mathrm{i} \boldsymbol{u} \cdot \boldsymbol{r}\right) \mathrm{d}^2 \boldsymbol{r}}{\iint I(\boldsymbol{r}, \lambda) \, \mathrm{d}^2 \boldsymbol{r}} = |V| \exp\left(\mathrm{i}\phi\right)$$

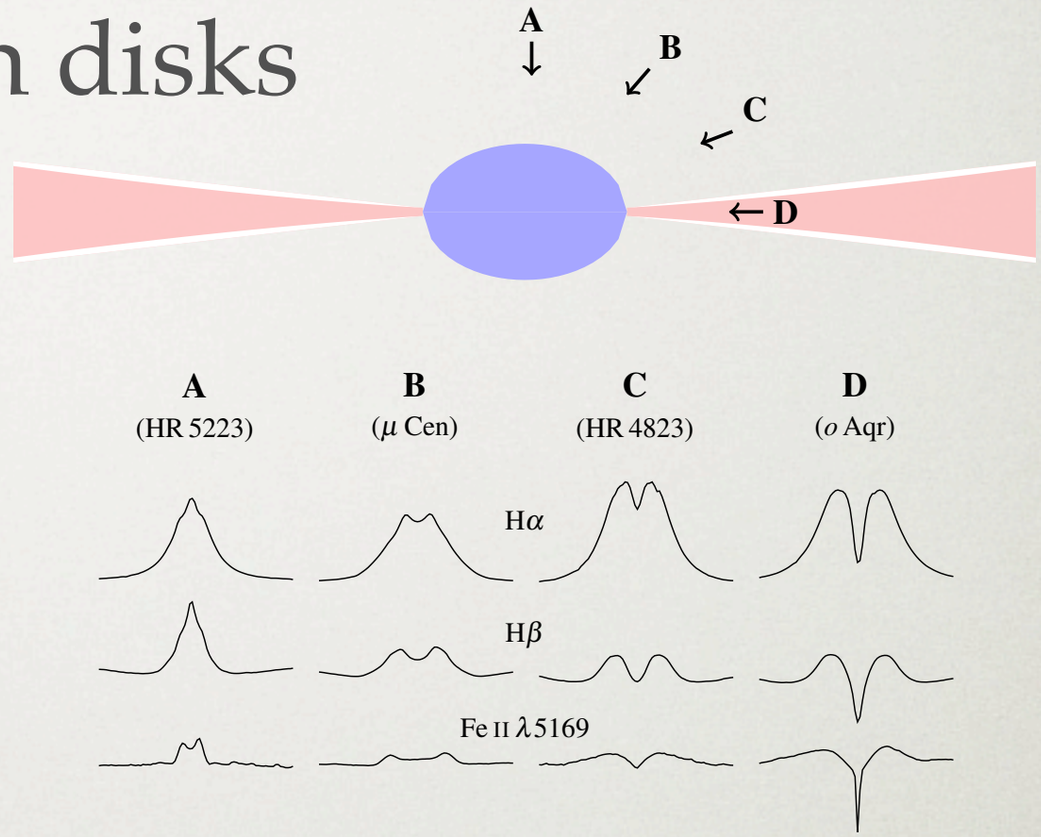
- Differential phases:

$$\phi_{\mathrm{diff}}(\lambda, \lambda_{\mathrm{r}}) = \phi(\lambda) - \phi(\lambda_{\mathrm{r}})$$

Intro + Science goals

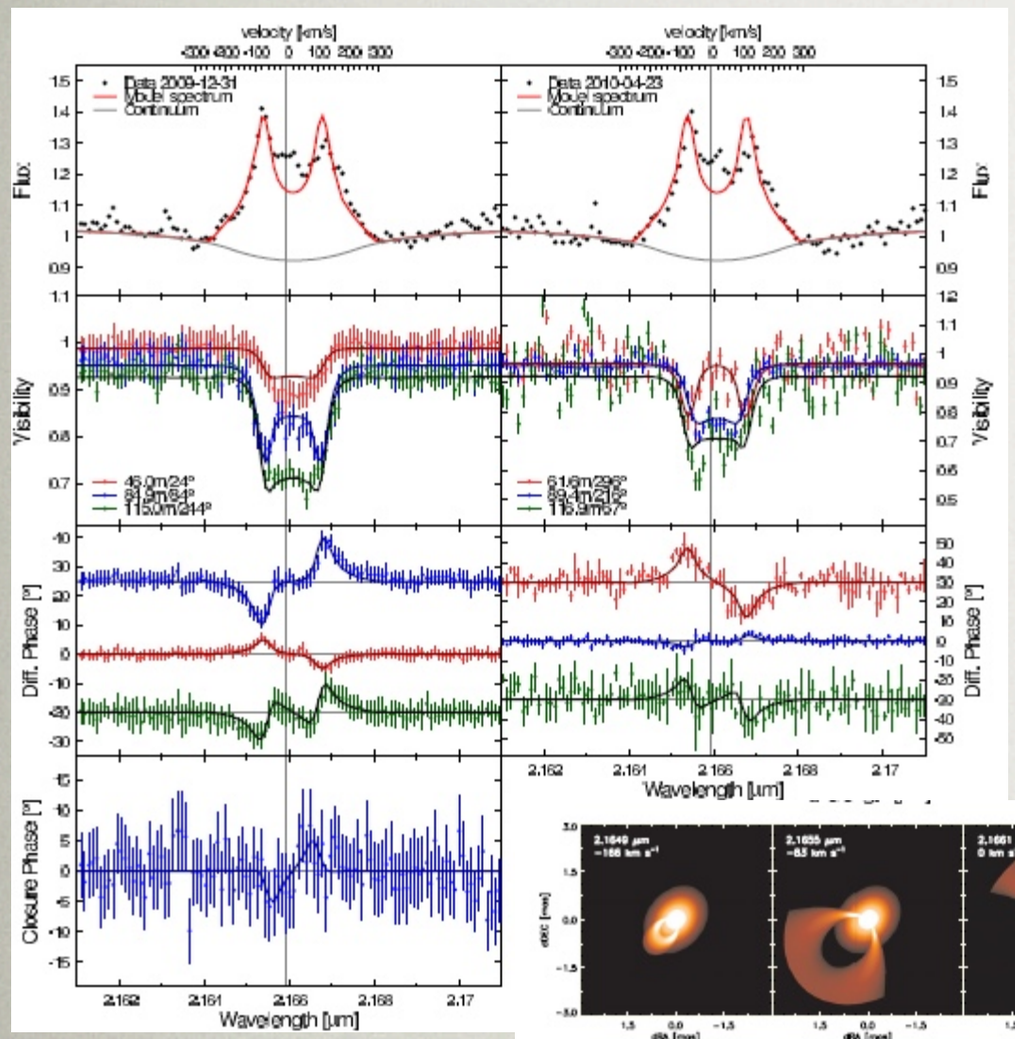
- **Be stars**: Keplerian disks

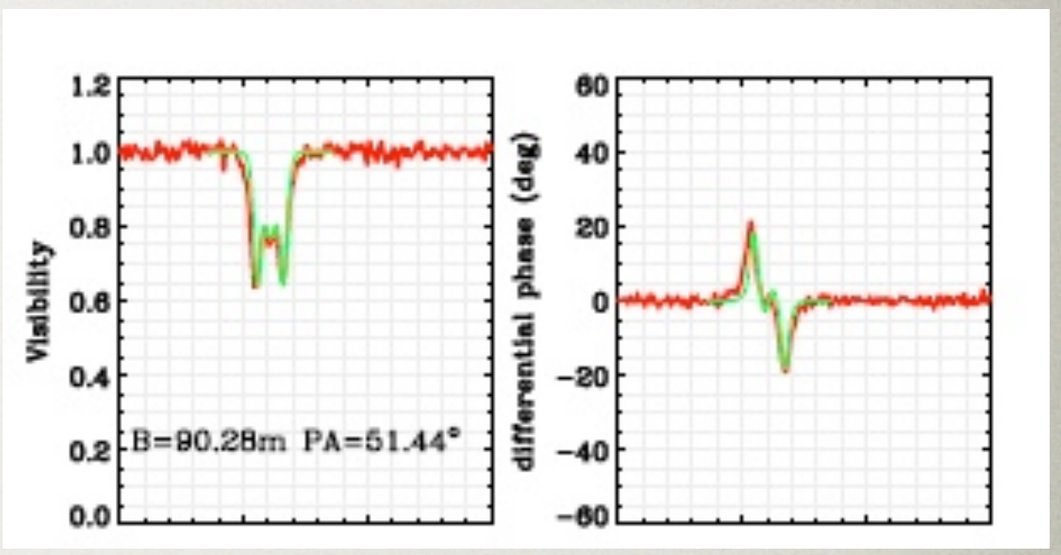




- **Be shell stars**: contrast between disk emission and photospheric absorption within a **line profile** probes physical disk conditions.
- Radiative transfer **modeling**!

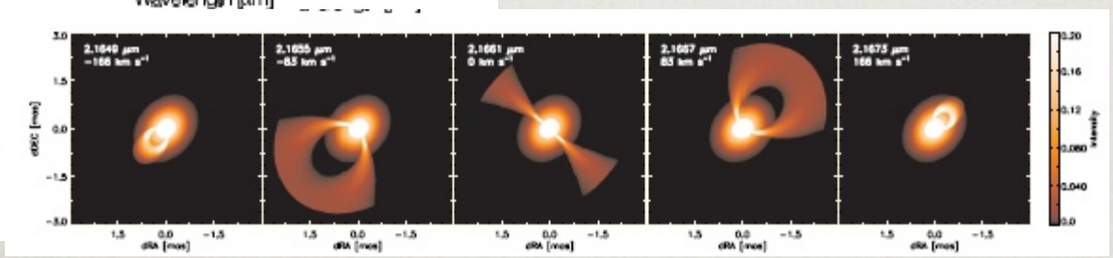
Intro + Science goals



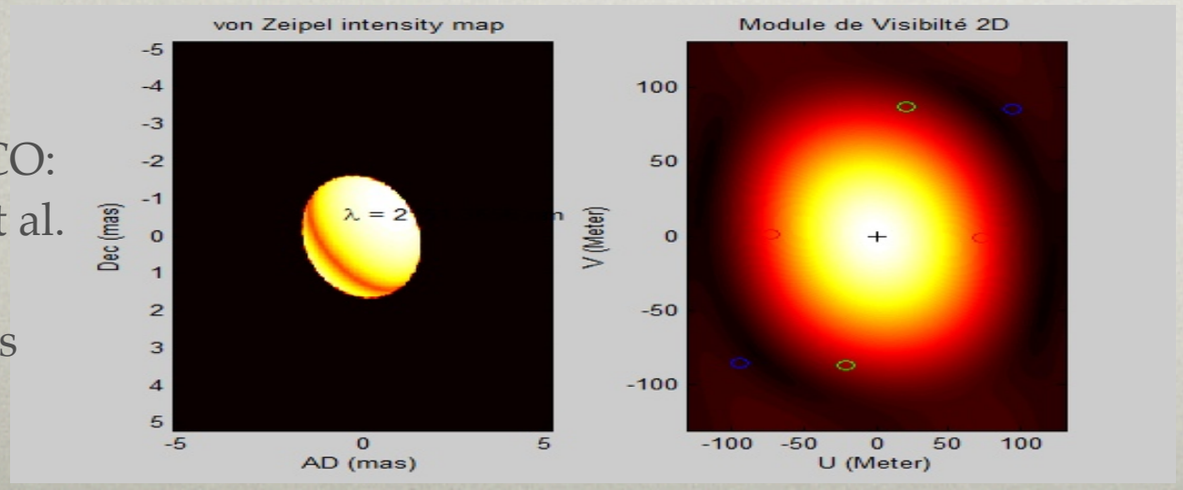


Meilland et al. 2013
Over-resolved

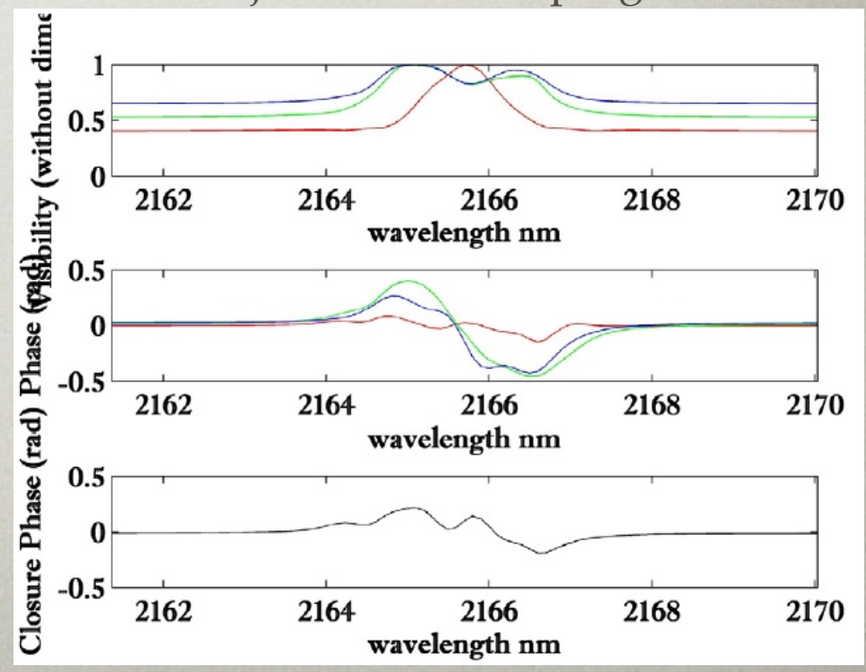
Kraus et al. 2013



SCIROCCO:
Hadjara et al.
-> In
progress

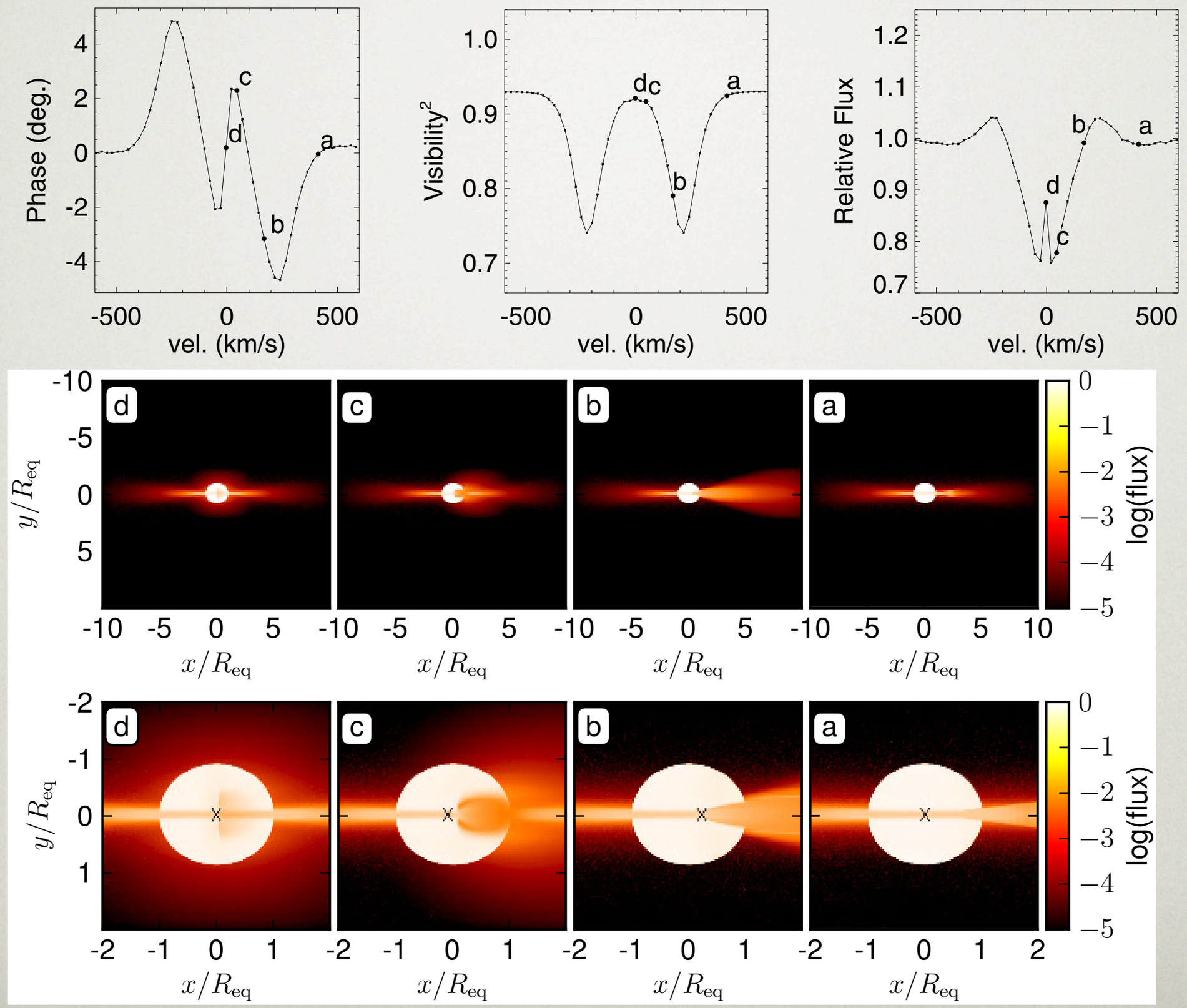


Hadjara et al. -> In progress



Intro + Science goals

Model predictions !!



Target list

- Bright Be shell stars *(Rivinius+ 2006, A&A 459 137)*:
  - Observable Declination at VLTI & Right Ascension of the period (AirMass < 1.5)
  - Magnitude limits (correlated)
  - Not in AMBER GTO target list & ESO Archive *
  - Corresponding calibrators (Calvin or SearchCal)!

Target list

Targets						
Targets	**Spectral type**	**RA[hms]**	**DE [° ′ ″]**	**V_{mag}**	**K_{mag}**	**K_{corr}**
eta Cen	B1.5Vne	14 35 30.42416	-42 09 28.1708	2. 322	2.750	3
eps Cap	B3V:p	21 37 04.83068	-19 27 57.6464	4.50	4.788	4.788
omi Aqr	B7Ive	22 03 18.84403	-02 09 19.3067	4.70	4.661	4.74
48 Lib	B8Ia/Iab	15 58 11.36869	-14 16 45.6894	4.943	4.591	4.99

Calibrators					
Targets	**Spectral type**	**RA[hms]**	**DE [° ′ ″]**	**V_{mag}**	**K_{mag}**
HIP 73273	B2III	14 58 31.92536	-43 08 02.2699	2.665	3.251
HIP 106590	K1III	21 35 15.95659	-23 27 15.5353	6.394	3.724
HIP 108506	K2V	21 58 54.98511	-04 22 23.1877	6.22	3.930
HIP 78228	MOIII	15 58 26.67	-13 26 34.00	7.11	3.05

General technical Setup

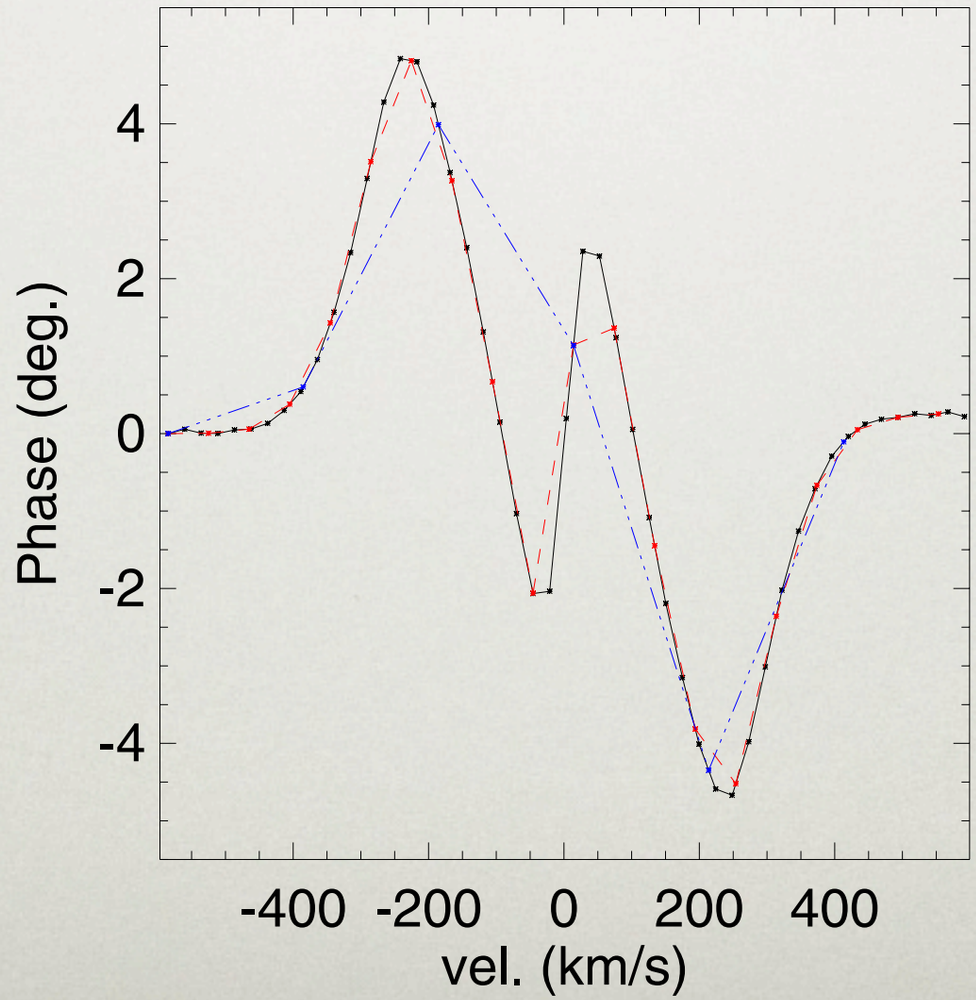
- AMBER Template Manual:
  - Instrumental configuration & DITs
- VLTI Configurations Overview (combinations of 3 Tel.):
  - UTs = all combinations.
  - ATs = 3 offered quadruplets (“large”,”medium” and “small” baselines, from ~130m to ~40m).

Project Setup

- Since we are interested on differential quantities (phases), observations can be done under “bad” sky conditions (**AMBER** limit = seeing <1.2” & sky coverage CLR) and CAL-SCI cycle.
- **Service Mode**.
- Bright objects = **ATs**; Using FINITO for better data reliability.
- Diff. Phases α Baseline length = “large” quadruplet **A1-G1-K0**-J3

Project Setup

- No time-critical observations.
- DIT (frame integration time) = 12s
- High-resolution requirement:

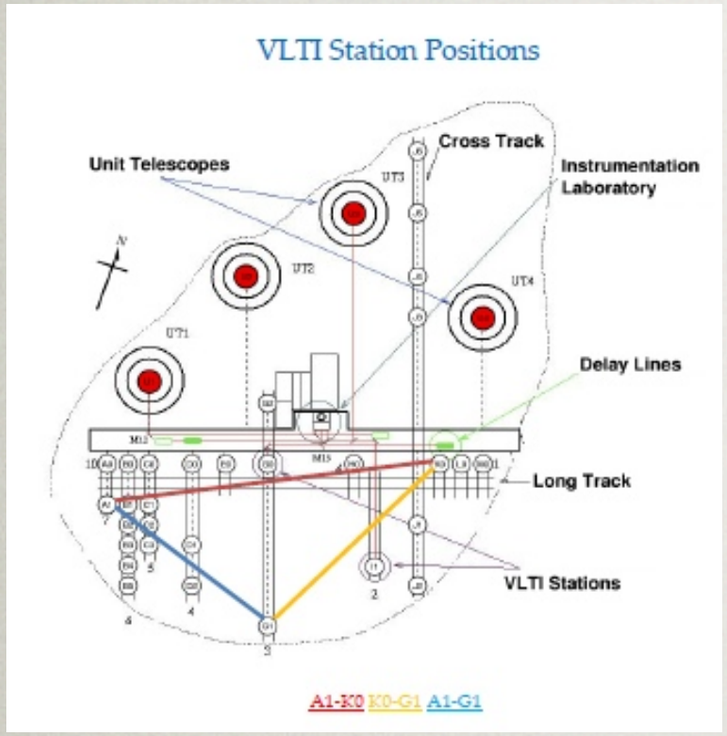


Project Setup

- We propose the execution in two times within a given night (2 position angles), separated by a few hours to increase Earth-rotation synthesis effect.
- Total time required: **5.33 hours**

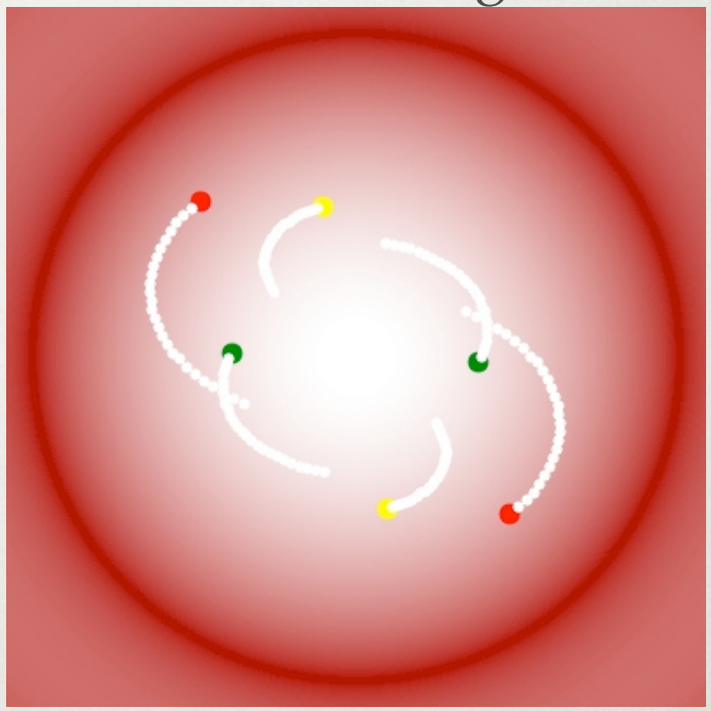
  2 PAs x 20min x (4 stars + 4 calibrators) = 320min

Observability

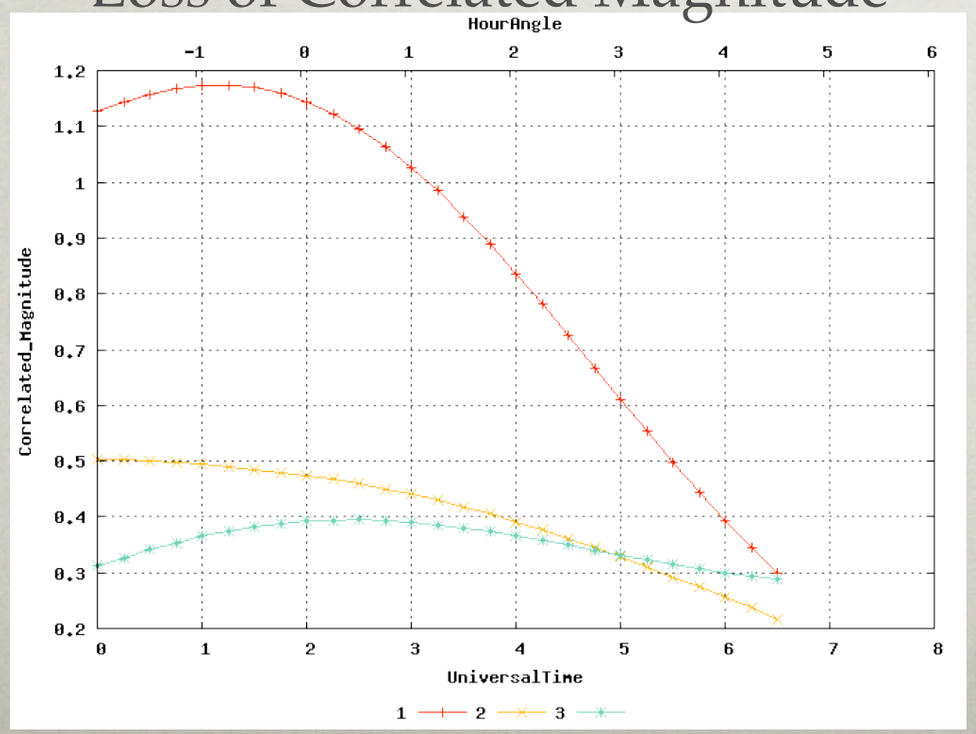


For 12 June 2014 (e.g. eta Cen)

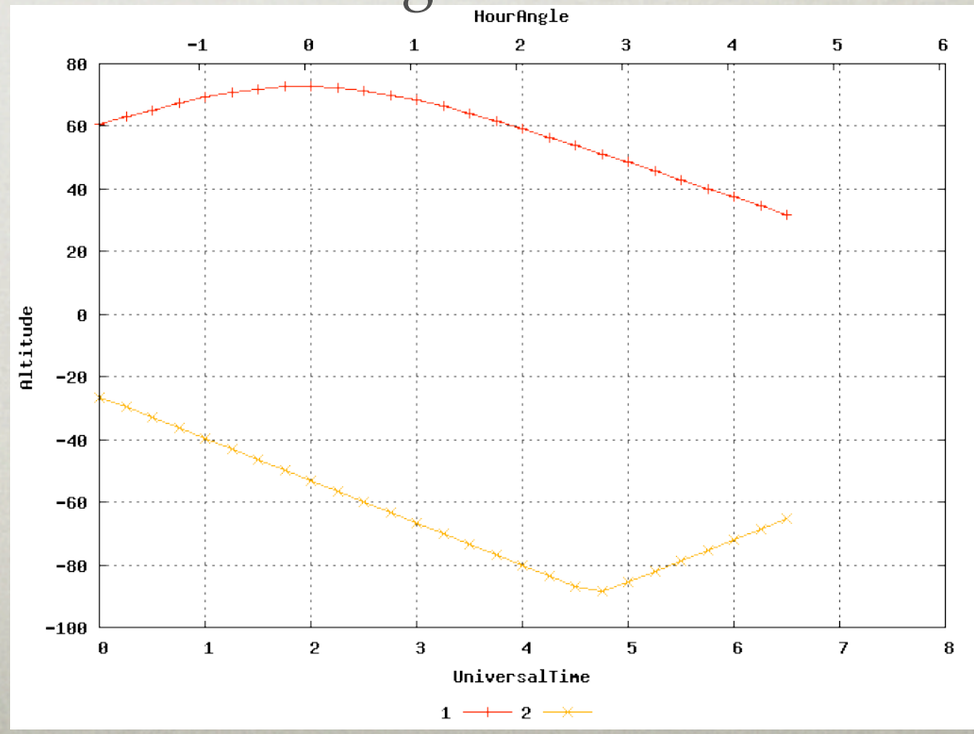
UV Coverage



Loss of Correlated Magnitude



Target Altitude



Immediate objective

- AMBER is the ideal instrument to do spectro-interferometric measurements within a line ($\Delta v \sim 25 km/s$).

- **Goal**: to measure the differential phases and interpret them with radiative transfer models.

End