

LIMITS IN ASTROMETRIC ACCURACY INDUCED BY SURFACE BRIGHTNESS ASYMMETRIES



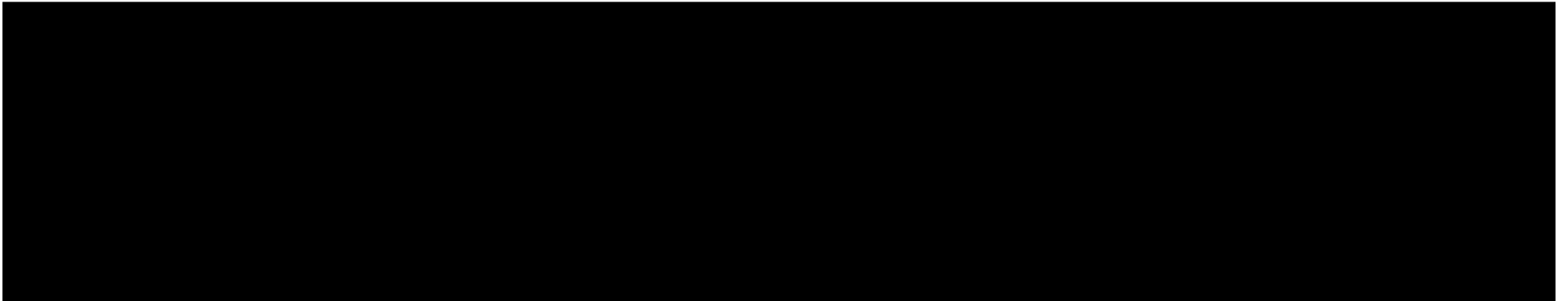
Ester Pasquato

Alain Jorissen, Dimitri Pourbaix

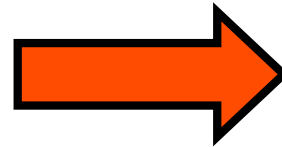
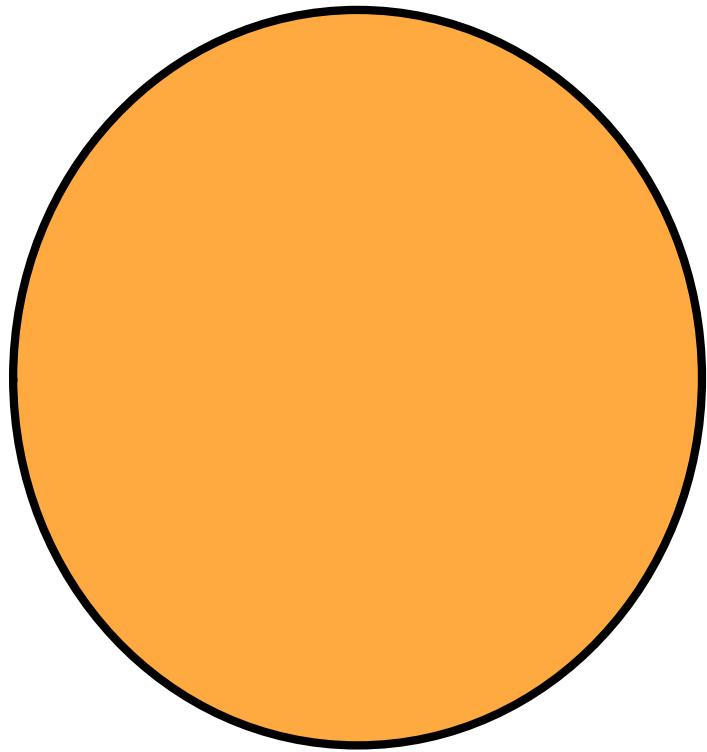
LIMITS IN ASTROMETRIC ACCURACY INDUCED BY SURFACE BRIGHTNESS ASYMMETRIES

1: WHY ?

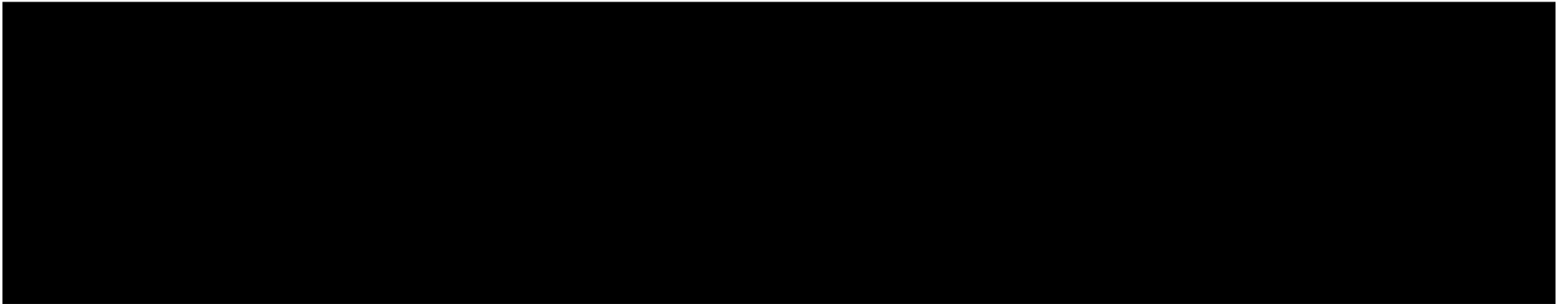
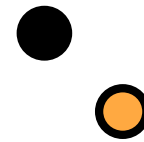
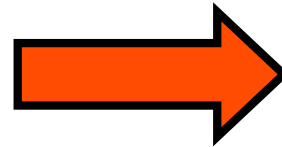
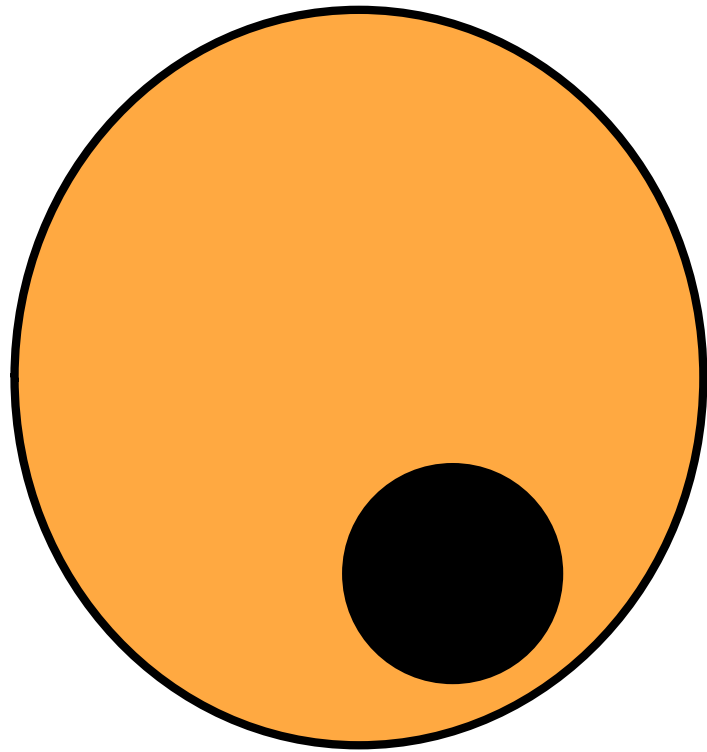
2: WHAT DO WE EXPECT ?



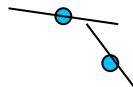
SURFACE BRIGHTNESS ASYMMETRIES



SURFACE BRIGHTNESS ASYMMETRIES



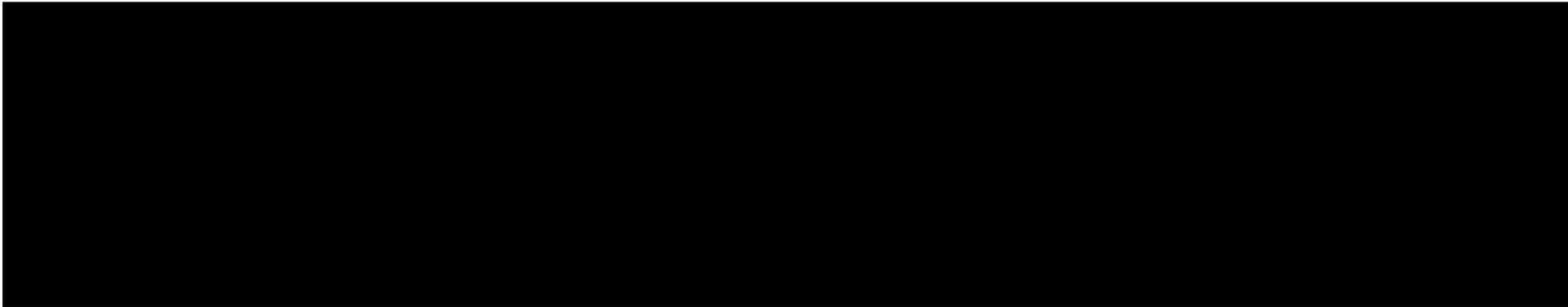
DECLINATION



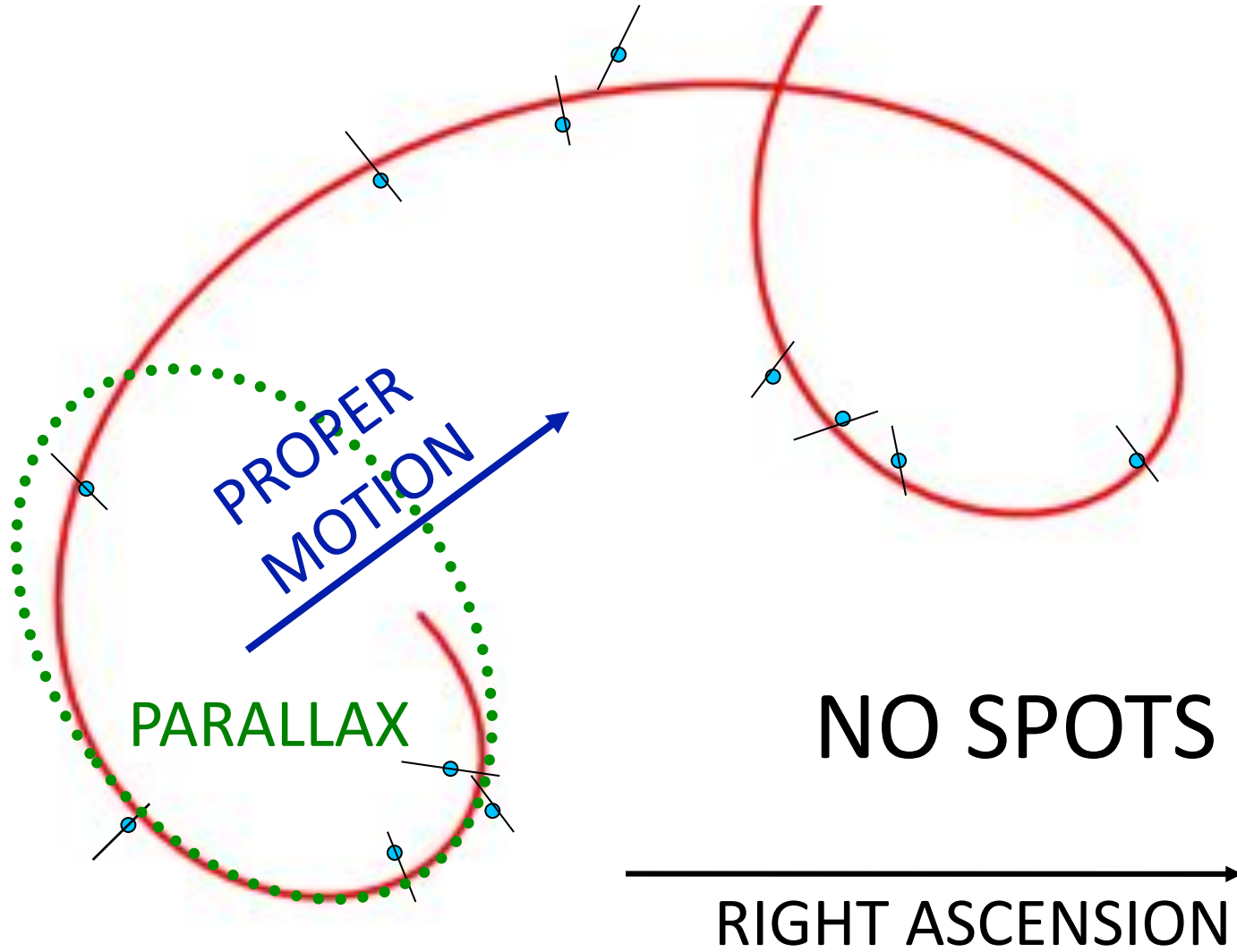
NO SPOTS



RIGHT ASCENSION

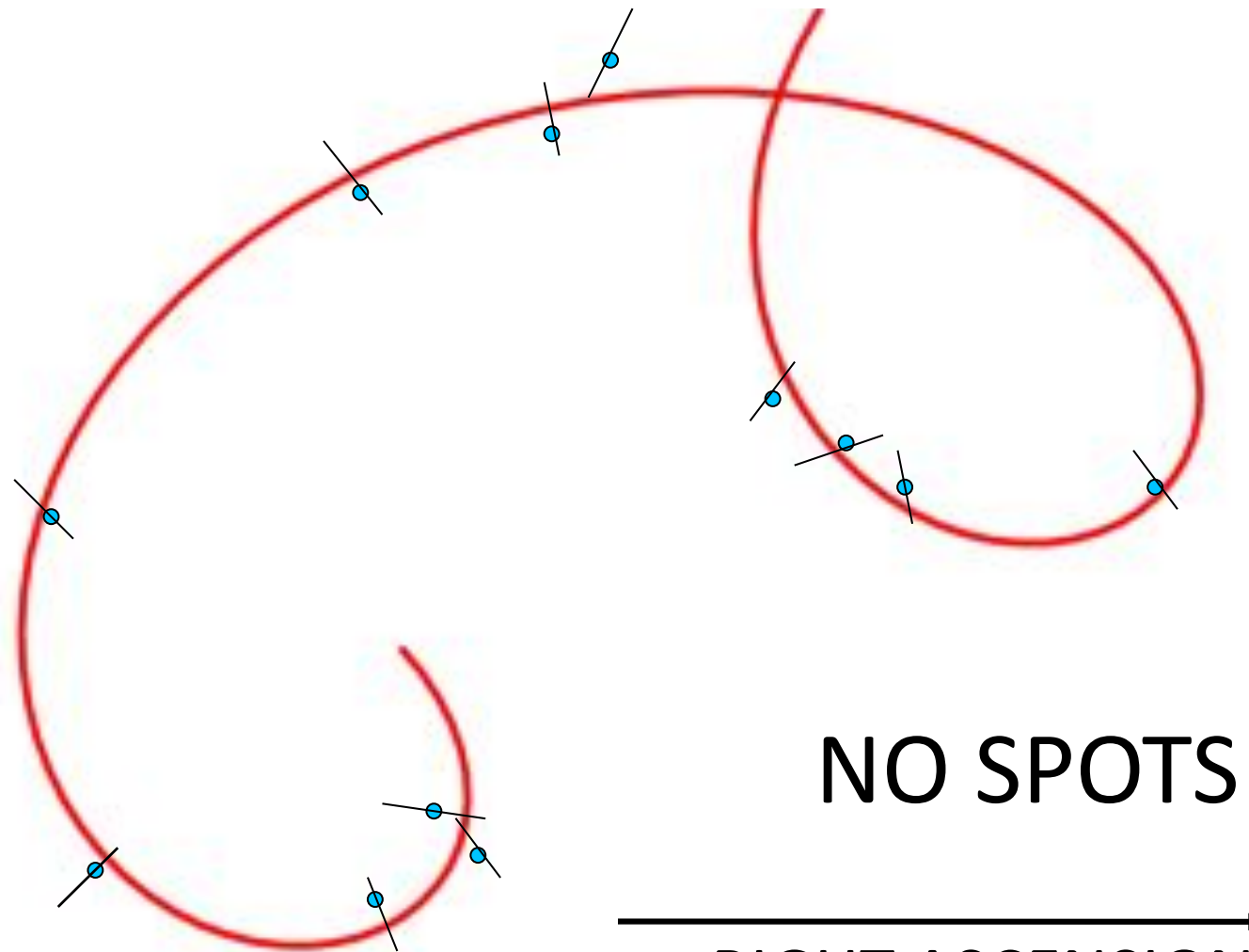


DECLINATION



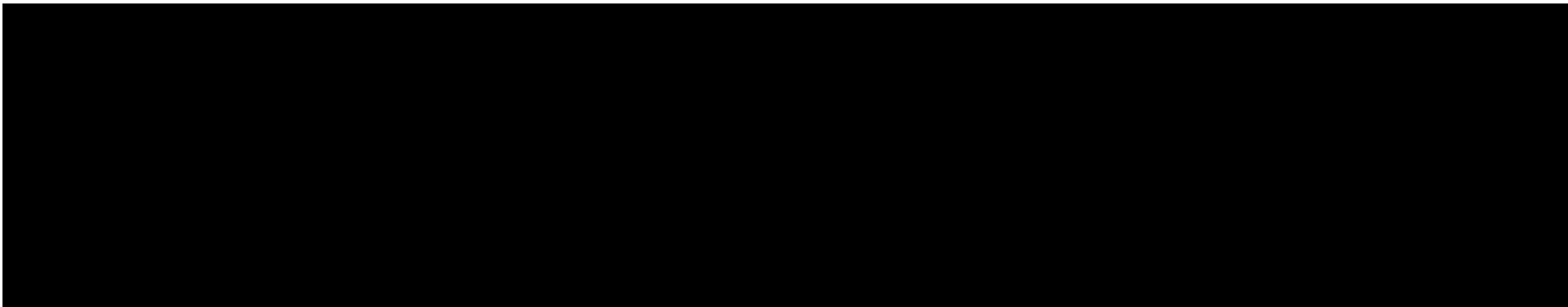
RIGHT ASCENSION

DECLINATION

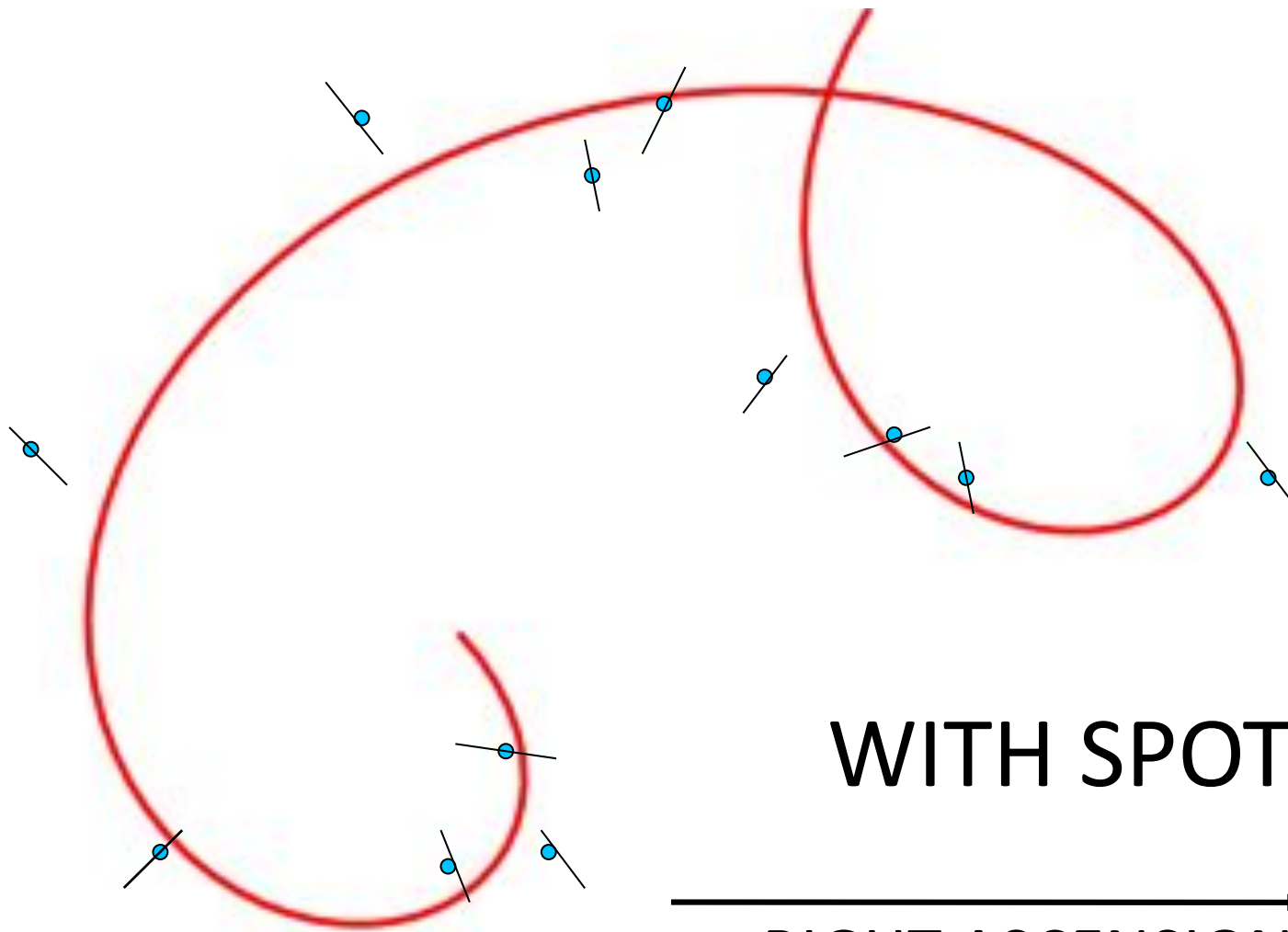


NO SPOTS

RIGHT ASCENSION



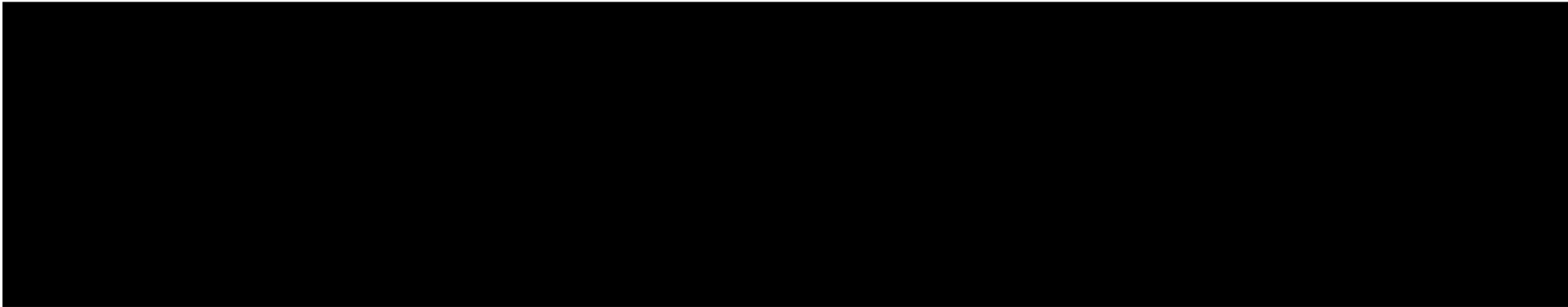
DECLINATION



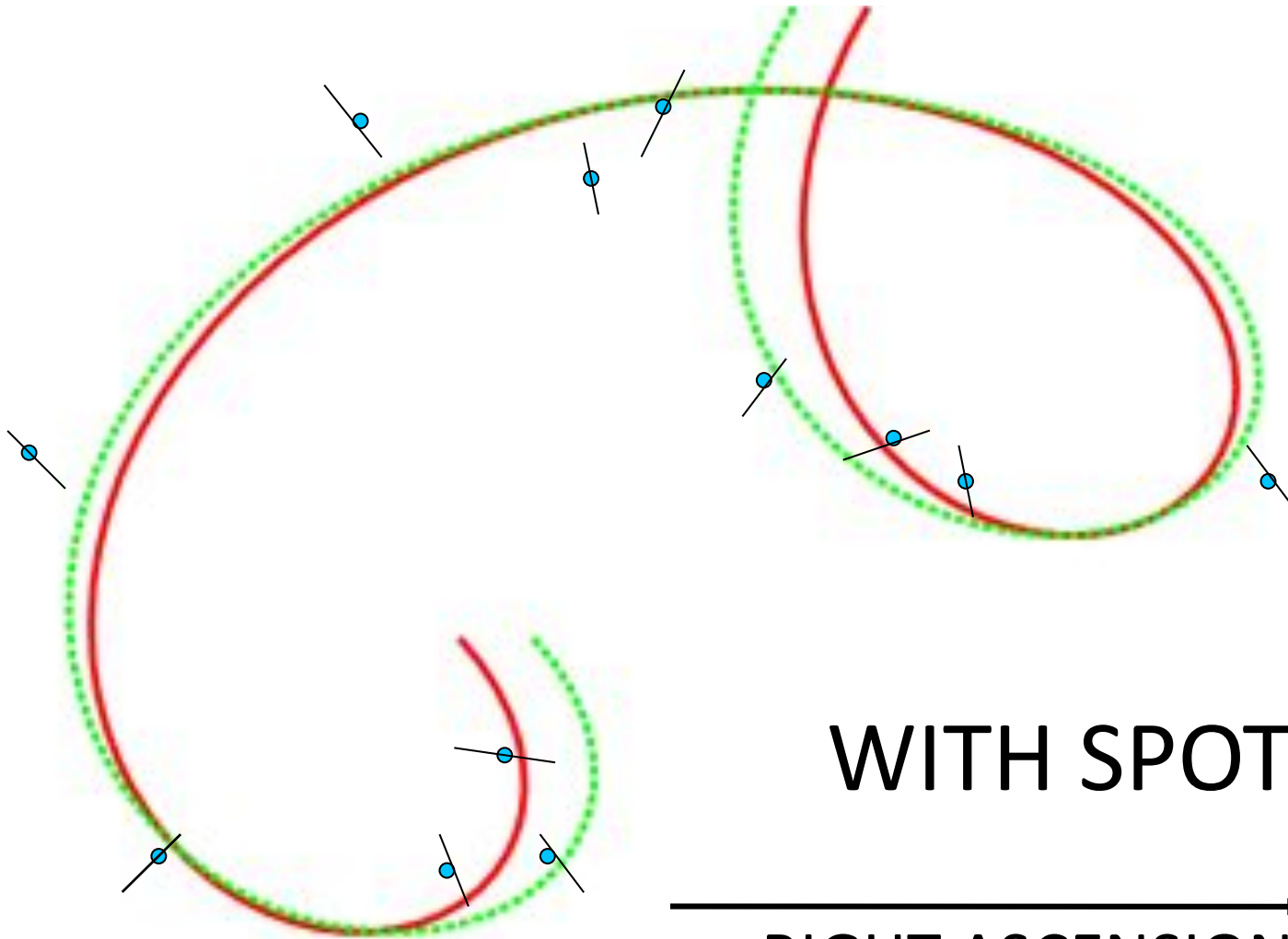
WITH SPOTS



RIGHT ASCENSION



DECLINATION



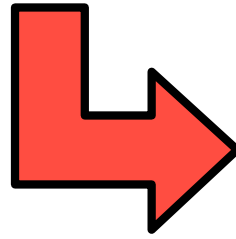
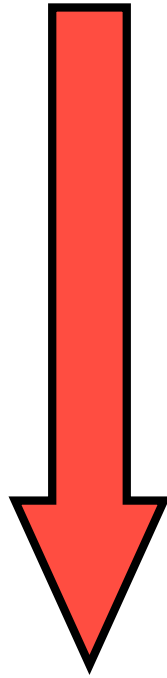
WITH SPOTS



RIGHT ASCENSION



SURFACE BRIGHTNESS ASYMMETRIES

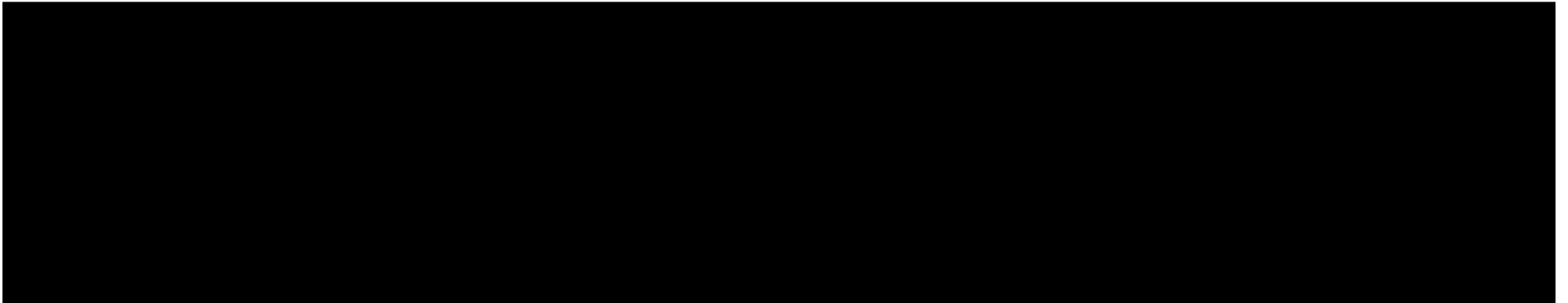


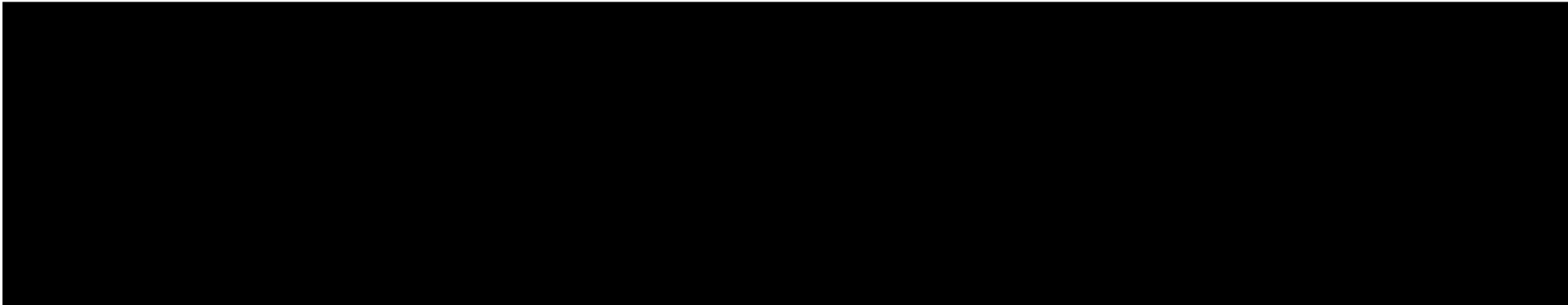
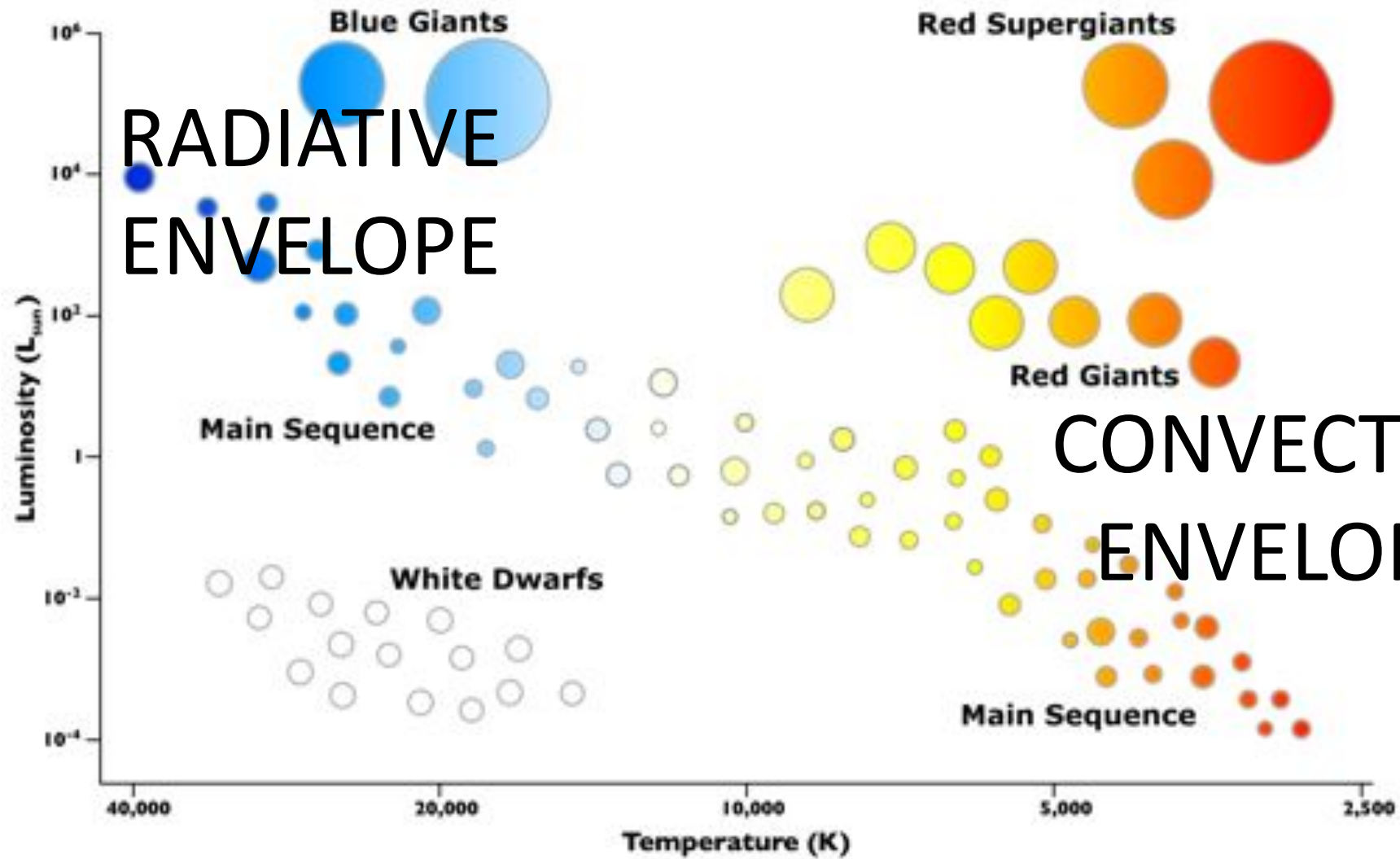
WORSE FIT



BIGGER GoF

NON ACCURATE PARAMETERS?





RED SUPERGIANTS: observations

700 nm 1989-91-92-93



D.F. Buscher, C.A. Haniff, J.E. Baldwin and P.J. Warner: 1990, MNRAS, 245, 7p
R.W. Wilson, J.E. Baldwin, D.F. Buscher and P.J. Warner: 1992, MNRAS, 257, 369
P.G. Tuthill, C.A. Haniff and J.E. Baldwin: 1997, MNRAS, 285, 529
B. Freytag, M. Steffen and B. Dorch: 2002, Astron. Nachr., 323, 213

$T_{\text{eff}}=3500\text{k}$

$\text{Log}(g)=-0.3$

$R=830 R_{\text{sun}}$

GAIA G band 3250-11000 A

(st35gm03n07, Andrea

Chiavassa)

4 AU

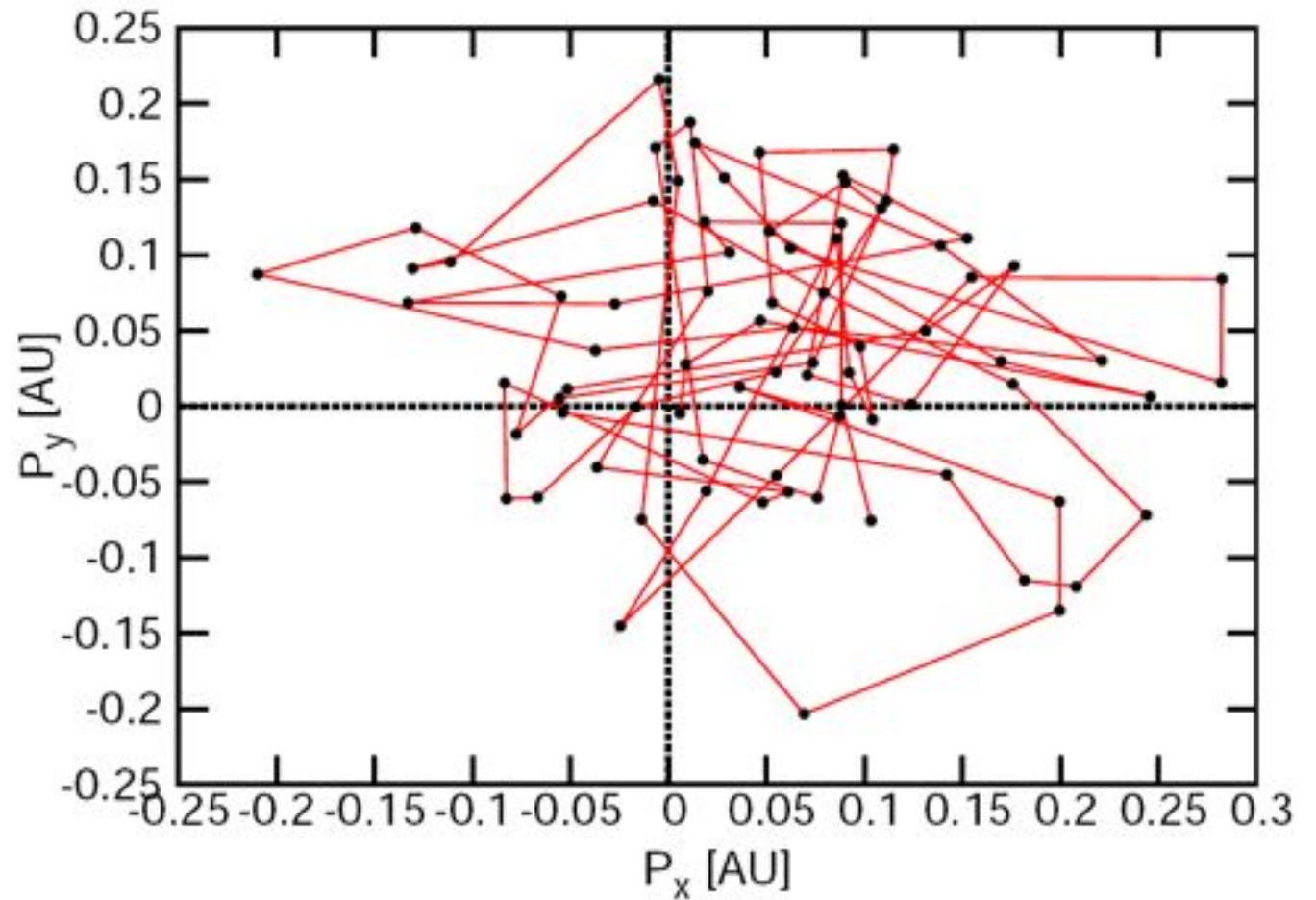


PHOTOCENTRE POSITION

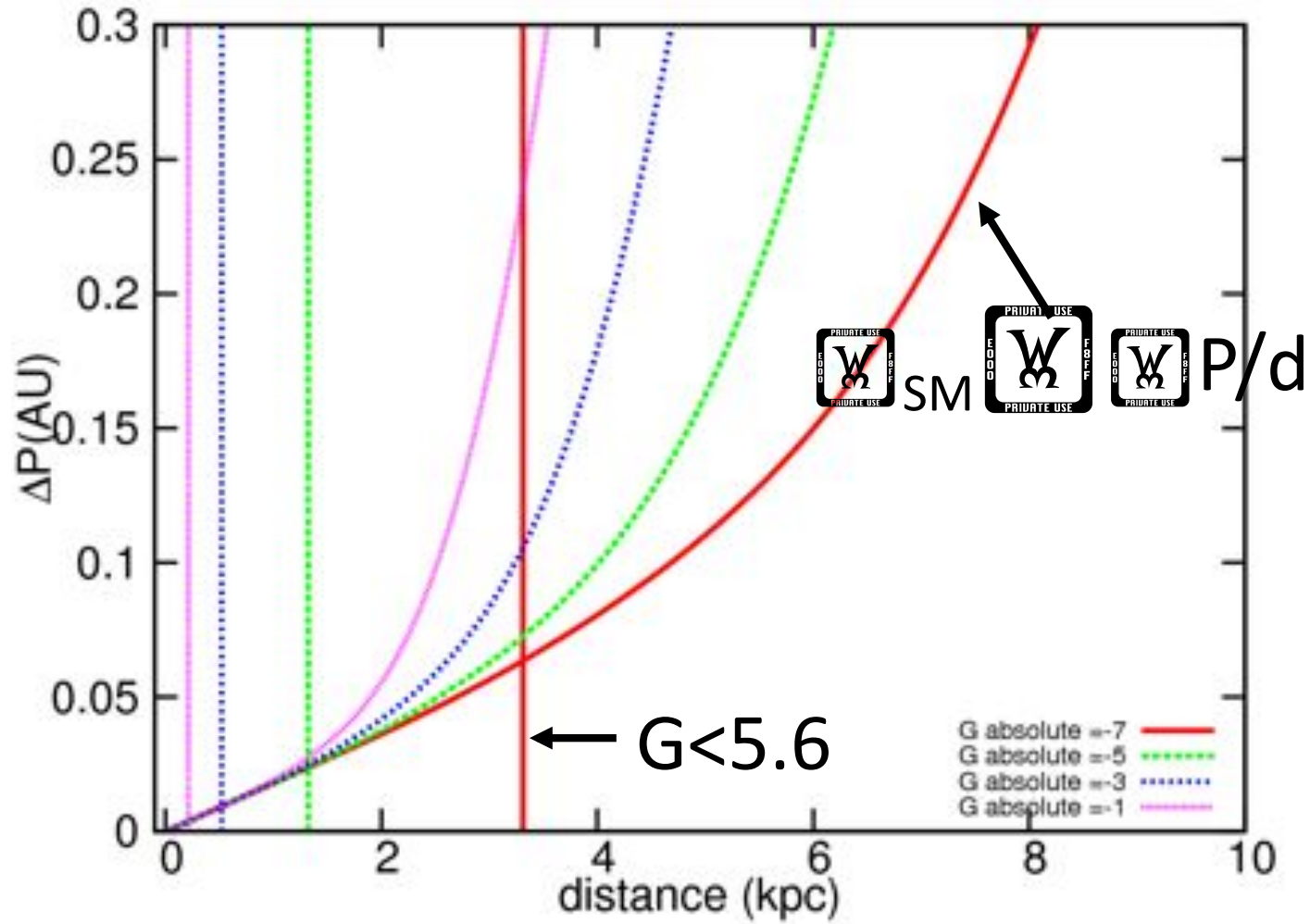
From RHD
simulations:
5 years

R=4 AU

Chiavassa, Pasquato,
Jorissen et al. 2010,
submitted



HOW FAR?



SIMULATIONS

PHOTOCENTRE POSITION MODEL:

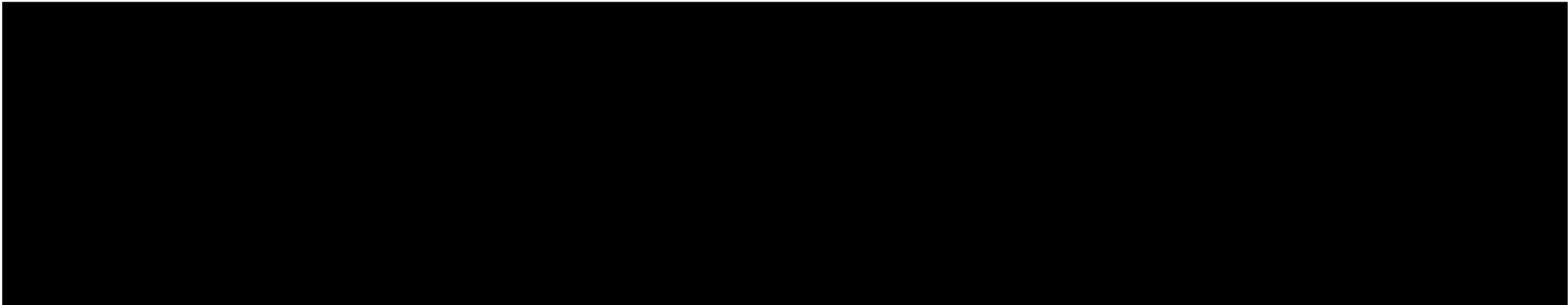
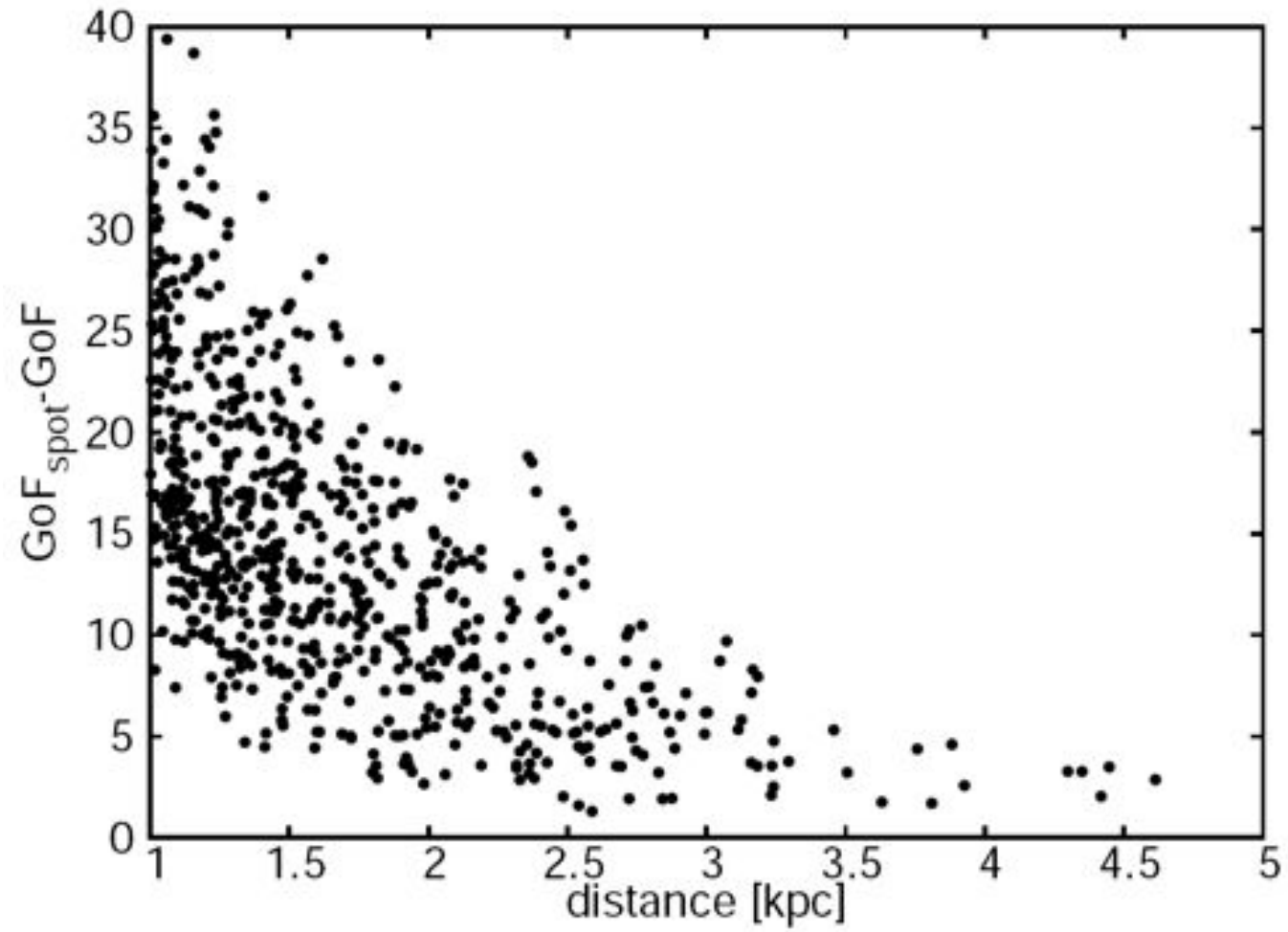
TIMESCALE and _p: from RHD simulations

+

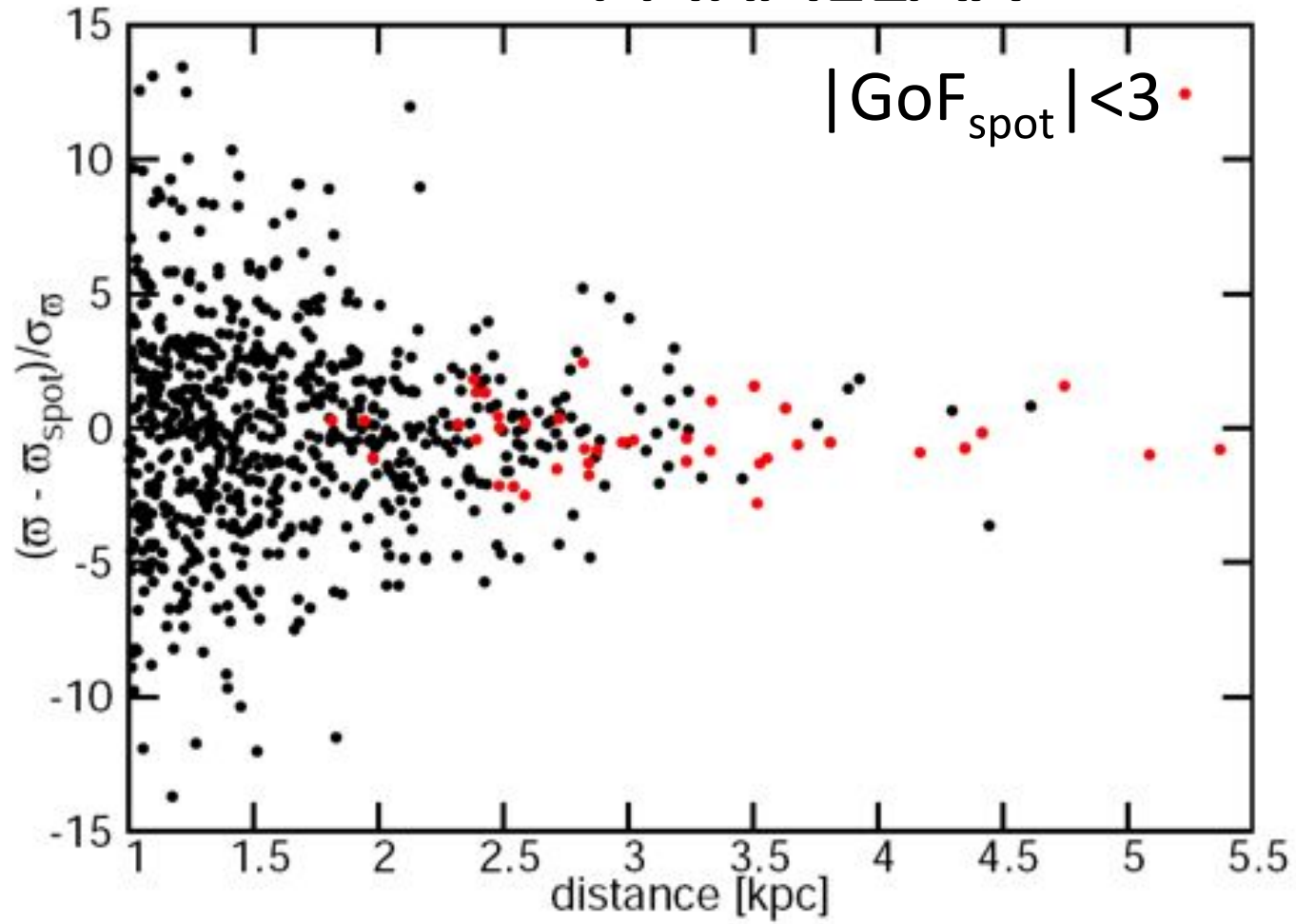
SIMULATED GAIA DATA (GOG)

STAR DISTANCE: 1kpc <d<5-8 kpc

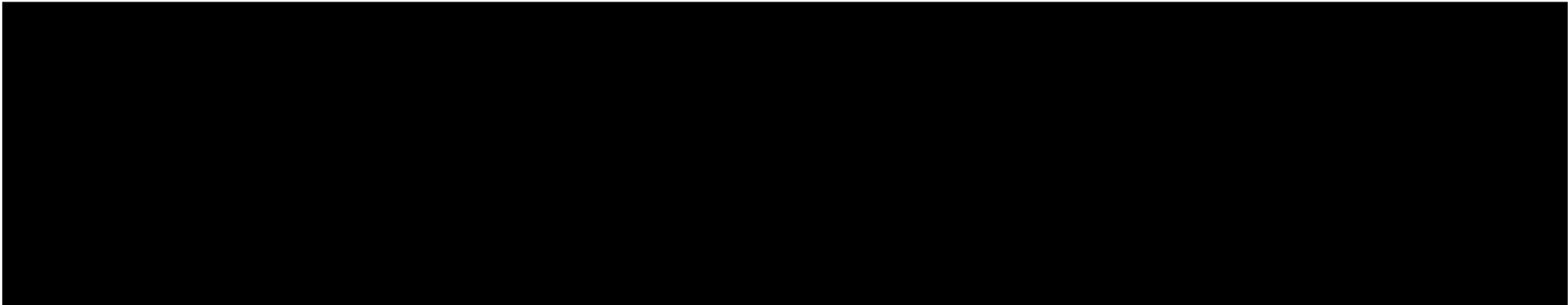
GOODNESS OF FIT



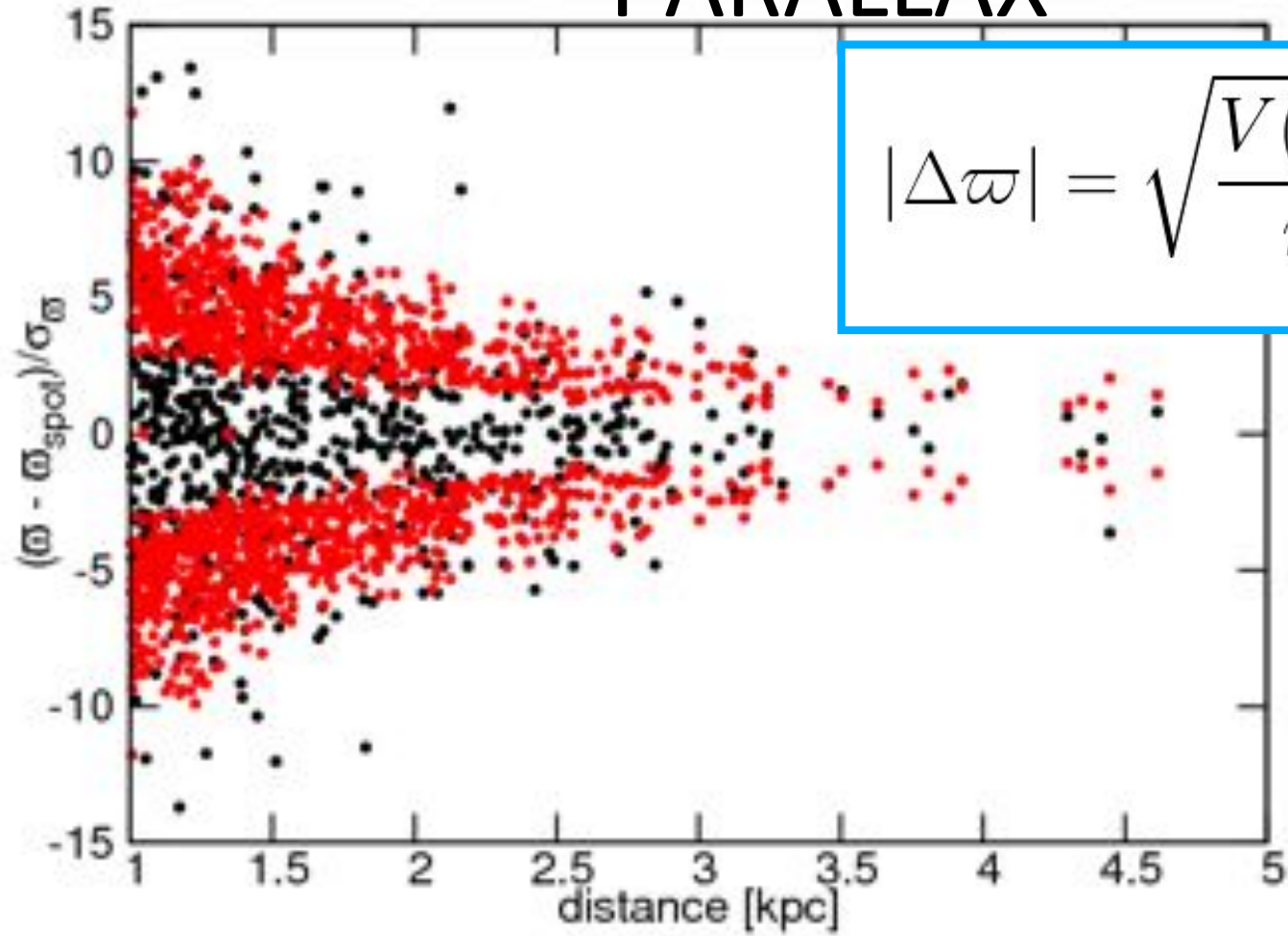
PARALLAX



   8  as

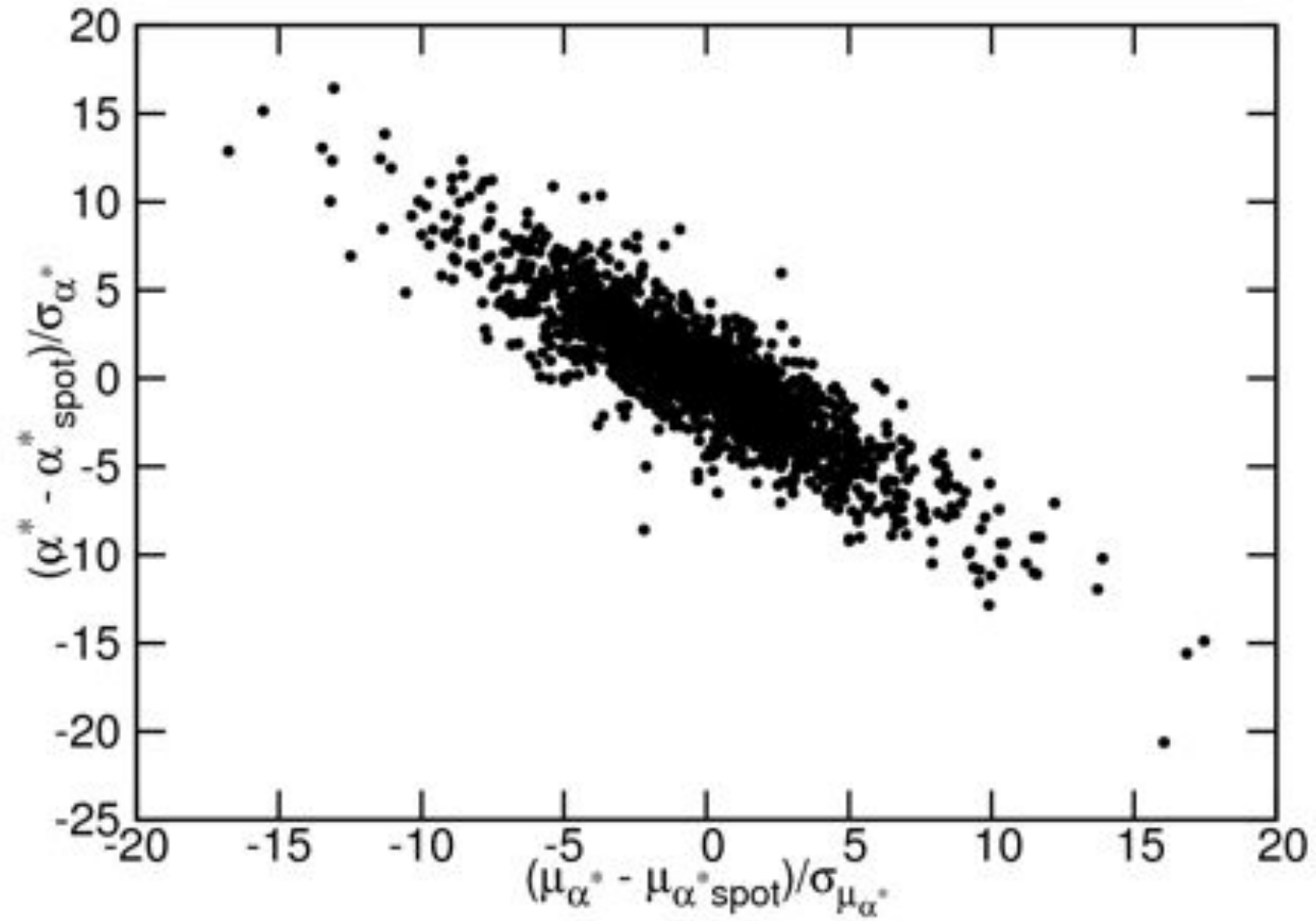


PARALLAX



$$|\Delta\varpi| = \sqrt{\frac{V(P)\sigma_P}{n} \frac{\sigma_{\varpi}^2}{d \sigma_{SM}^2}}$$

POSITION AND PROPER MOTION



HOW MANY?

~26000 Red SuperGiants; $d < 8\text{kpc}$

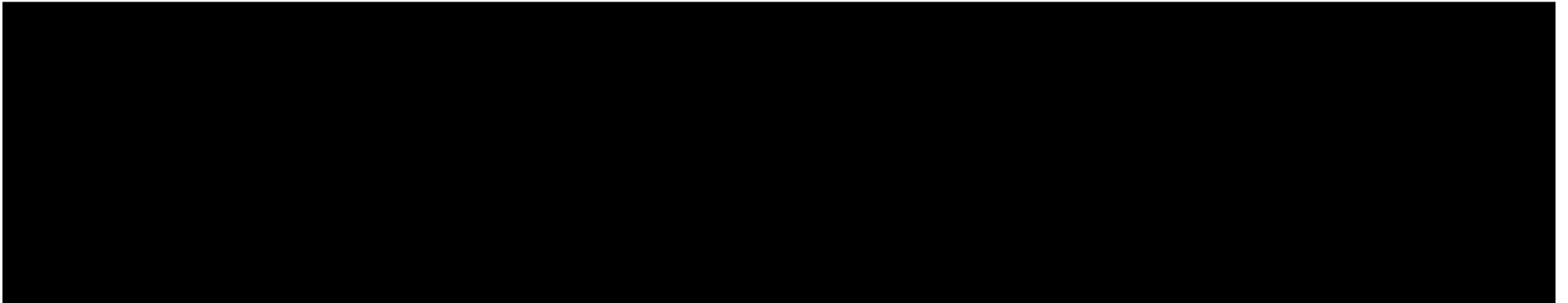
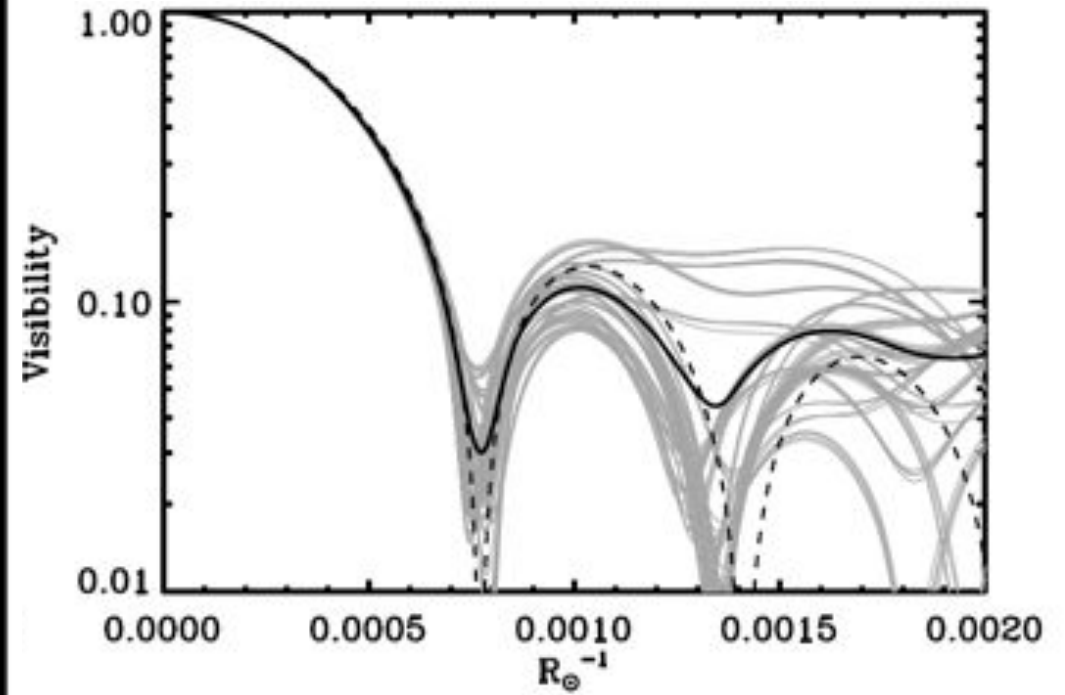
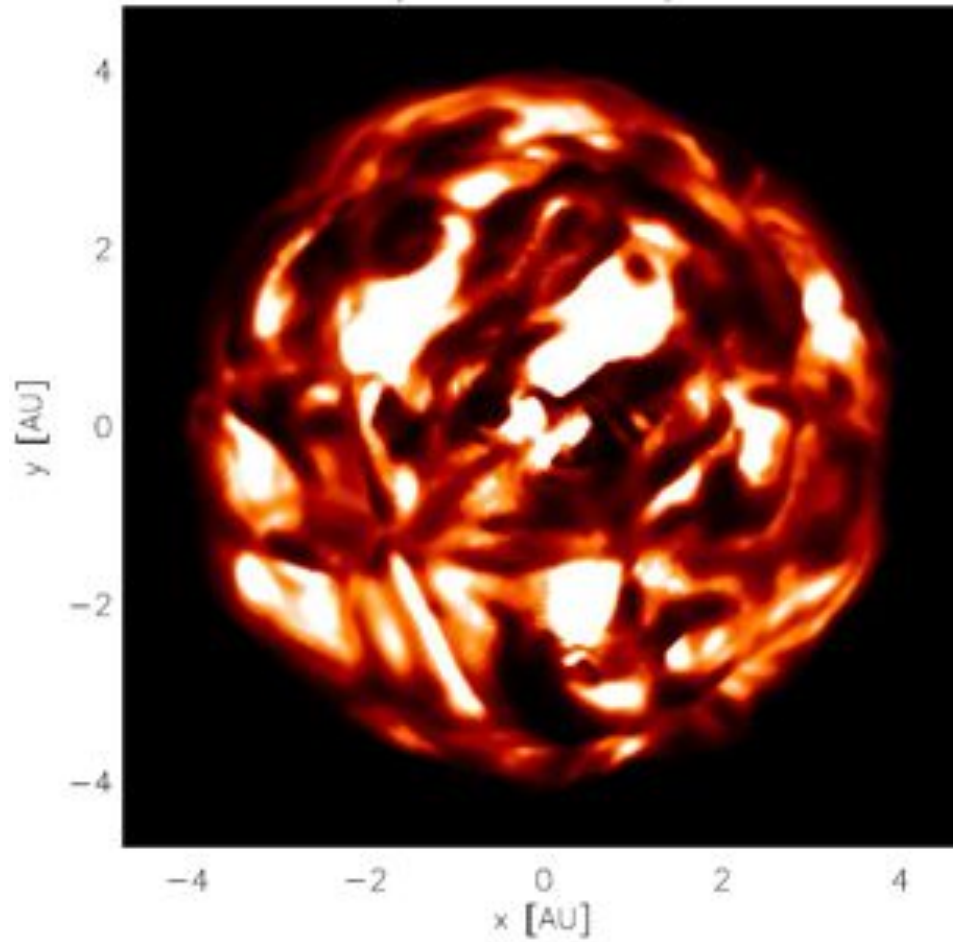
From Besançon model

$$\left[\begin{array}{c} \text{PRIVATE USE} \\ \text{W} \\ \text{M} \\ \text{PRIVATE USE} \end{array} \right]_{SM} \leq \left[\begin{array}{c} \text{PRIVATE USE} \\ \text{W} \\ \text{M} \\ \text{PRIVATE USE} \end{array} \right]_P (T/g)/d$$

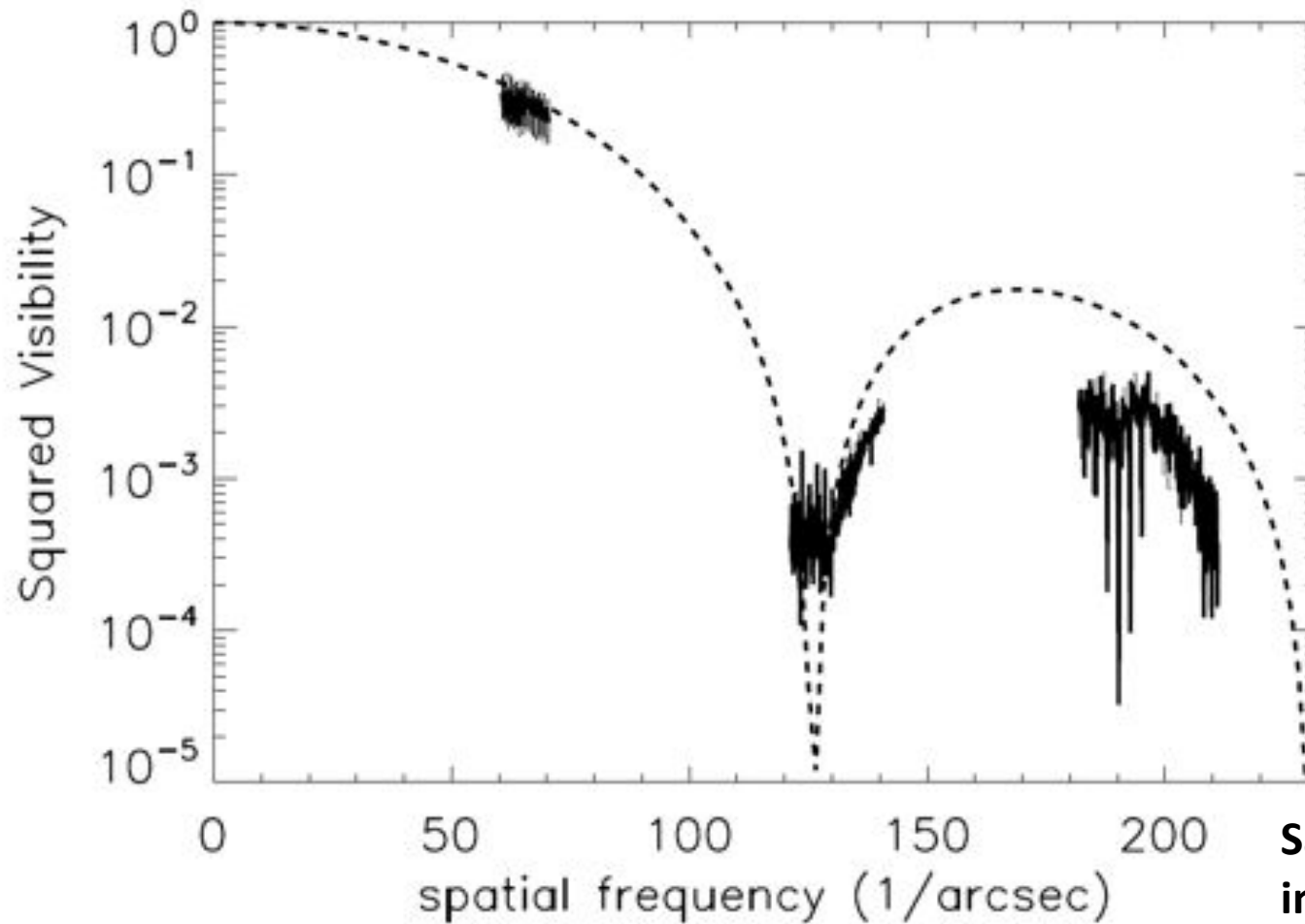


~1200 possibly affected

OBSERVATIONS?



OBSERVATIONS



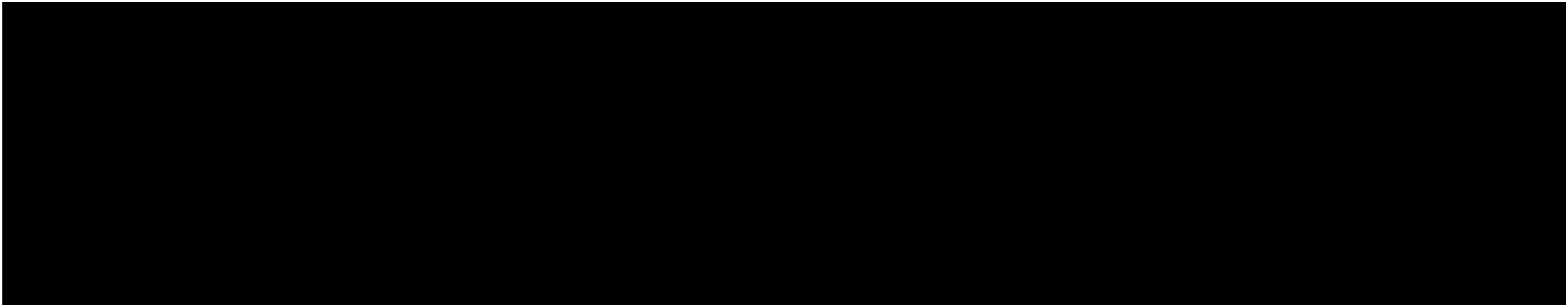
Sacuto et al. 2010,
in preparation

CONCLUSIONS

Photocentre motion is a threat to the accuracy in the determination of positions, parallaxes and proper motions

This will be the case for about 1200 supergiants

Need of a better constrain on physical parameters: VLTI observation programme



ACKNOWLEDGMENTS

Andrea Chiavassa

Max Planck Institute für Astrophysik

Stéphane Sacuto

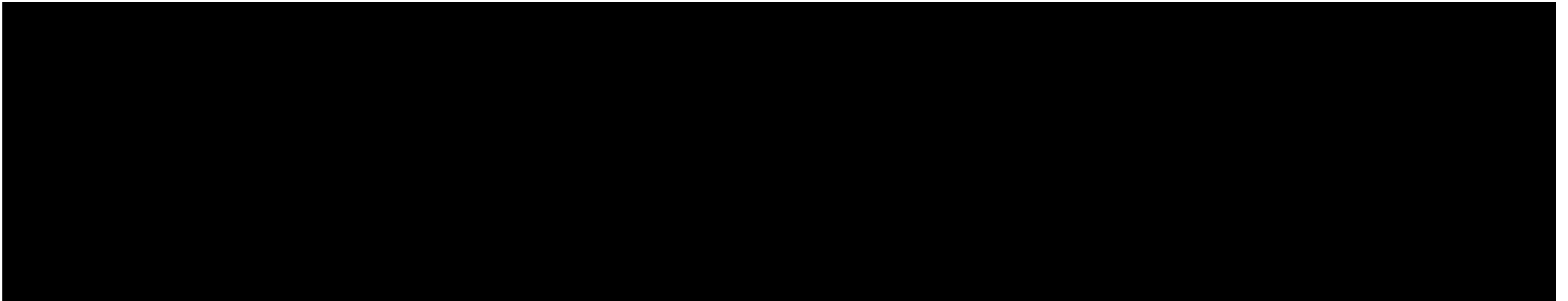
University of Vienna

Pierre Cruzalèbes, Olivier Chesneau

Observatoire de la Côte d'Azur

Lennart Lindegren, Berry Holl

Lund Observatory



Radiative hydrodynamics simulations of red supergiant stars. III. Spectro-photocentric variability, photometric variability, and consequences on Gaia measurements

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Y. Rabbia⁹, A. Spang⁹, and O. Chesneau⁹

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