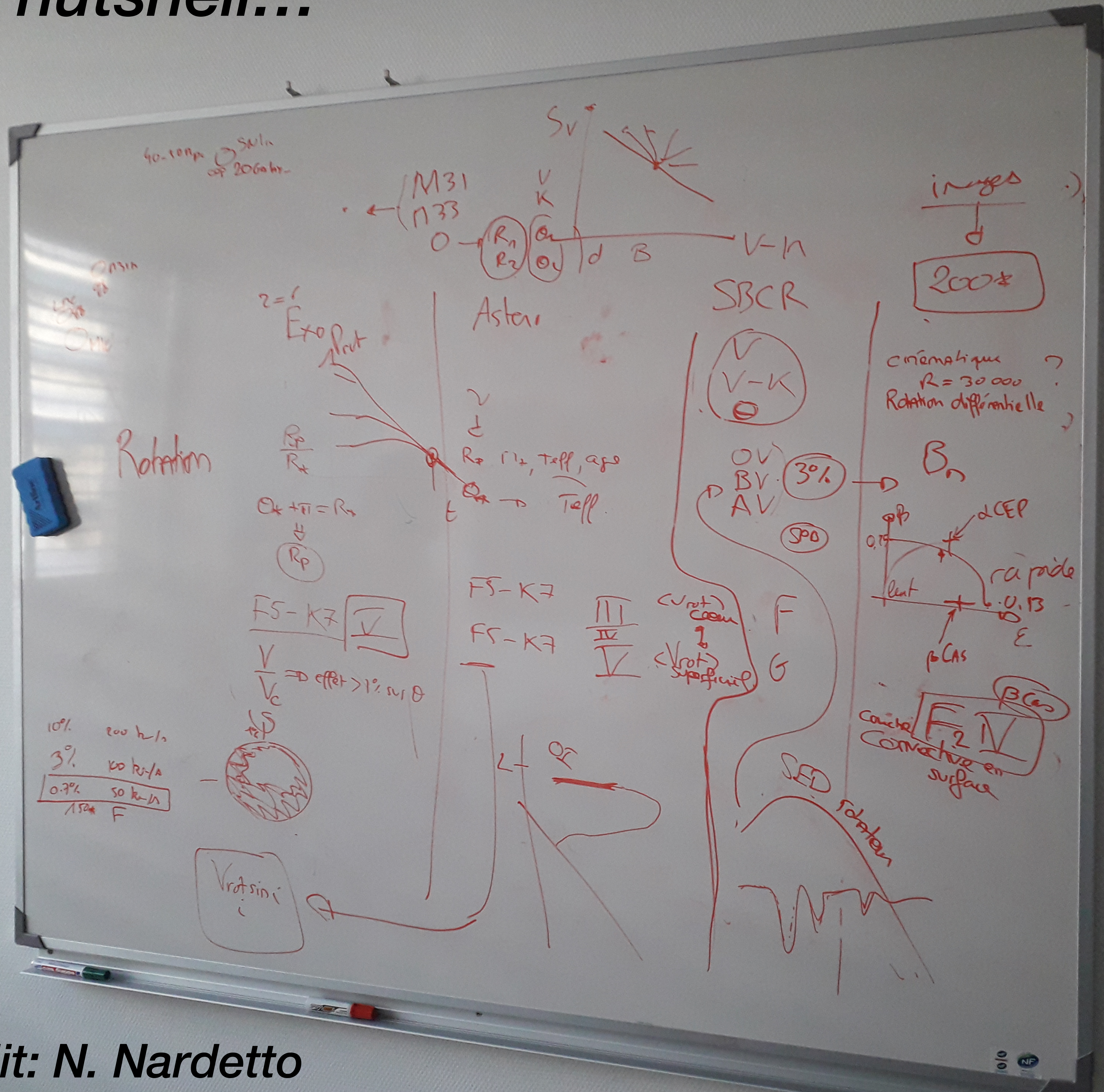
Working group #7: rotation

In a nutshell…



crédit: N. Nardetto

Exoplanet Host Stars

- Can rotation impact the determination of the planet host star radii?

✓ Typical PLATO targets (core program = F5-K7)

✓ benchmark: a F star (1.5 Msol // 1.5 Rsol)

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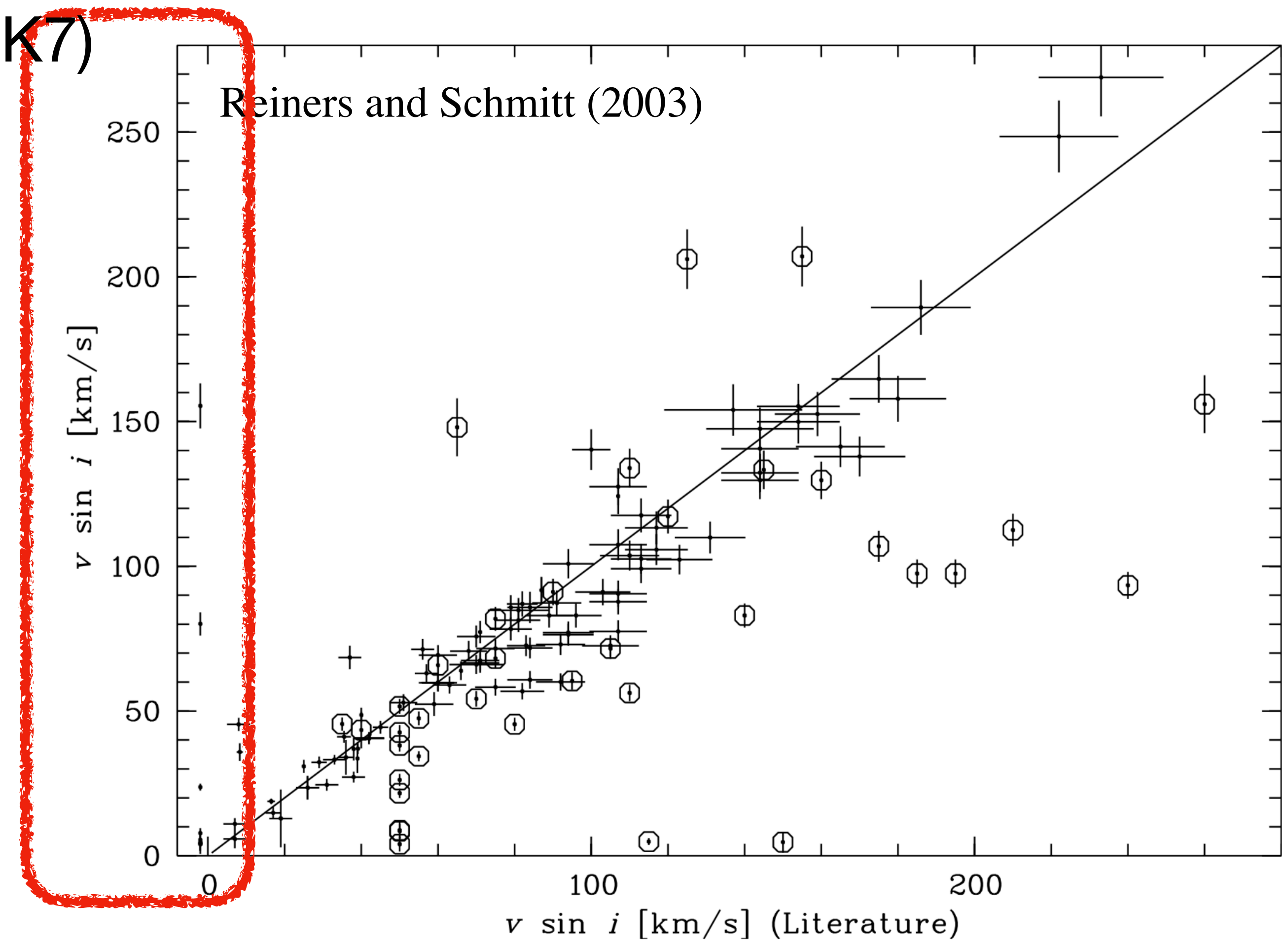

Fig. 3. Values of $v \sin i$ from this work vs. literature values. Those found only in Uesugi & Fukuda (1982) are marked with an open circle.

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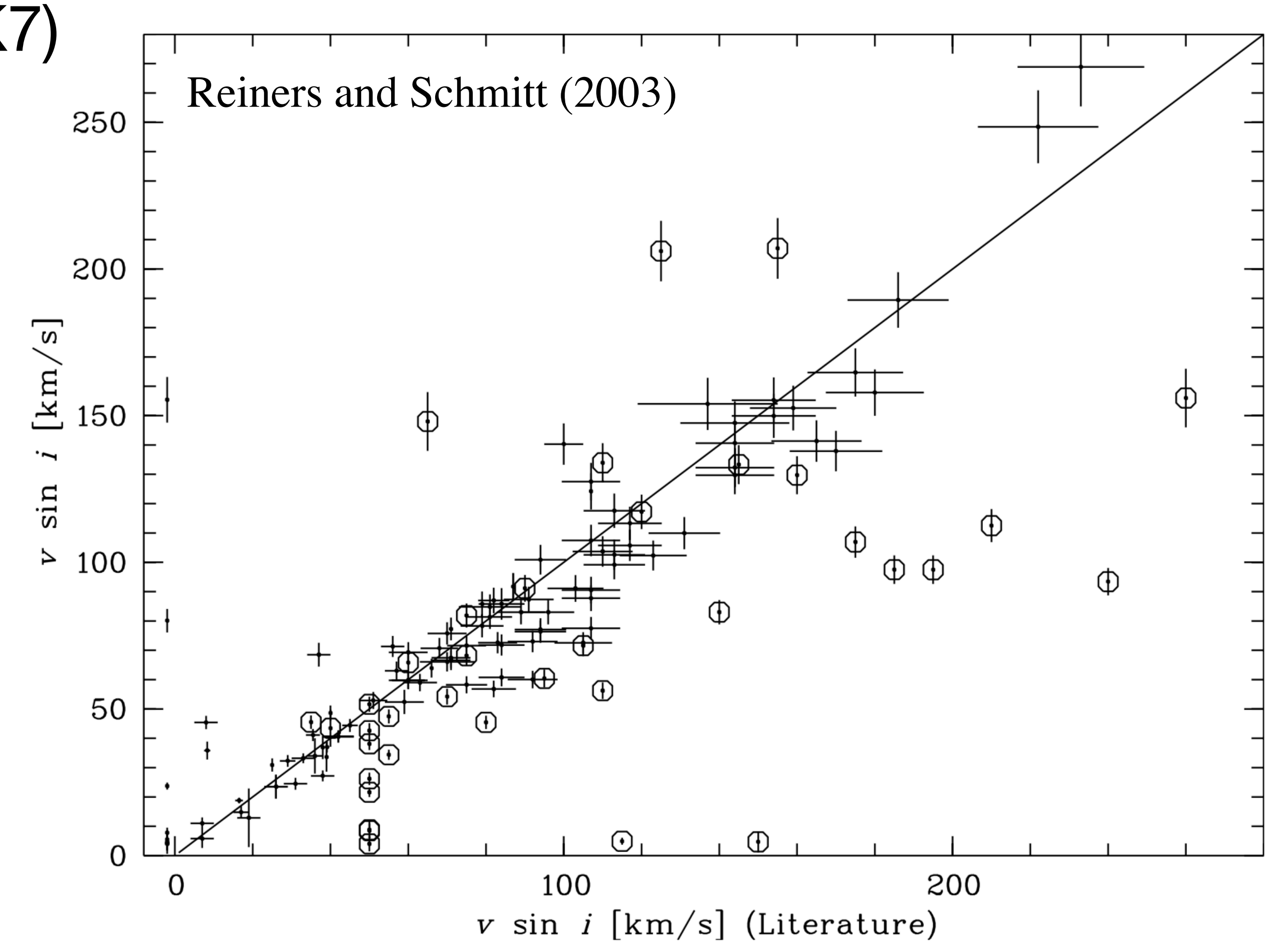
➡ This order of magnitude need to be consolidated !! but



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- If Vrot < 50 km/s : within the specs (1% on the radius)

- If Vrot > 50 km/s : need more information to get the stellar and planetary radii (inclination angle and mean surface rotation) + go through 2D stellar models

Asteroseismology

- For low-mass main-sequence and sub giant stars (PLATO core program)

Asteroseismology and spot modeling is expected to provide both rotation and inclination

➡ For negligible rotation SPICA = input for PLATO

➡ For more rapid rotation = interplay between SPICA and PLATO to get stellar and planetary radii

Validated imagettes, light curves and centroid curves	DP0	L0
Calibrated imagettes, light curves and centroid curves	DP1	L1
Planetary candidate transits and their parameters	DP2	L2
Asteroseismic mode parameters	DP3	L2
Stellar rotation and activity	DP4	L2
Stellar radii, masses, and ages	DP5	L2
Living catalogue of confirmed planetary systems and their characteristics using light curves and transit time variations	DP6	L2
Follow-up ground-based observations		Lg
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- For other type of pulsators:

SPICA should focus on slow rotators and will provide stringent additional constraints on stellar models

e.g.:

➡ Slow rotating beta Cep stars

Several of these stars exhibit oscillating modes and have already been modeled but the observational constraints on the stellar parameters are often a big problem

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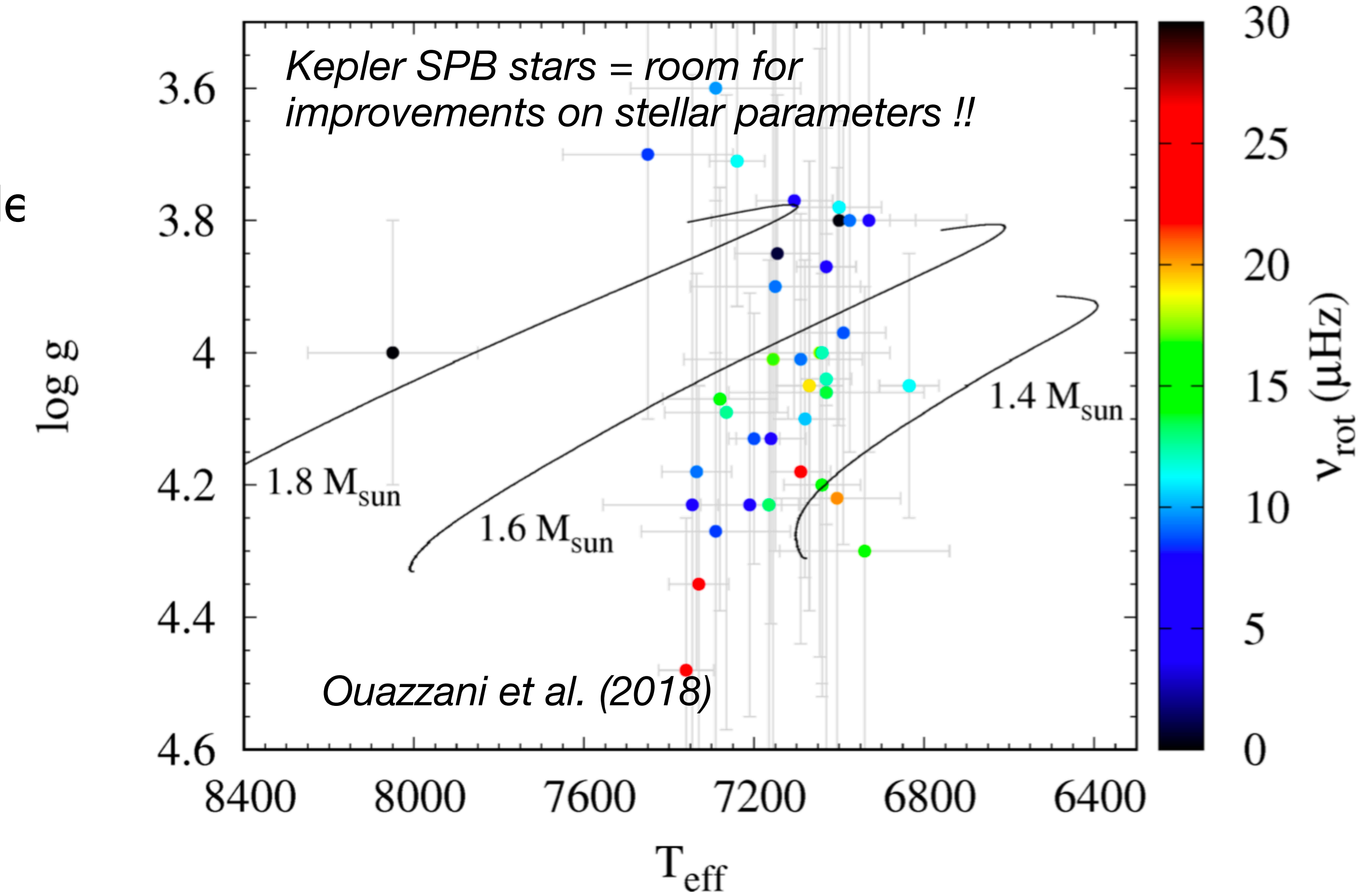

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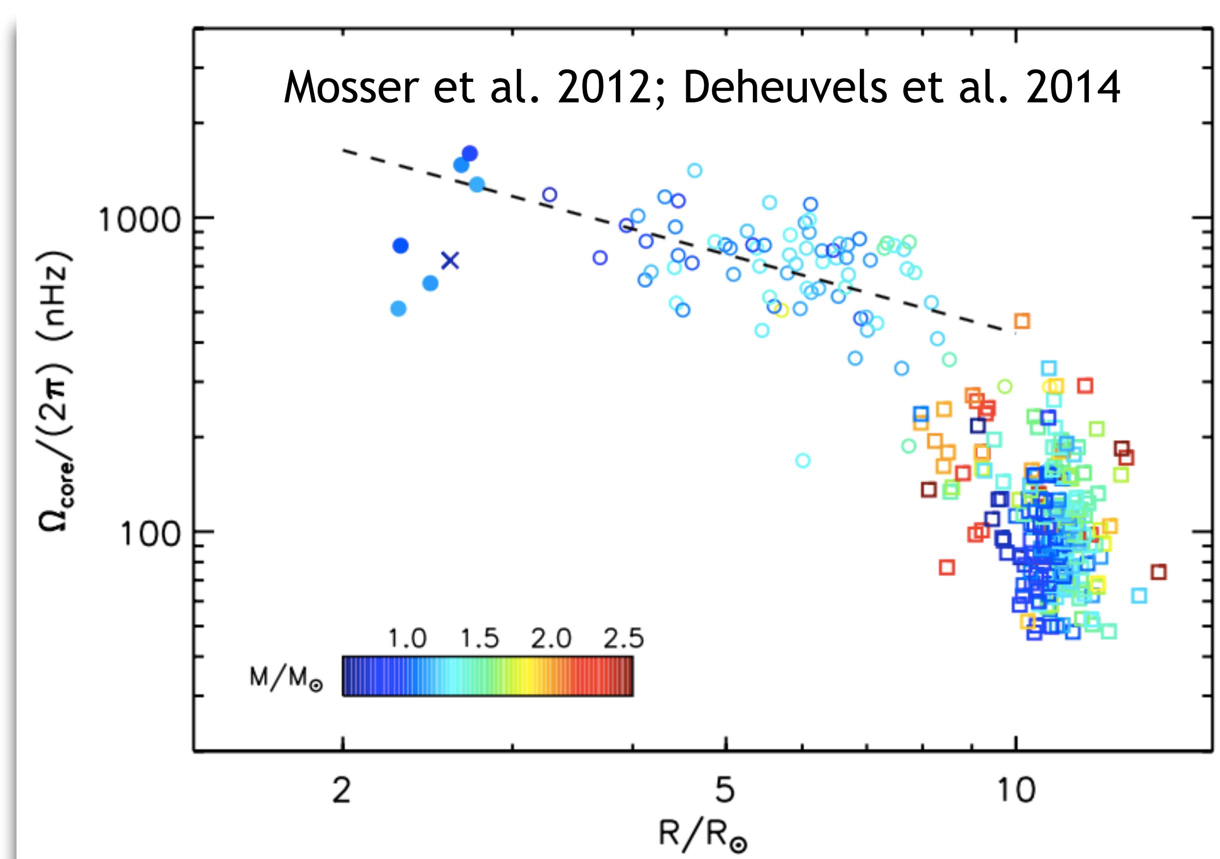
➡ Red giants



SBCR

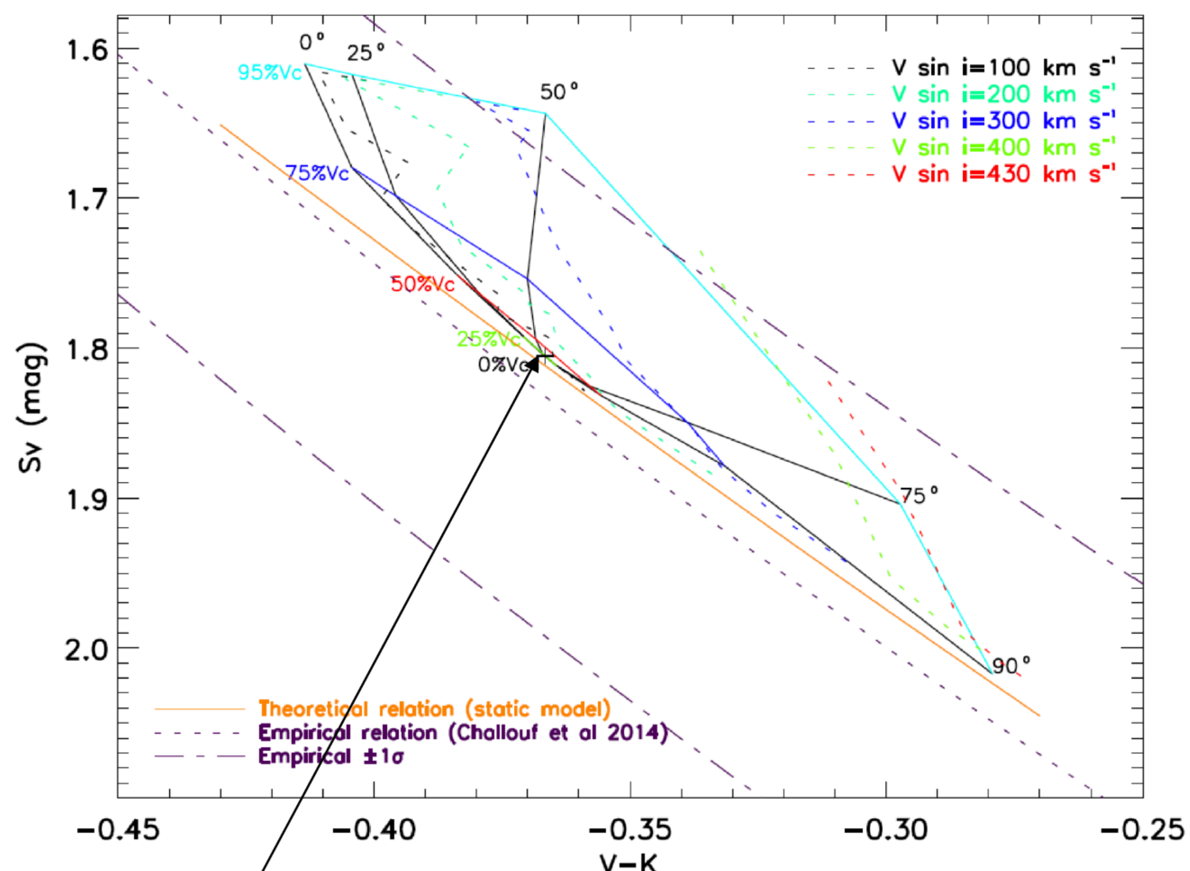
- The rotation has a strong impact on early-type stars O, B, A.

Theoretical impact of fast rotation on calibrating the surface brightness-color relation for early-type stars *A&A, 2015, A&A, 579, 107*

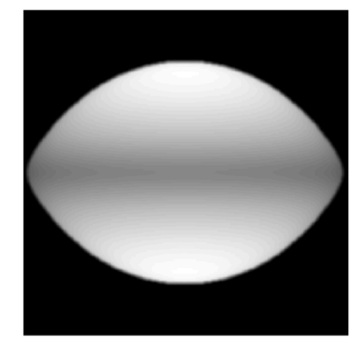
M. Challouf[1,2], N. Nardetto[1], A. Domiciano de Souza[1], D. Mourard[1], H. Aroui[2], P. Stee[1], O. Delaa[1], D. Graczyk[3], G. Pietrzyński[3,4], and W. Gieren[3,5]

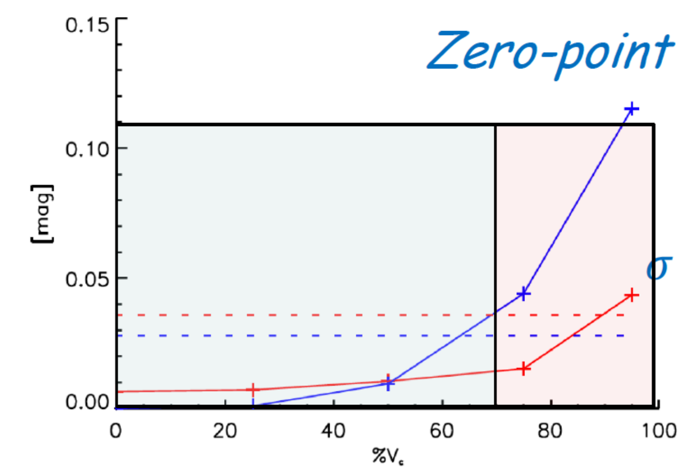
- For rapid rotation, any hope for a calibration? Not obvious because of the increase of the dispersion

➡ if able to select in inclination can we limit the impact of rotation?



CHARON Model Domiciano+02,12





Model of a standard stars, then exploration of parameters space (rotation velocity, inclination) for different interferometric configurations. Calculation of the impact of rotation on the SBCR

- Idea of building synthetic SED from fast rotating model in order to discriminate fast rotating stars.

SPICA images : useful for fast rotation

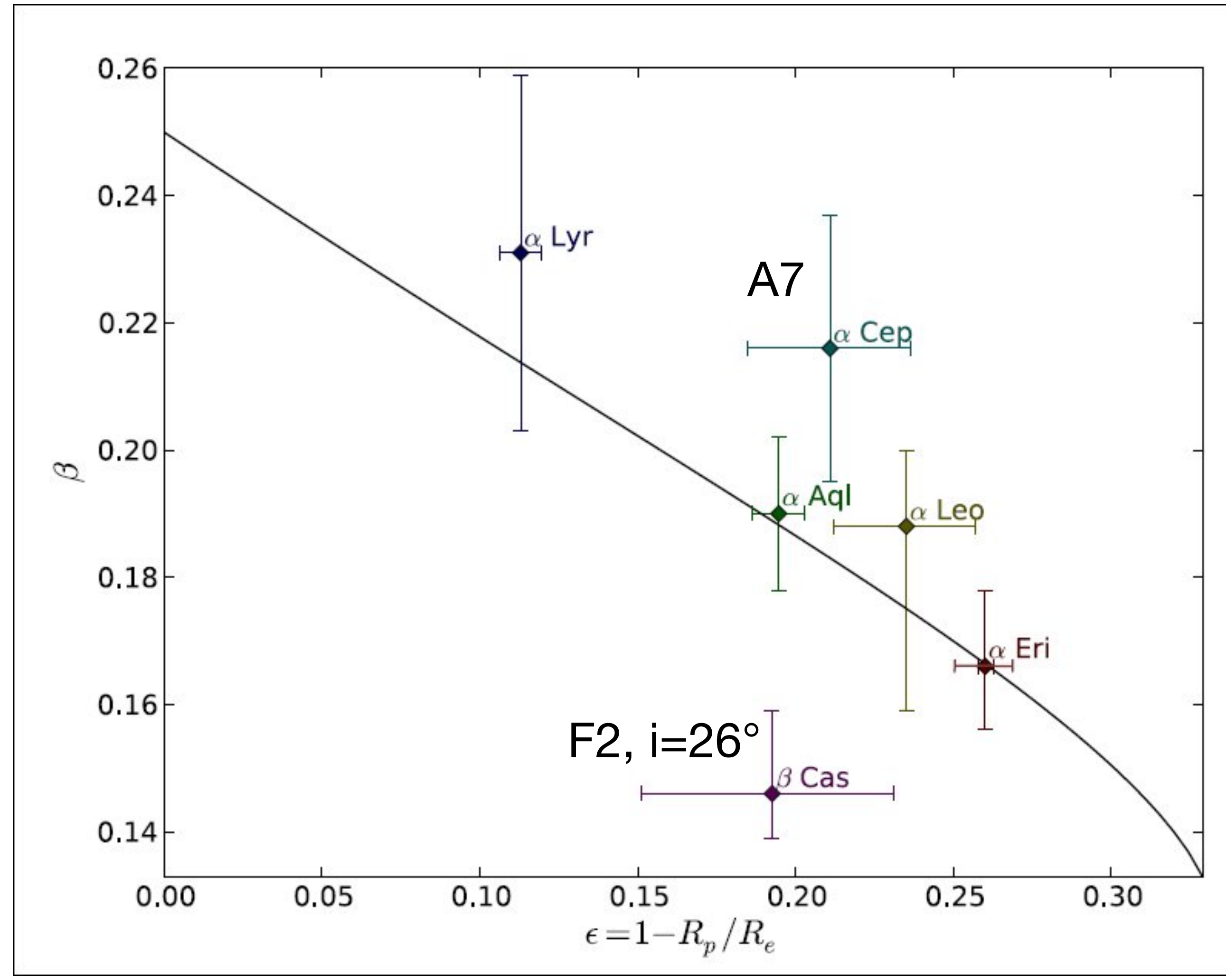
- SPICA images would provide valuable constraints on 2D stellar models

<u>e.g. gravity darkening: need for observational inputs</u>

➡ SPICA can provide to complete this diagram with a better accuracy

➡ SPICA can observe F/G stars because of their external convective layers

<u>e.g. constraints on bi-stability of winds</u>



- To measure differential rotation: resolution of 3000 is not enough, minimum of 10 000 is needed