Long period variables and Gaia

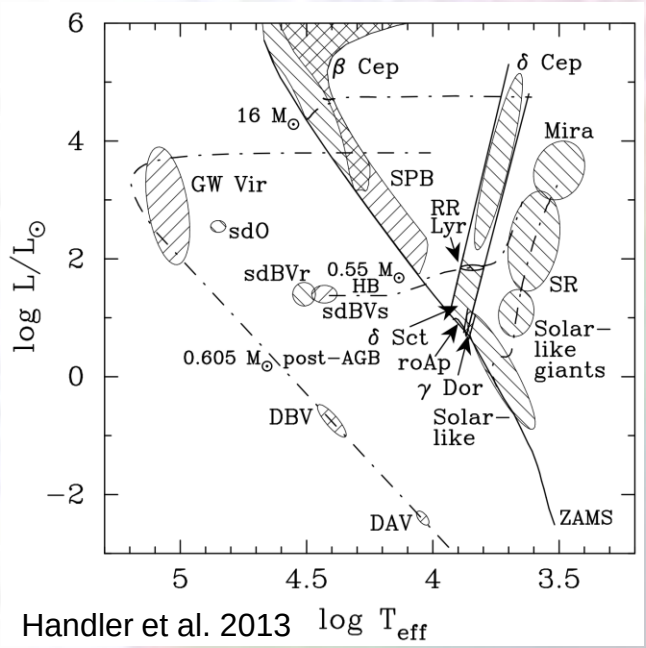
Thomas Lebzelter

Nami Mowlavi, Michele Trabucchi, Isabelle Lecoeur, et al.

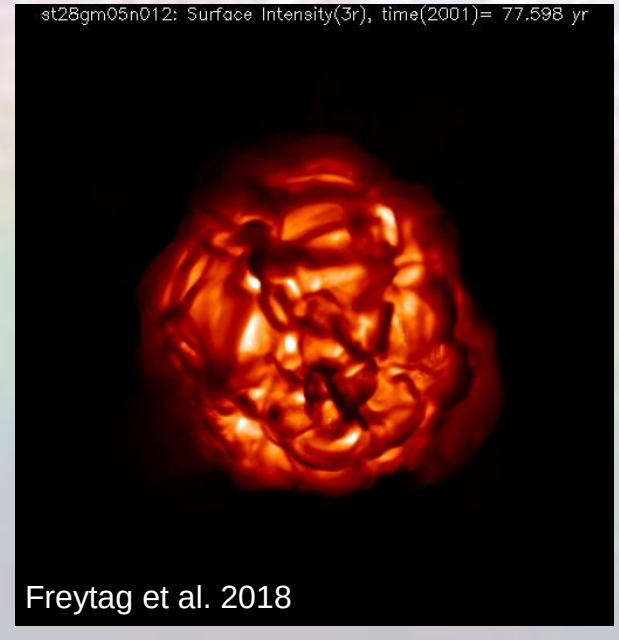
Outline

- A brief introduction on LPVs
- The 2nd Gaia LPV catalog
- Identification of C-stars
- A comment on distance uncertainties
- The Gaia-2MASS-diagram
- Period-luminosity diagrams in the Gaia era

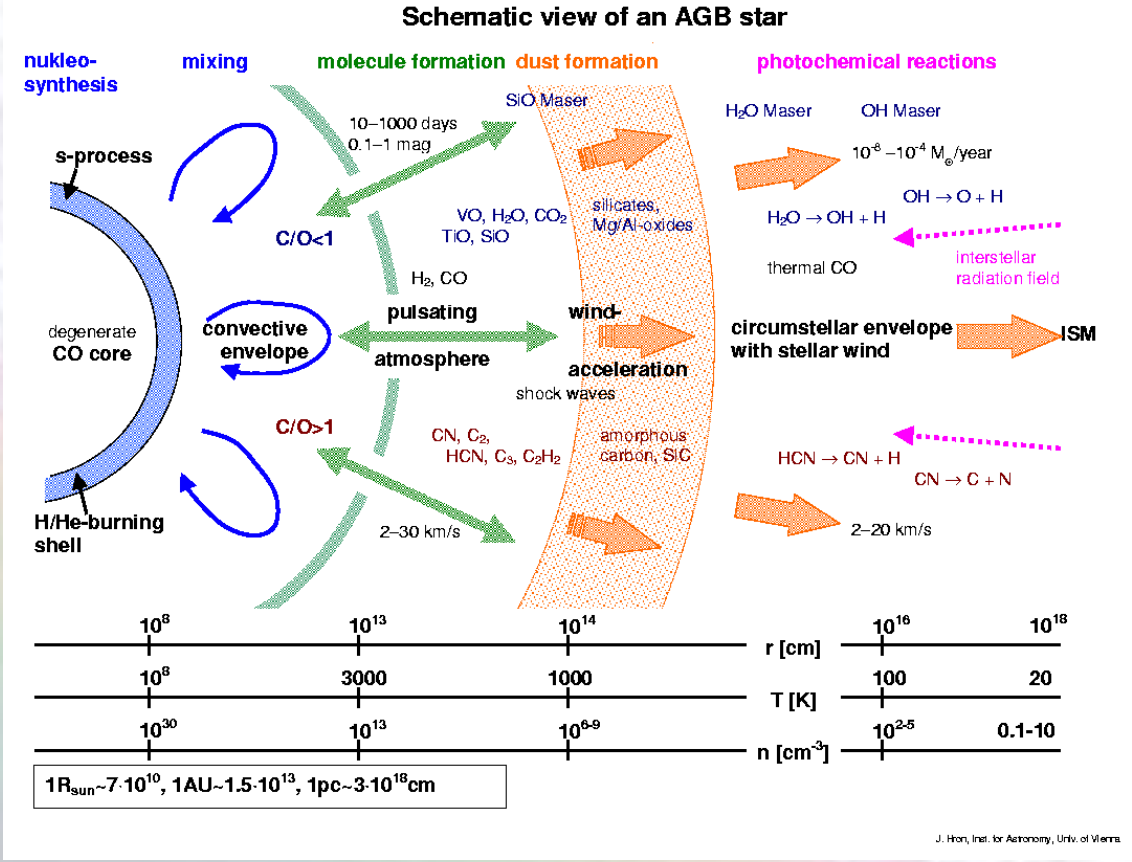
Long period variables

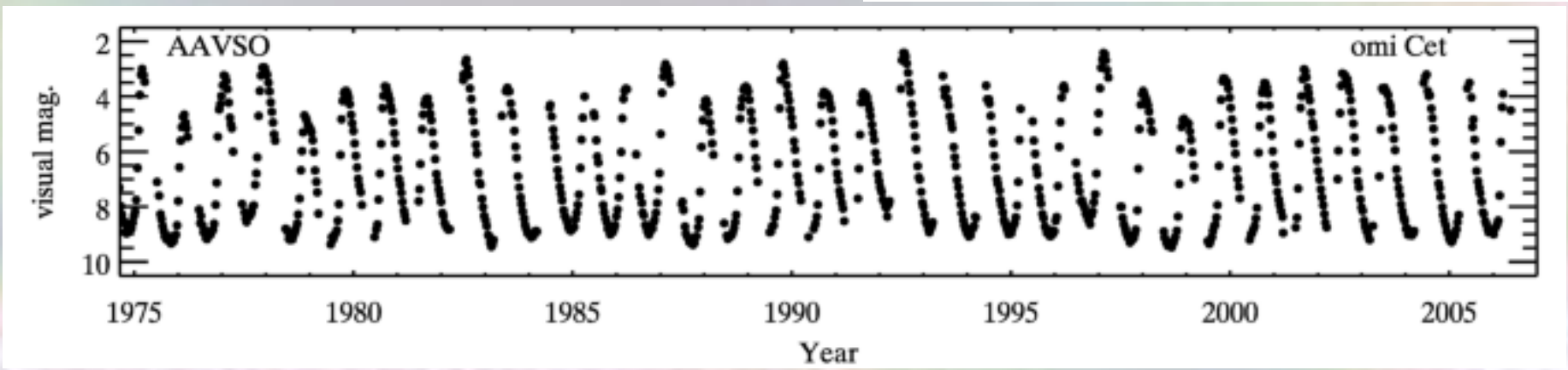


Handler et al. 2013

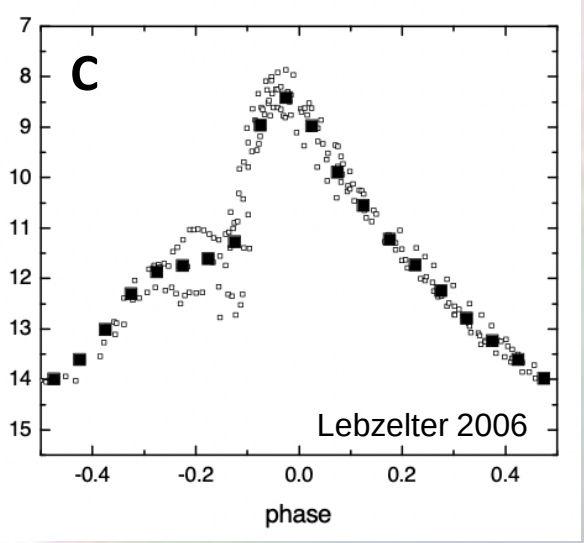


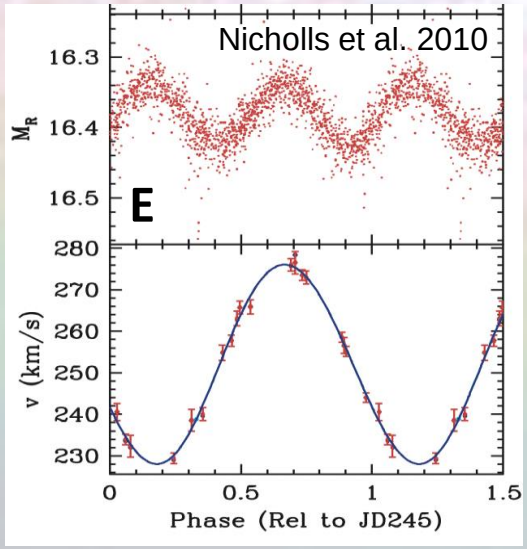
Freytag et al. 2018

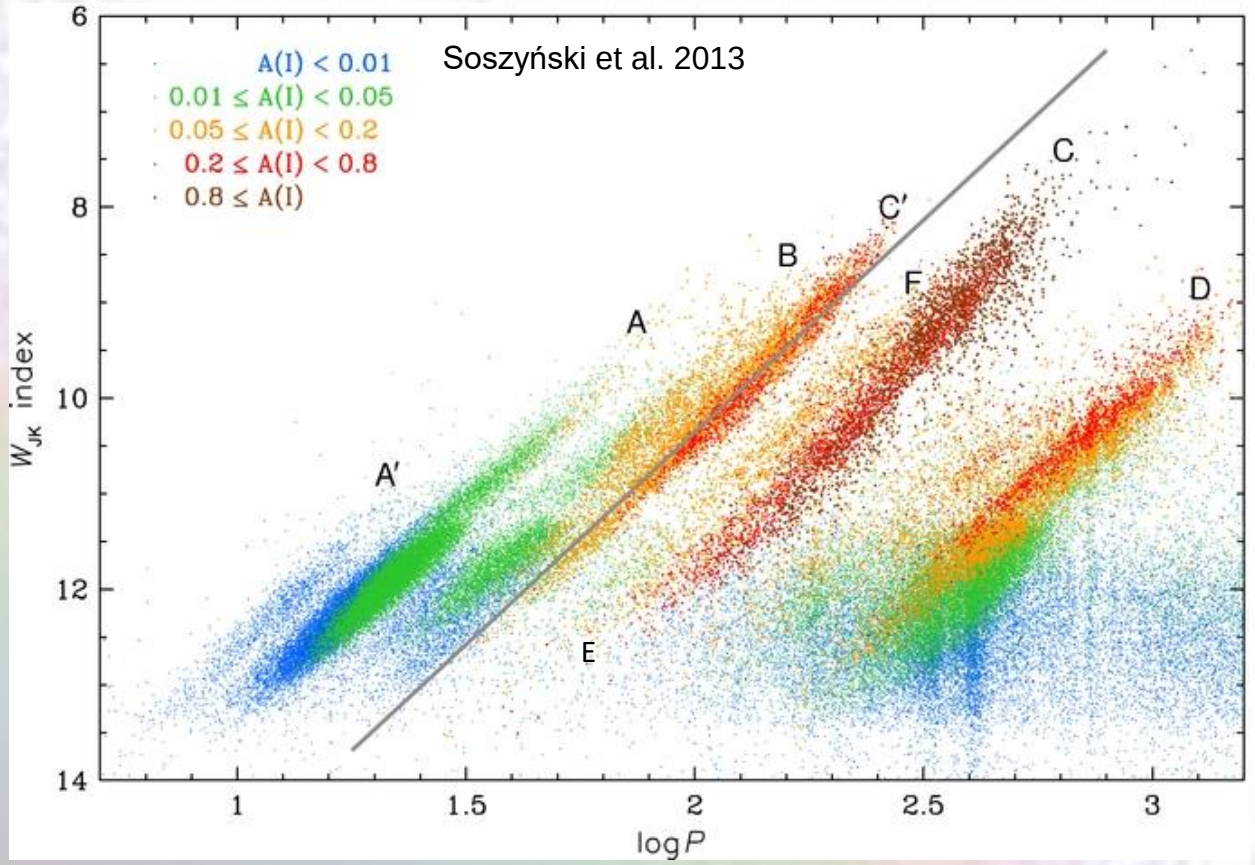


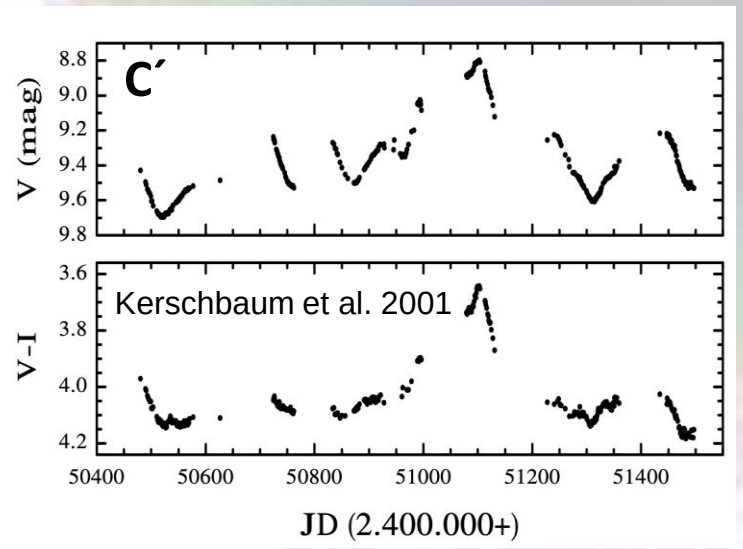


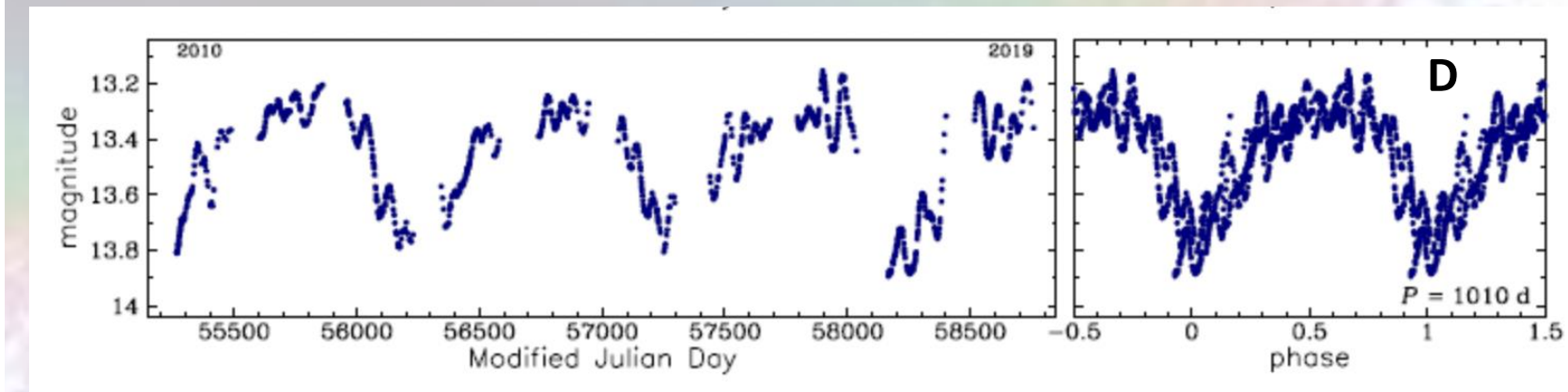
Long period variables



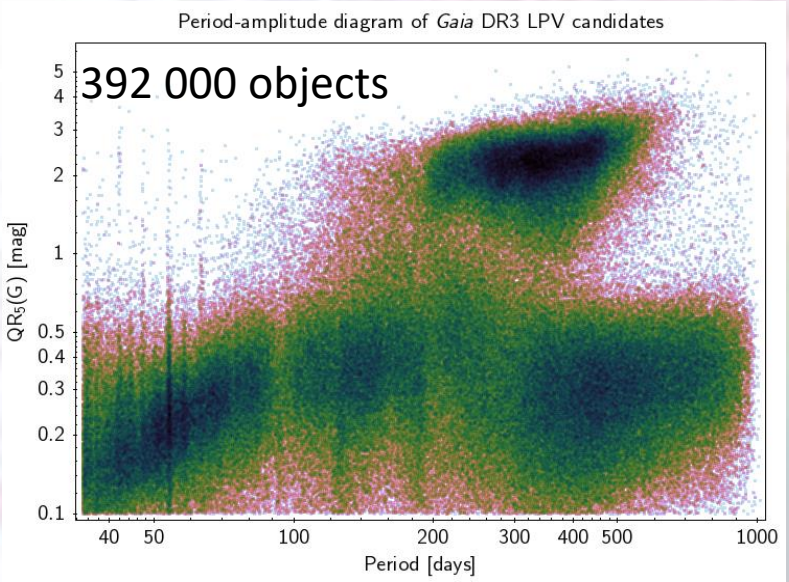


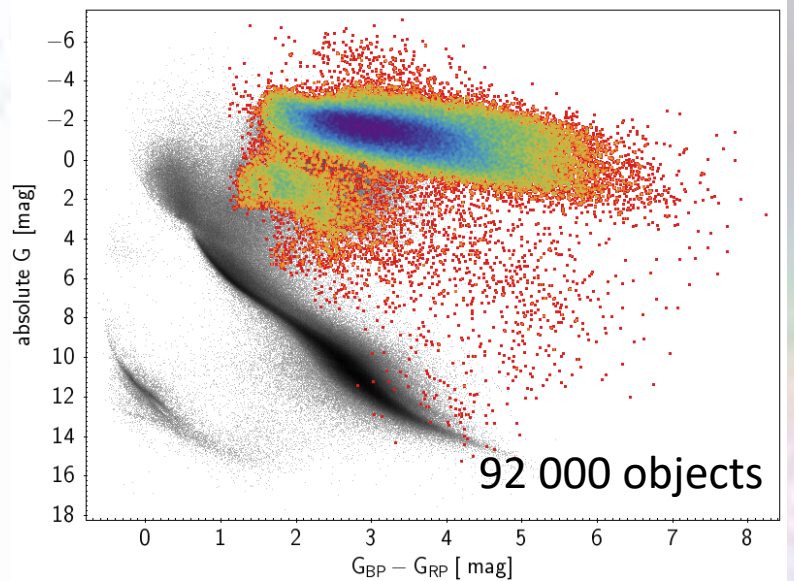


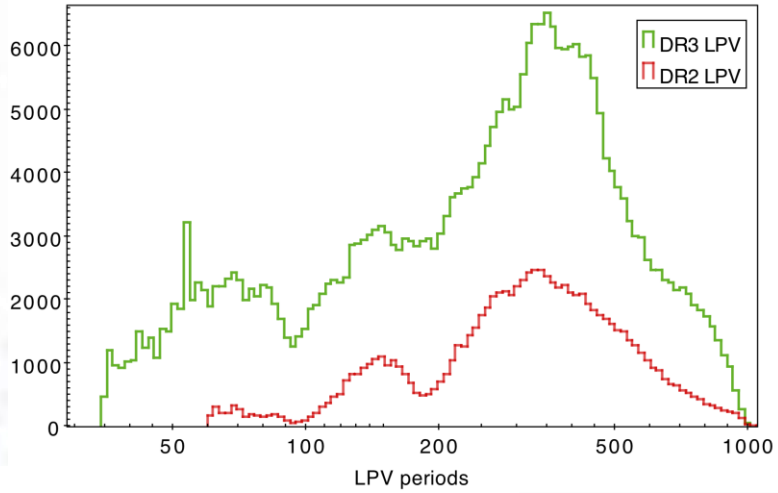


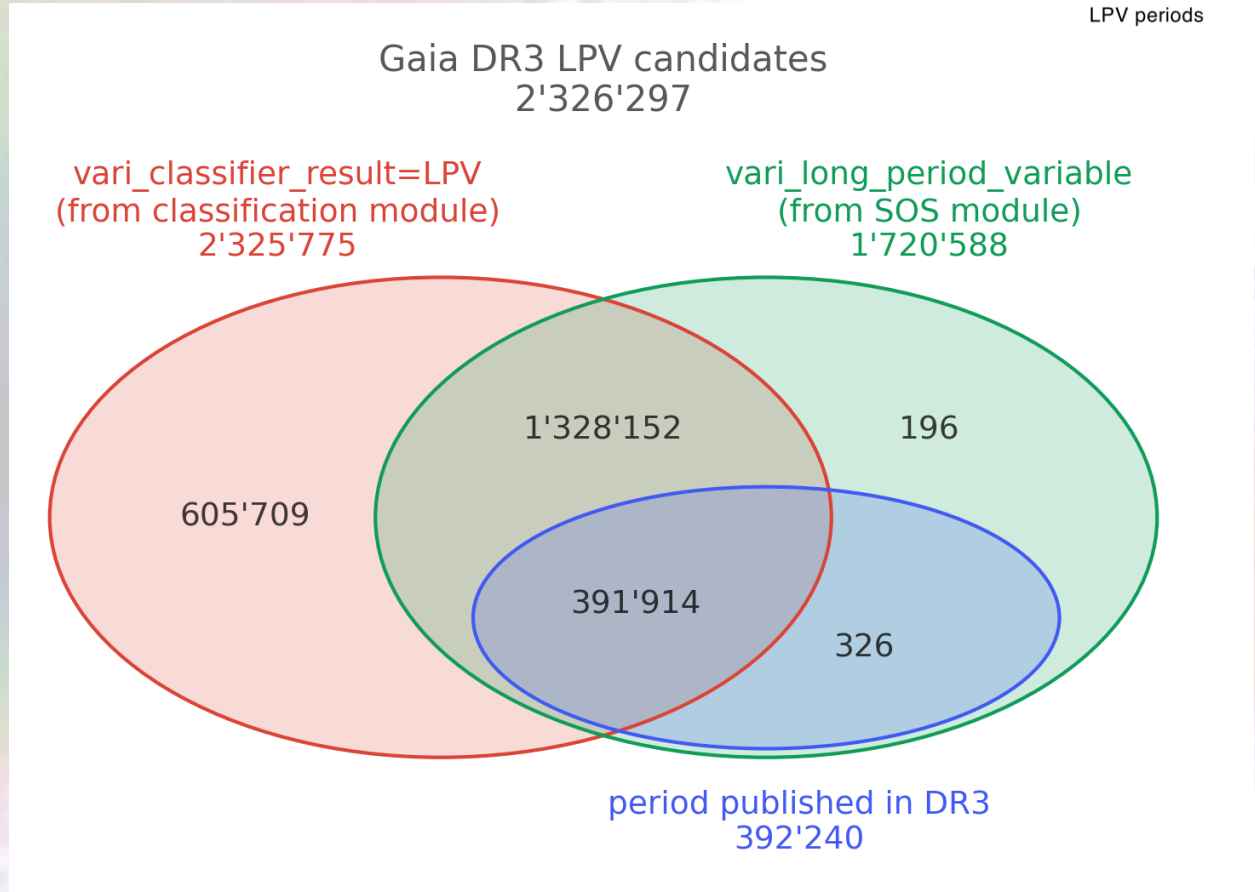


The Gaia DR3 catalog of LPVs

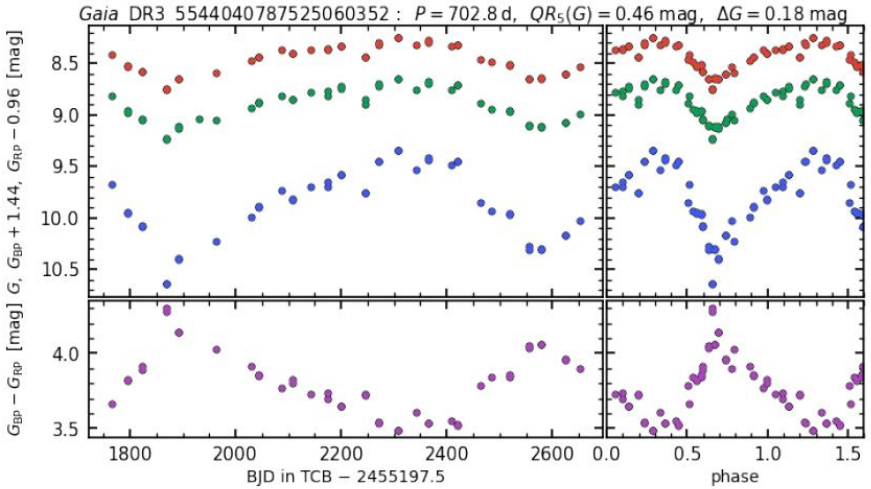


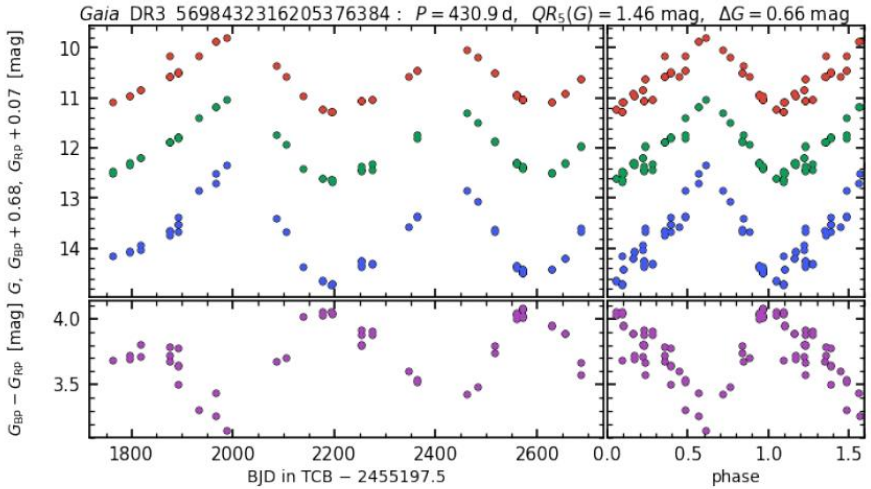


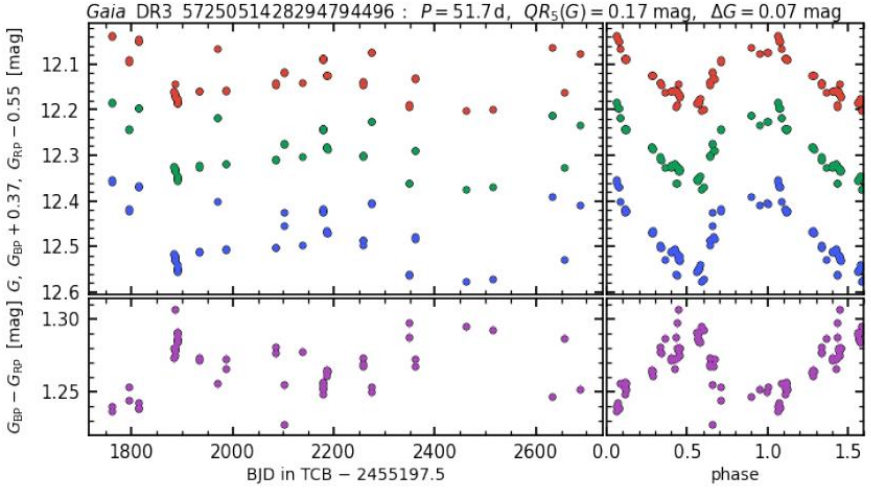


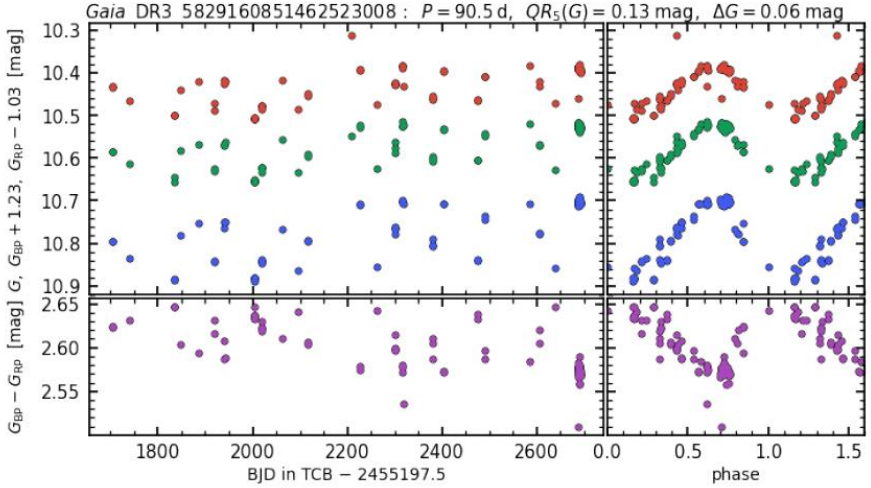


Example light curves

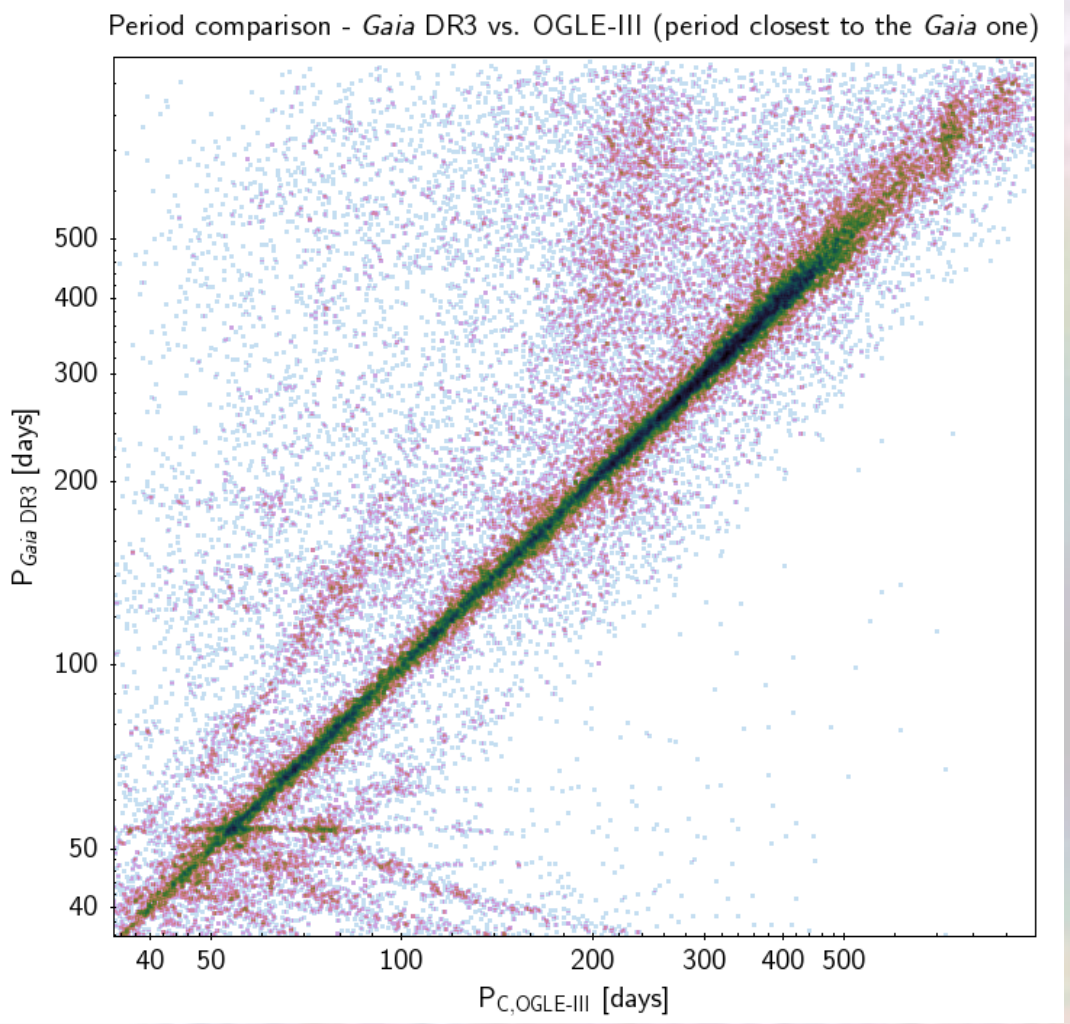








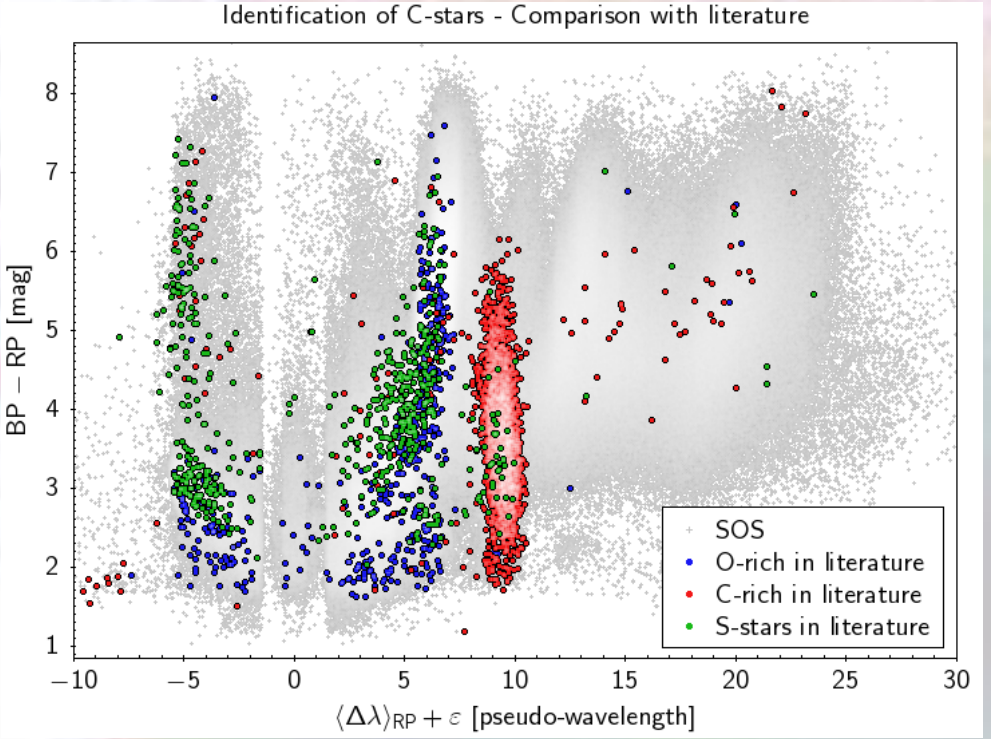
Accuracy and Completeness

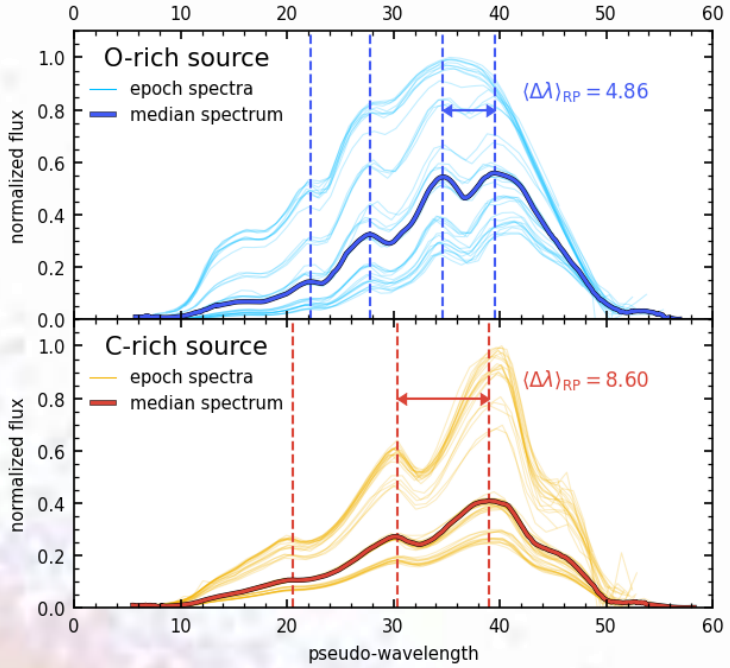


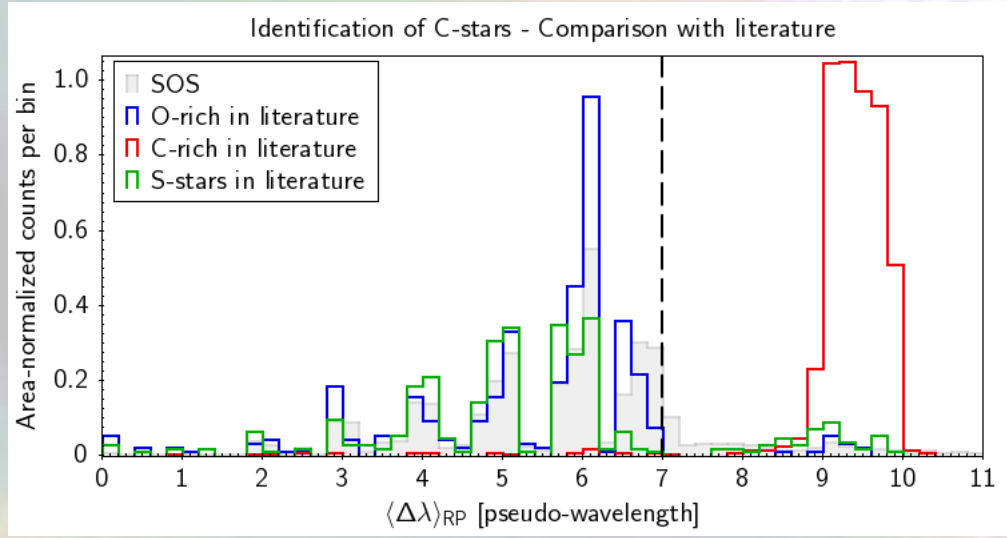
Selection	N_{xm}	$\delta P_1 < 0.1$	$\delta P_c < 0.1$	$\delta P_1 < 0.2$	$\delta P_c < 0.2$
All	29 865	12 797	16 754	14 457	19 710
		(42.8%)	(56.1%)	(48.4%)	(66.0%)
Mira	4 436	4 290	4 310	4 340	4 360
		(96.7%)	(97.2%)	(97.8%)	(98.3%)
SRV	15 018	4 856	7 441	5 523	8 953
		(32.3%)	(49.5%)	(36.8%)	(59.6%)
OSARG	10 411	3 651	5 003	4 594	6 397
		(35.1%)	(48.1%)	(44.1%)	(61.4%)

Selection	OGLE-III	Matched ≤ 2″	Recovery rate
LPV candidates			
All	84 897	70 395	82.9%
BLG	55 644	45 659	82.1%
LMC	25 015	21 370	85.4%
SMC	4 238	3 366	79.4%
Mira	5 843	4 679	80.1%
O-Mira	494	470	95.1%
C-Mira	1 479	1 006	68.0%
SRV	32 630	30 063	92.1%
O-SRV	6 413	5 874	91.6%
C-SRV	6 461	6 144	95.1%
OSARG	46 424	35 653	76.8%

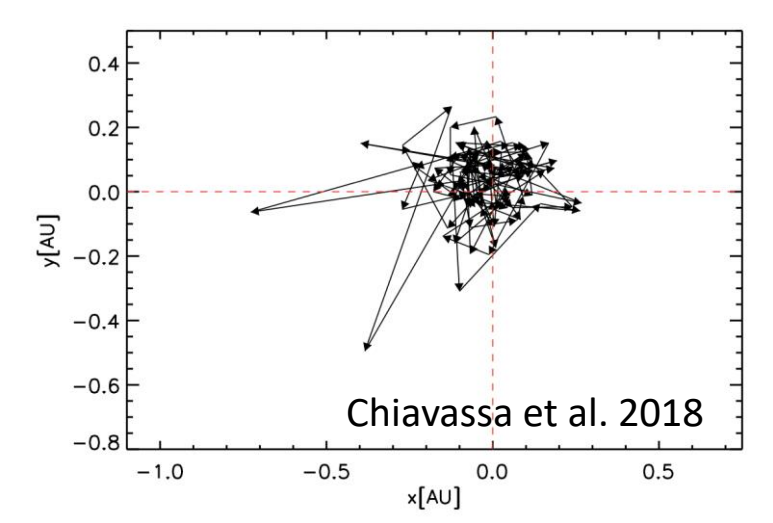
Identification of C-stars

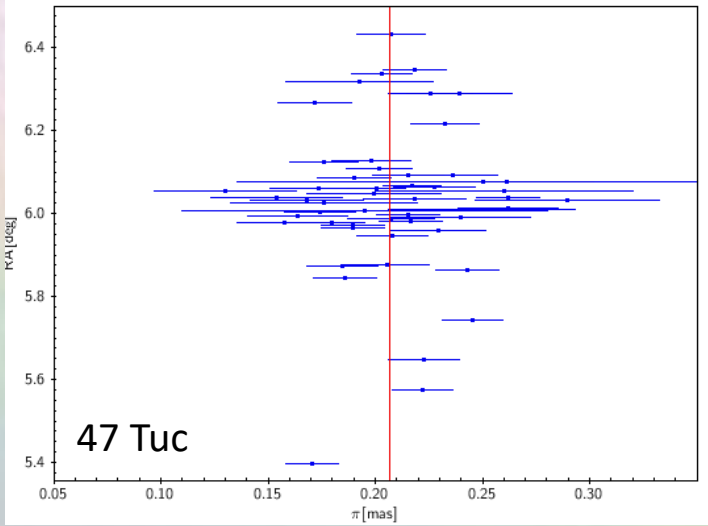


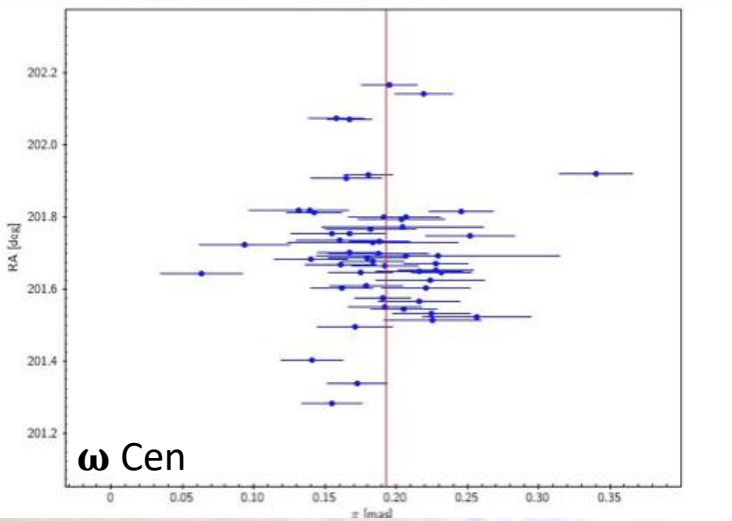


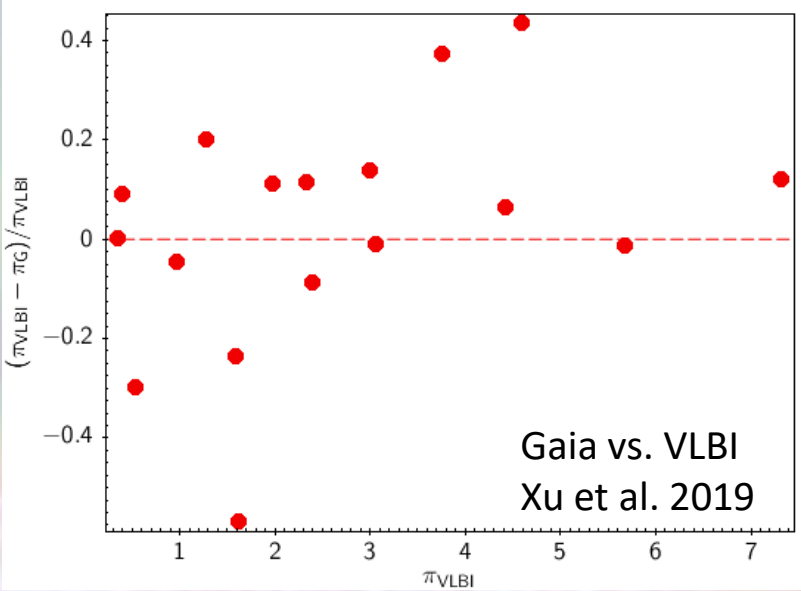


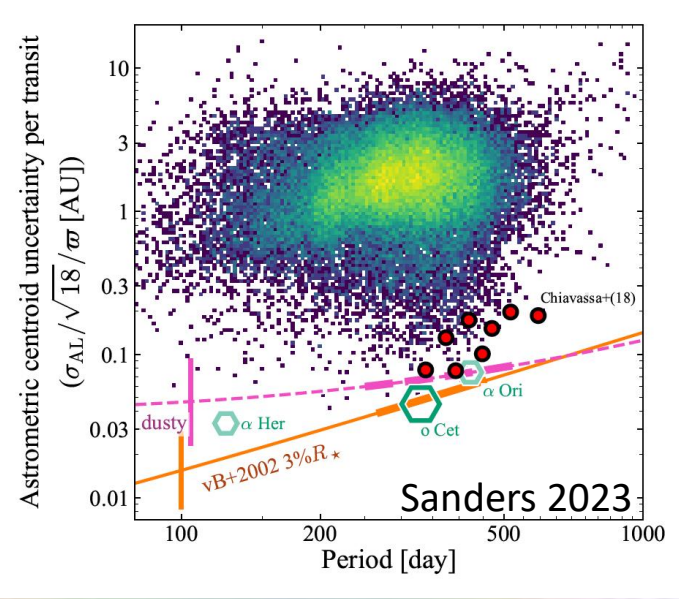
LPV distances



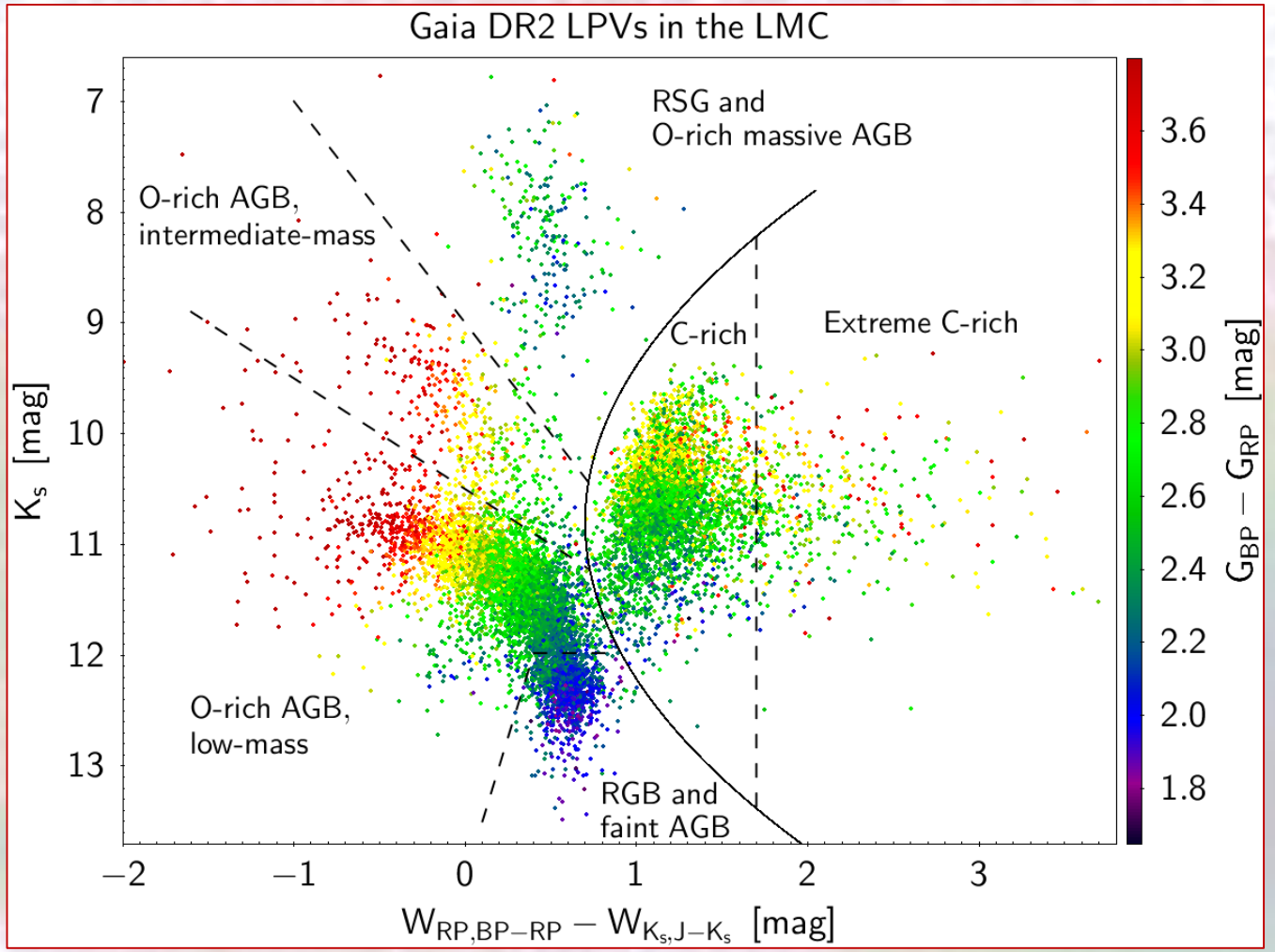


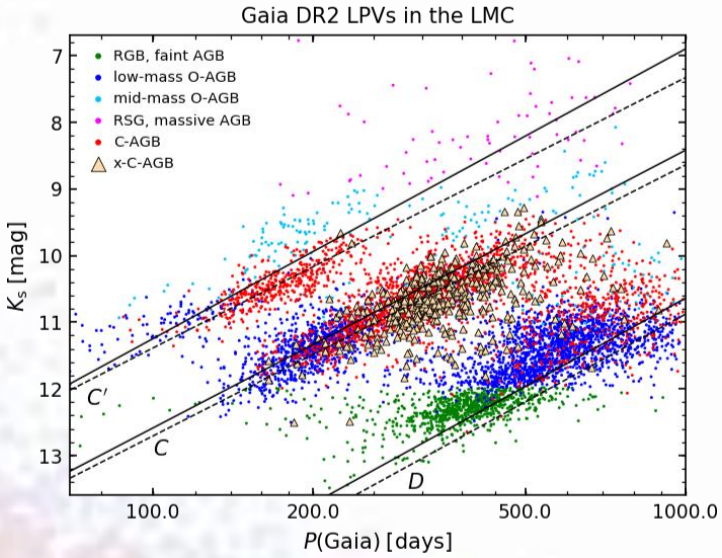


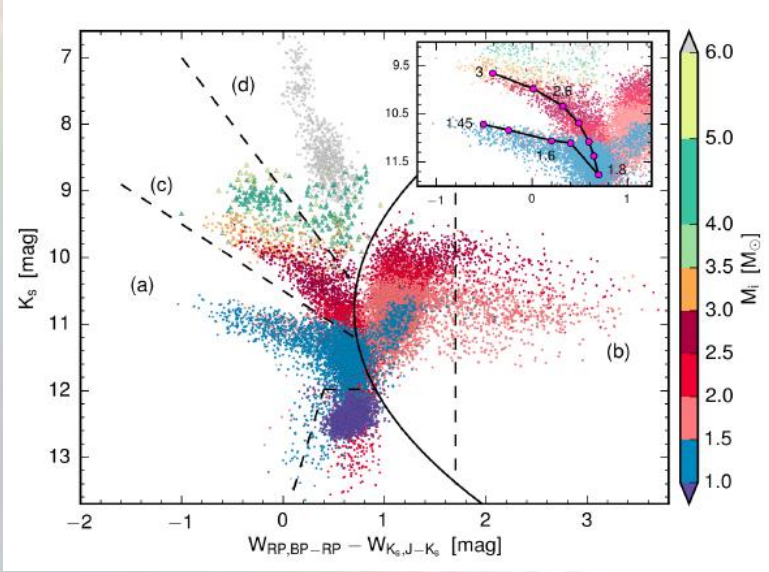




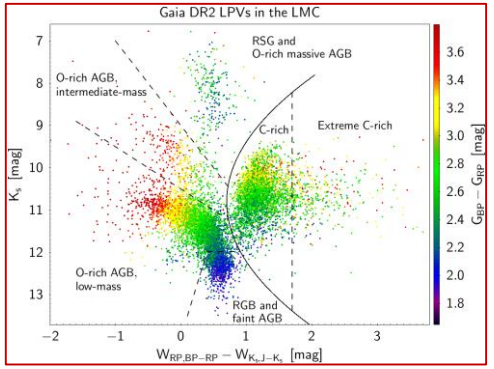
The Gaia-2MASS-diagram

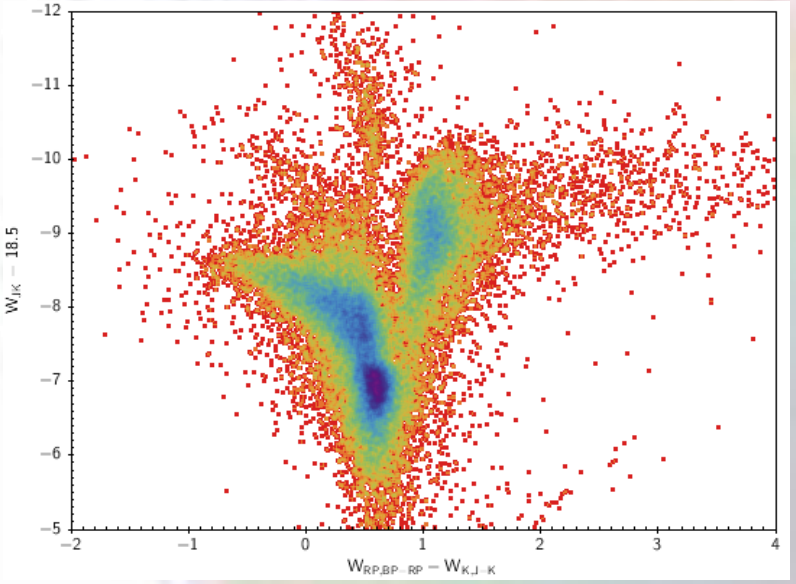






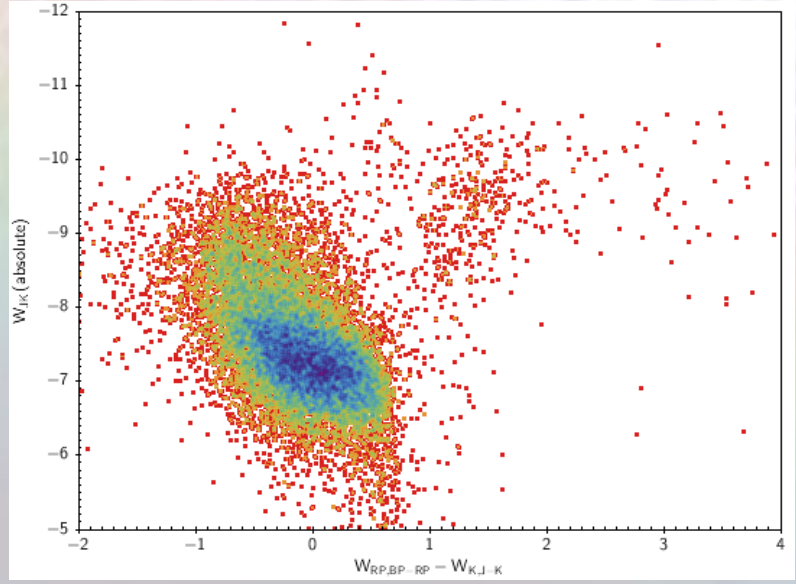
The Gaia-2MASS-diagram (DR3)



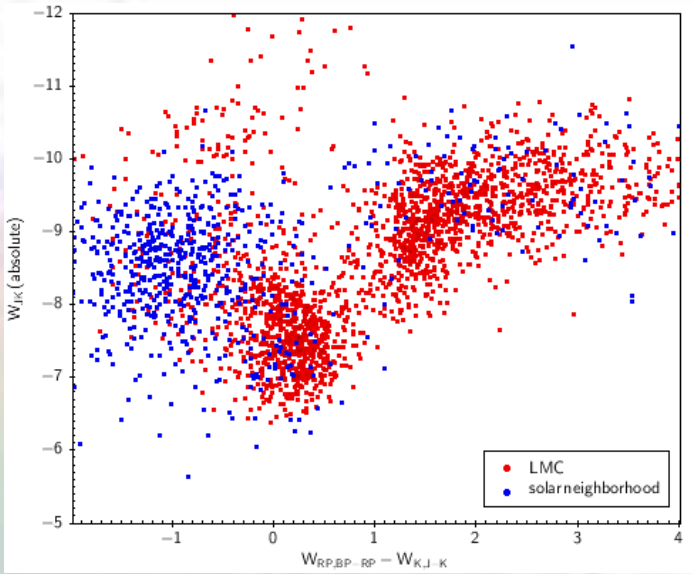


LMC

40 700 LPVs

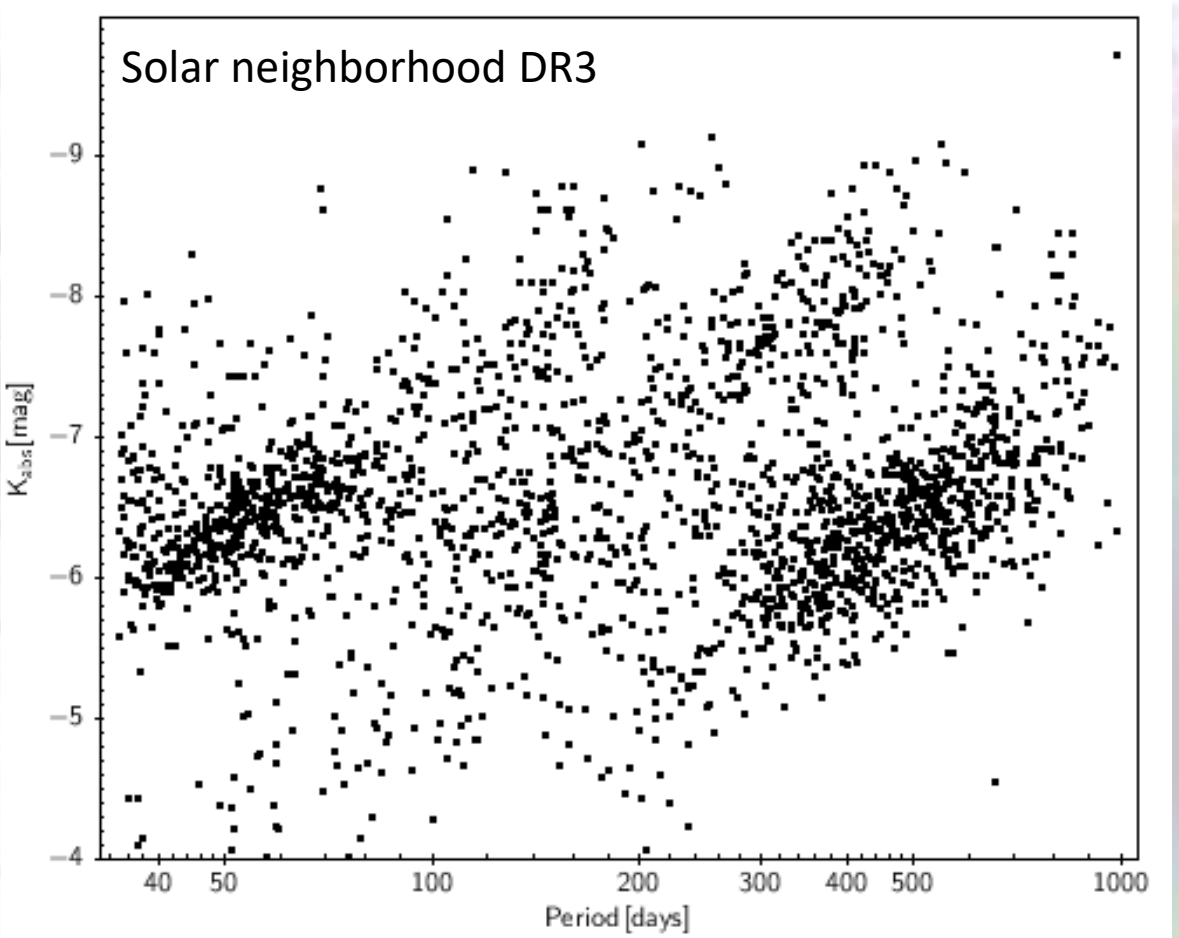


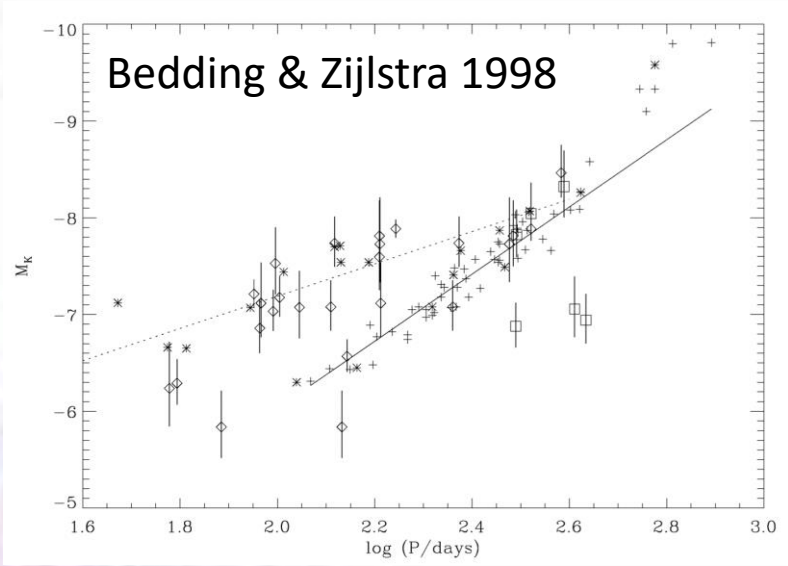
Solar neighborhood (< 2kpc)
Parallax uncertainty <10 %
15 000 LPVs

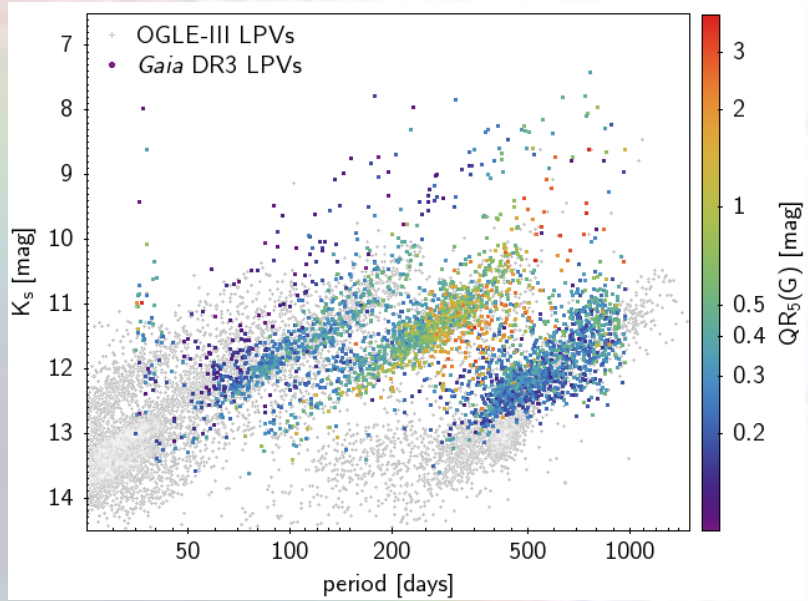


Miras
LMC (red) vs.
solar neighborhood (blue)

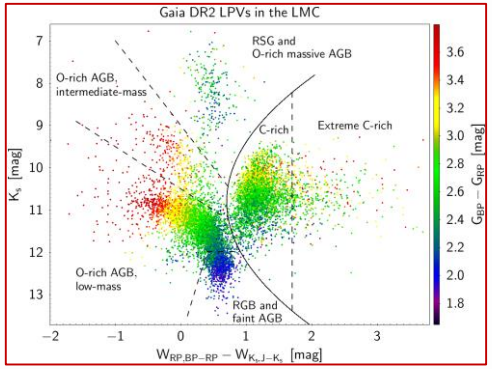
Period-luminosity-diagrams in the Gaia era

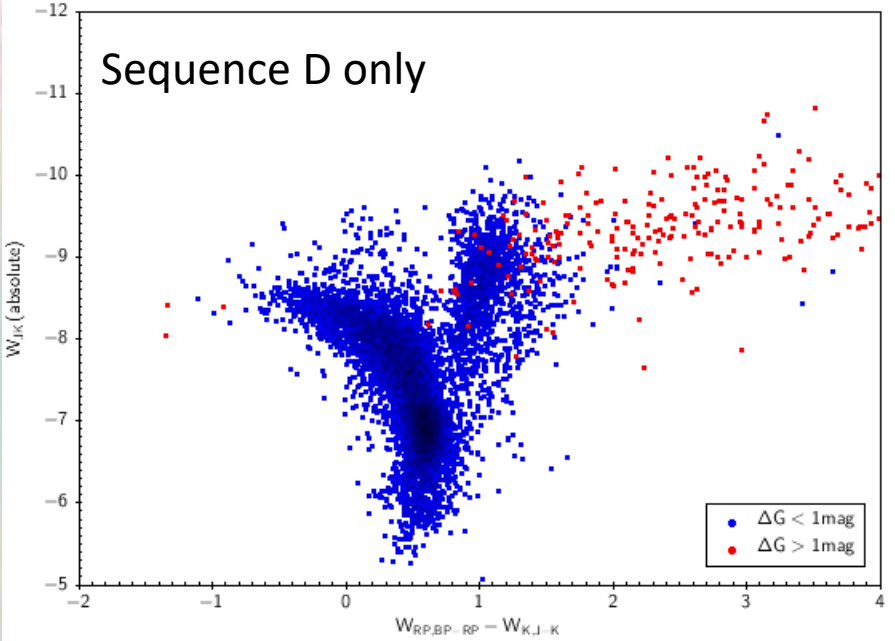




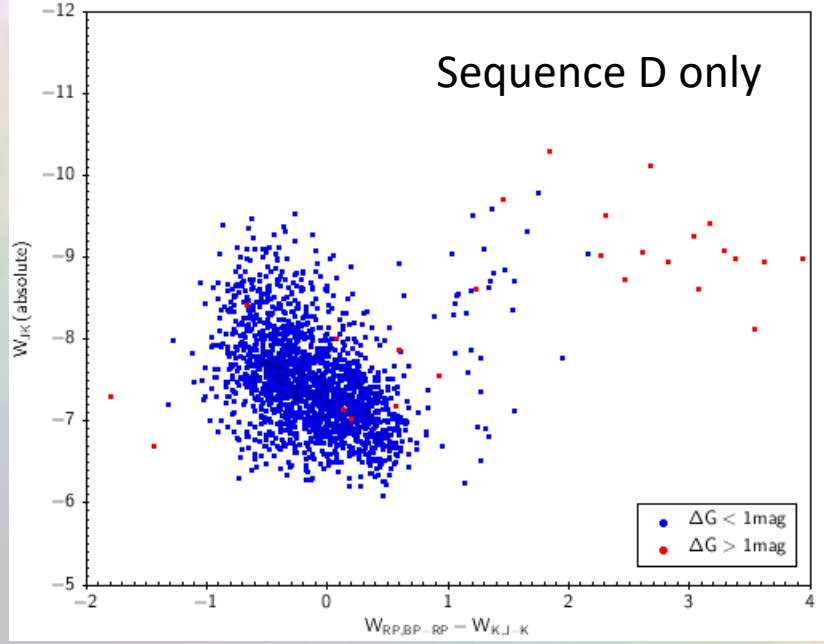


The Gaia-2MASS-diagram (DR3)



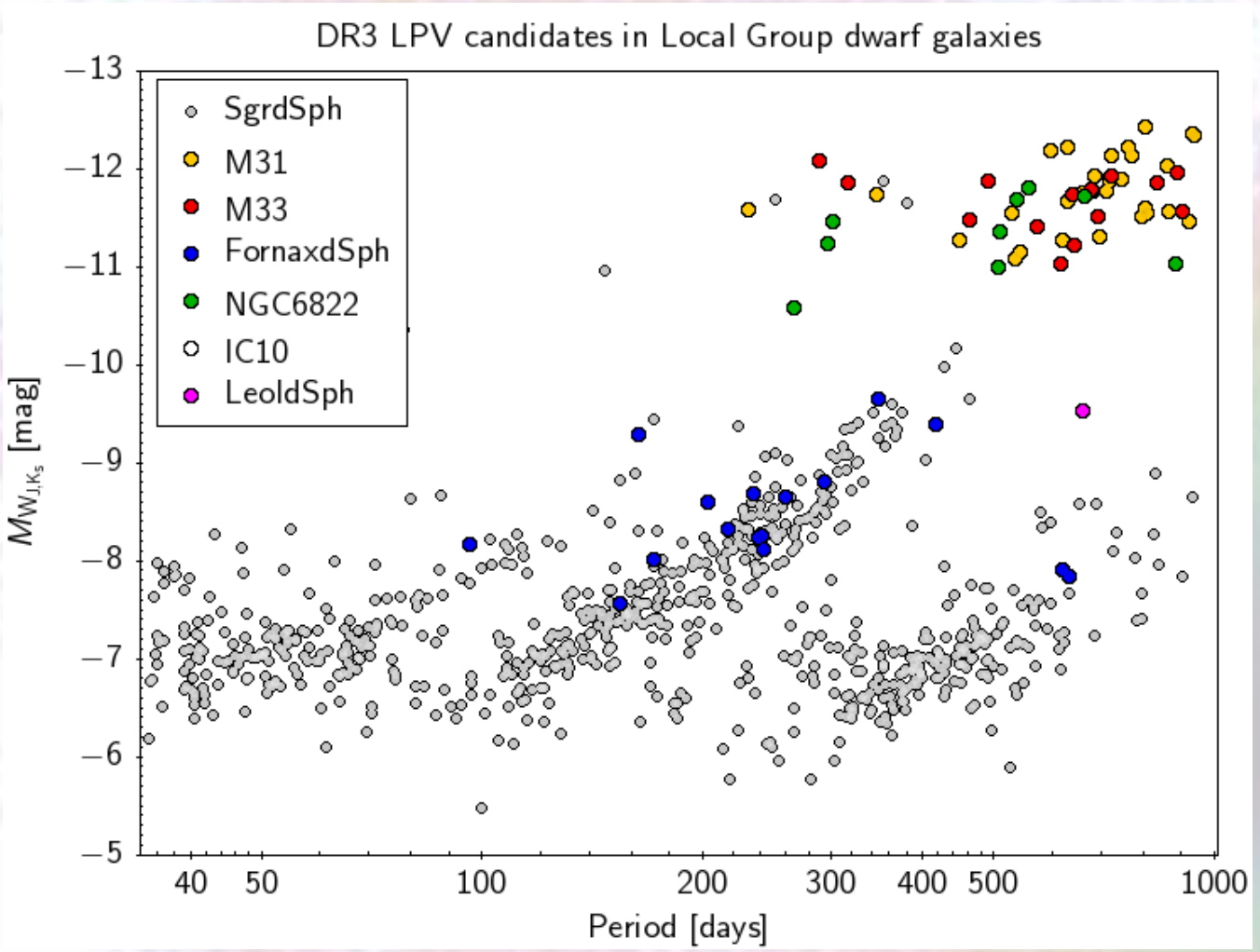


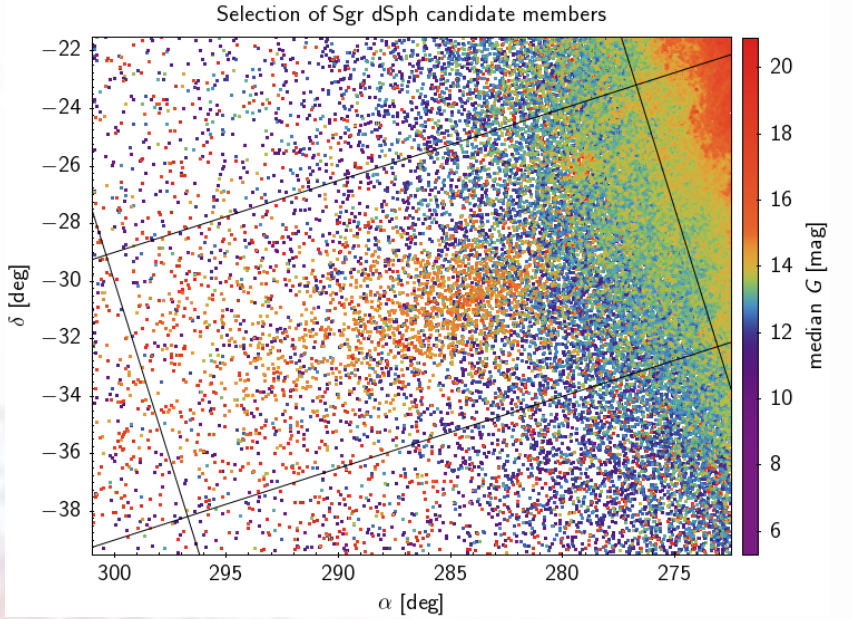
LMC

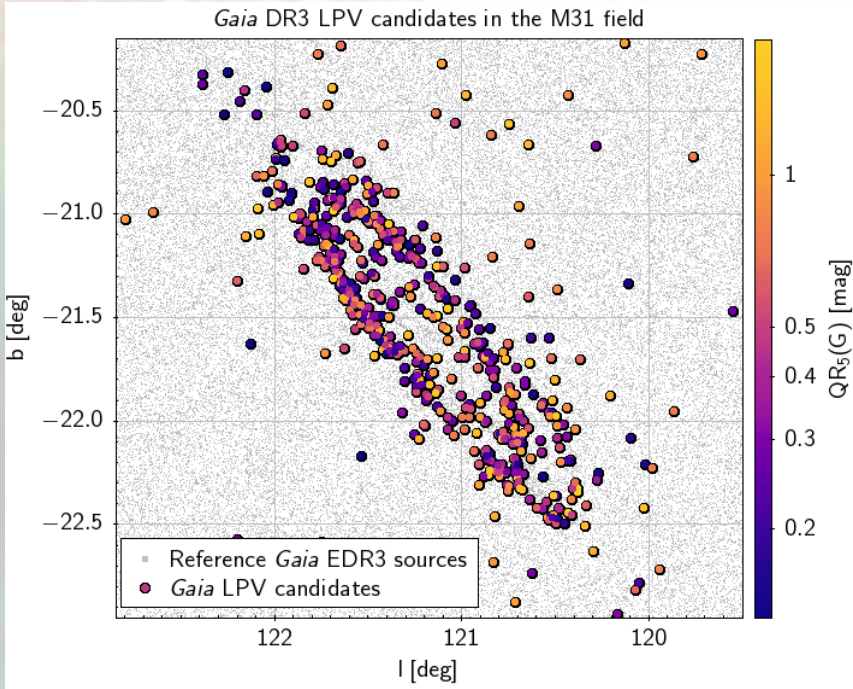


Solar neighborhood (< 2kpc)
Parallax uncertainty <10 %

Galactic and extra-galactic LPVs







Summary

- 1.7 million LPV candidates
  - with G, BP, and RP amplitudes / epoch photometry
  - Identification of C-stars
  - 392 000 with periods (single period fit)
  - 92 000 with parallax uncertainty <10%
- Perspectives
  - Galactic distribution of LPVs / C-stars / Miras
  - Local Group LPVs / LPVs in stellar clusters
  - PLDs for various environments
  - Distances for spectroscopic and interferometric studies
  - New distance indicators