Synergies within the programs of the survey ISSP

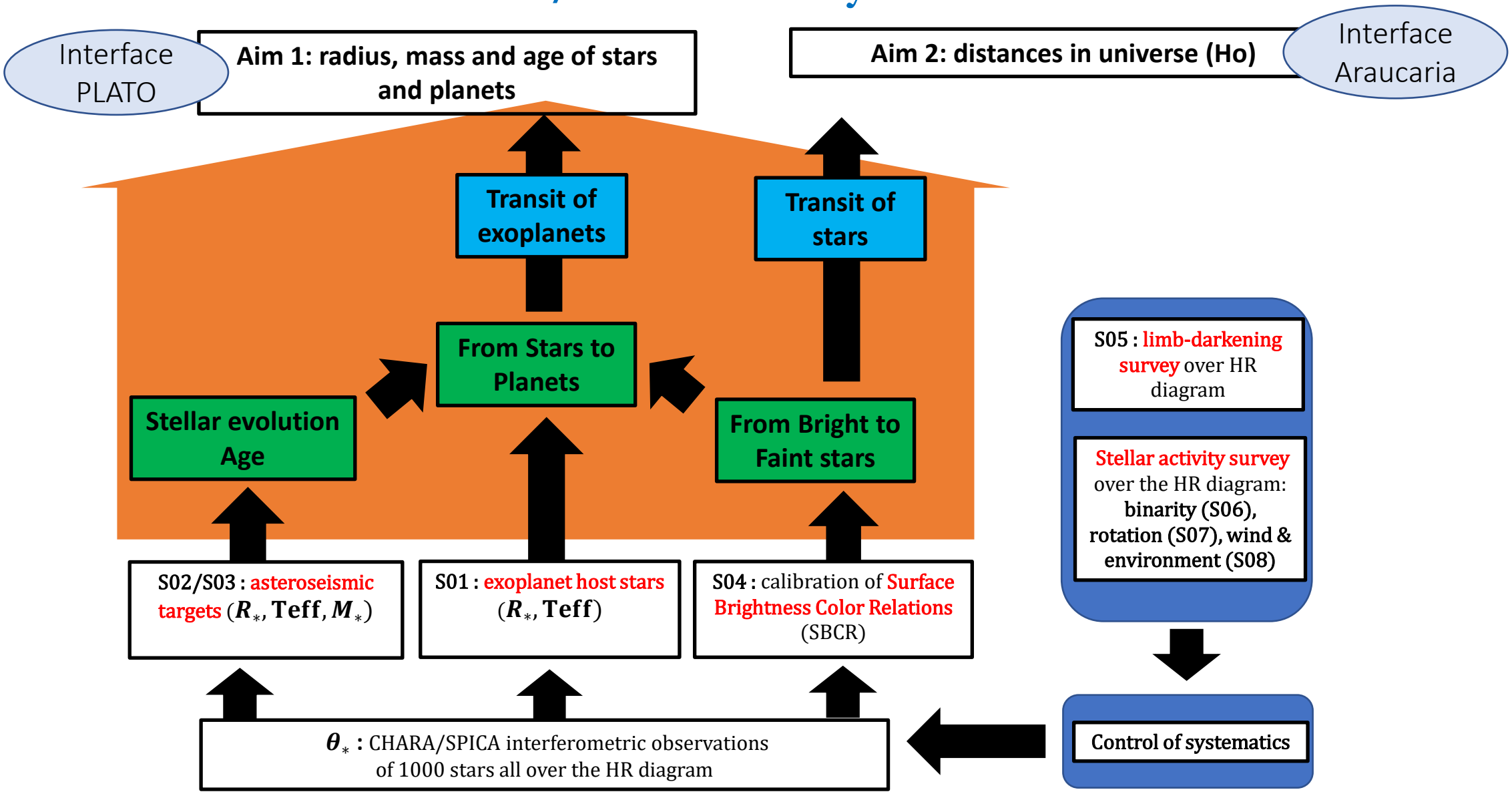
N. Nardetto

Synergy: *the interaction or cooperation of two or more organizations, substances, or other agents* ***to produce a combined effect greater than the sum of their separate effects.***

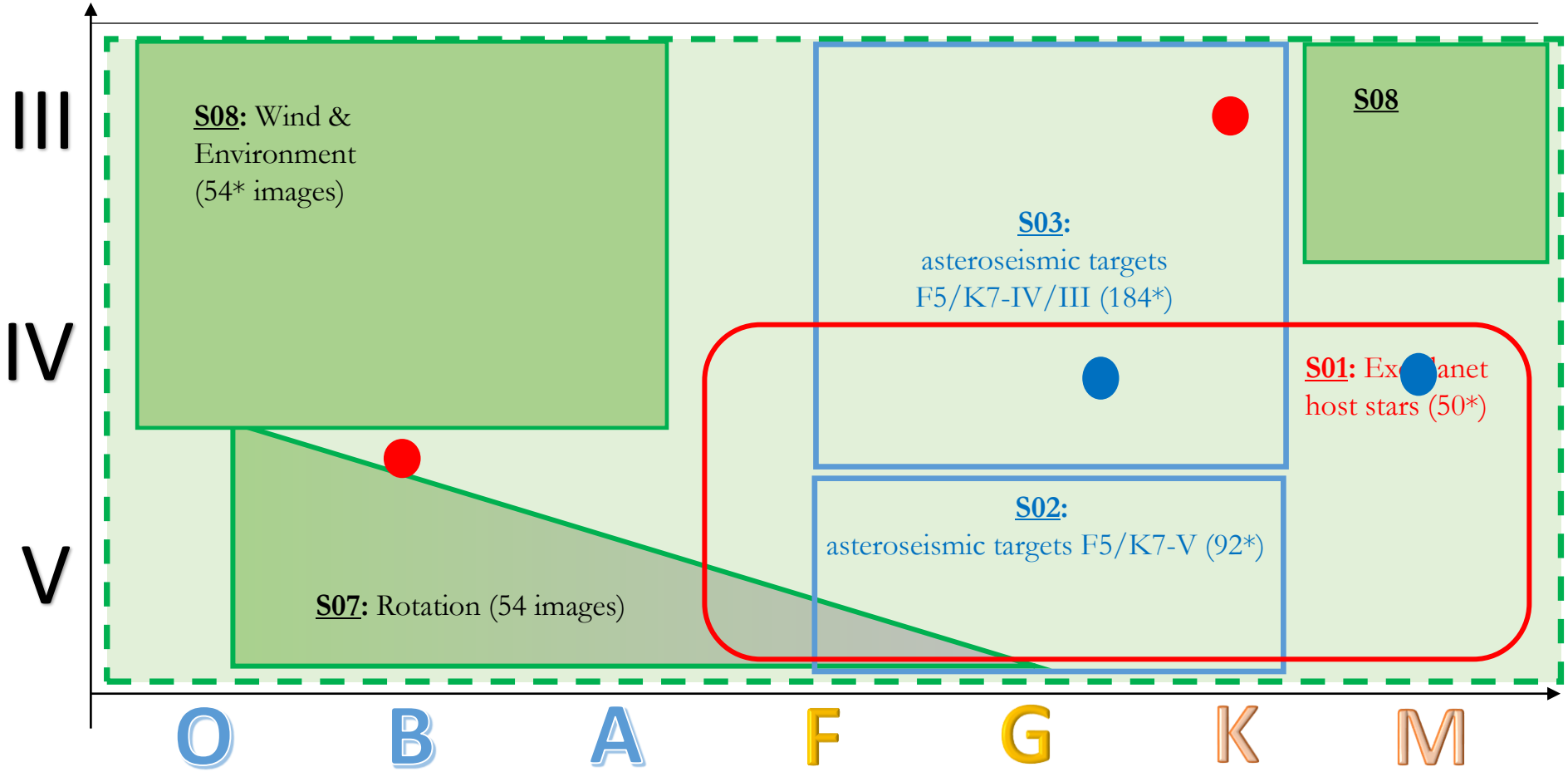
SPICA Workshop, Nice, 01/06/23

ISSP
Interferometric Survey of Stellar Parameters
erc
European Research Council

The CHARA/SPICA survey



The CHARA/SPICA survey: summary



Survey all over the HR diagram

S04: Surface-Brightness Color Relations (324*)

S05: Limb-darkening (162 targets)

S06: Multiplicity (54 monitoring)

- Synergy CHARA/SPICA survey /Araucaria Project ●
- Synergy CHARA/SPICA survey / PLATO space mission ●
- Other synergies GBS/Metal Poor survey (talk by C. Soubiran), BIFROST (Talk by S. Kraus), Synergies with MIRC-X/MYSTIC (Talk by Narsi), Open time programs, etc…

Synergies : the same stars

In SPICA database, 2 cases:

- **two PI, same star, different modes => synergy ?**
- **Two PI, same star, same modes => redonduncy/synergy**

Number of lines in SPICA database: 2505
Number of redondant lines: 71

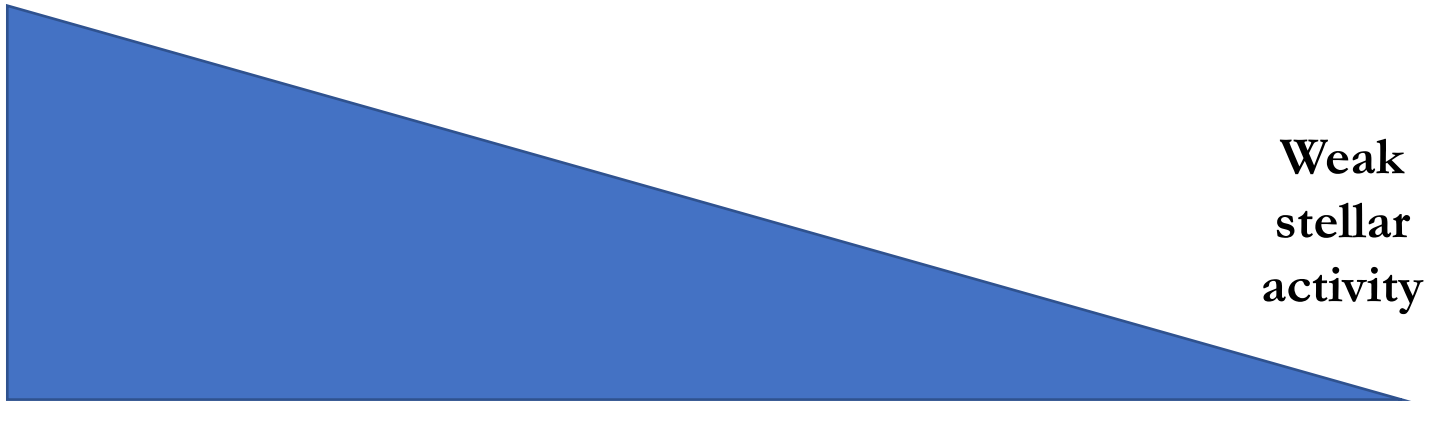
S01							
S02	**5**						
S03	0	**4**					
S04	**2**	**12**	0				
S05	0	**3**	**9**	**24**			
S06	0	0	0	0	0		
S07	0	0	0	**2**	**9**	0	
S08	0	0	0	0	0	0	0

Summary:

- **5** asteroseismic targets (dwarfs) with exoplanet(s) : age of the planet(s) !
- **2** stars with exoplanets host stars used to calibrate the SBCR
- **4** asteroseismic targets is S02 and S03
- **12** asteroseismic targets used to calibrate the SBCR : Ra, Ri => benchmark
- **3** asteroseismic targets (dwarfs) for which LD measurement is forseen: constrain on atmosphere models ?
- **9** asteroseismic targets (giants) for which LD measurement is forseen: constrain on atmosphere models ?
- **24** with LD measurements will be also used to calibrate SBCR
- **2** stars for SBCR calibration might have wind
- **9** stars for LD measurements might have wind

Reduce the volume to hear the noise !

Strong stellar activity: binarity, rotation, wind/environment



Weak stellar activity

Systematics !

Estimation of **bias** on the stellar angular diameters and fundamental parameters.

Comment by M. Rieutord in 2018 (kick-off meeting os SPICA: Vrotsini of 50km/s => 1% of flattening on the angular diameter)

Synergies : analysis of V2

The case in which a standard star is actually active

	A	B
1	QCS_UD_DIAM	4.833394
2	QCS_UD_ERRDIAM	0.047661
3	QCS_UD_REDCHI2	14073.259
4	QCS_UD_NBDOF	1109
5	QCS_GAUSS_DIAM	3.843490
6	QCS_GAUSS_ERRDIAM	ND
7	QCS_GAUSS_FWHM	16.350667
8	QCS_GAUSS_ERRFWHM	ND
9	QCS_GAUSS_FRATIO	0.811066
10	QCS_GAUSS_ERRFRATIO	ND
11	QCS_GAUSS_REDCHI2	13841.928
12	QCS_GAUSS_NBDOF	1107
13	QCS_ROTATOR_MAJORDIAM	4.850135
14	QCS_ROTATOR_ERRMAJORDIAM	0.049247
15	QCS_ROTATOR_ELONG	1.446456
16	QCS_ROTATOR_ERRELONG	0.181981
17	QCS_ROTATOR_PA	162.467533
18	QCS_ROTATOR_ERRPA	14.640330
19	QCS_ROTATOR_REDCHI2	13508.252
20	QCS_ROTATOR_NBDOF	1107
21	QCS_BINARY_DIAM1	0.422059
22	QCS_BINARY_ERRDIAM1	0.000554
23	QCS_BINARY_X	3.000727
24	QCS_BINARY_ERRX	0.001170
25	QCS_BINARY_Y	7.996381
26	QCS_BINARY_ERRY	0.001039
27	QCS_BINARY_FRATIO	9.946218
28	QCS_BINARY_ERRFRATIO	0.059350
29	QCS_BINARY_REDCHI2	0.862
30		

Fig. 7 : An example of a CVS file created by the QCS modeling module.

UD

GAUSS = environnement/wind (=> S08)

FLATTEN STAR = rotation (=> S07)

Binarity (=> S06)

A specific strategy/analysis/modelling/new observations can be done (*i.e. S04: study of weak stellar activity on fundamental parameters and SBCR*)

Synergies : parameter space (to be improved)

√ = output

★ = « direct constraints »

	R	Teff	M (logg)	age	Control Systematics	specific	Notes
S01	√	√	√ ★	√		Rp, Mp	M star (transit) => age
S02	√ ★	√ ★	√ ★	√		Asteroseismic frequencies	Full asteroseismic analysis or scaling relations => S07 (astero+rotation)
S03	√ ★	√ ★	√ ★	√		Asteroseismic frequencies	Full asteroseismic analysis or scaling relations => S07 (astero+rotation)
S04	√	√	√	√		SBCR ★	Extension to faint stars, distances, calibrators diameters, …
S05	√	√	√	√		Limb-darkening I(mu) ★	constraints on atmospheric models (R, Teff, M)
S06			√ ★	√	√	Parameters of the binary	age, SBCR, calibration of Gaia/ SBCR
S07					√	Parameters of the rotating star ★	age, SBCR, LD ?
S08					√	Wind/Environment parameters ★	age, SBCR, LD

Common tools ?
=> Homogeneous parameters

DLD +d

DLD + **Fbol**

Spectro + Atm. models

Evol. models

Complemantary data: photometry/spectroscopy

S04/S05: programs with HR diagram coverage