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Mentor: Lovro Palaversa

Period- luminozitet relacije zvijezda Mira

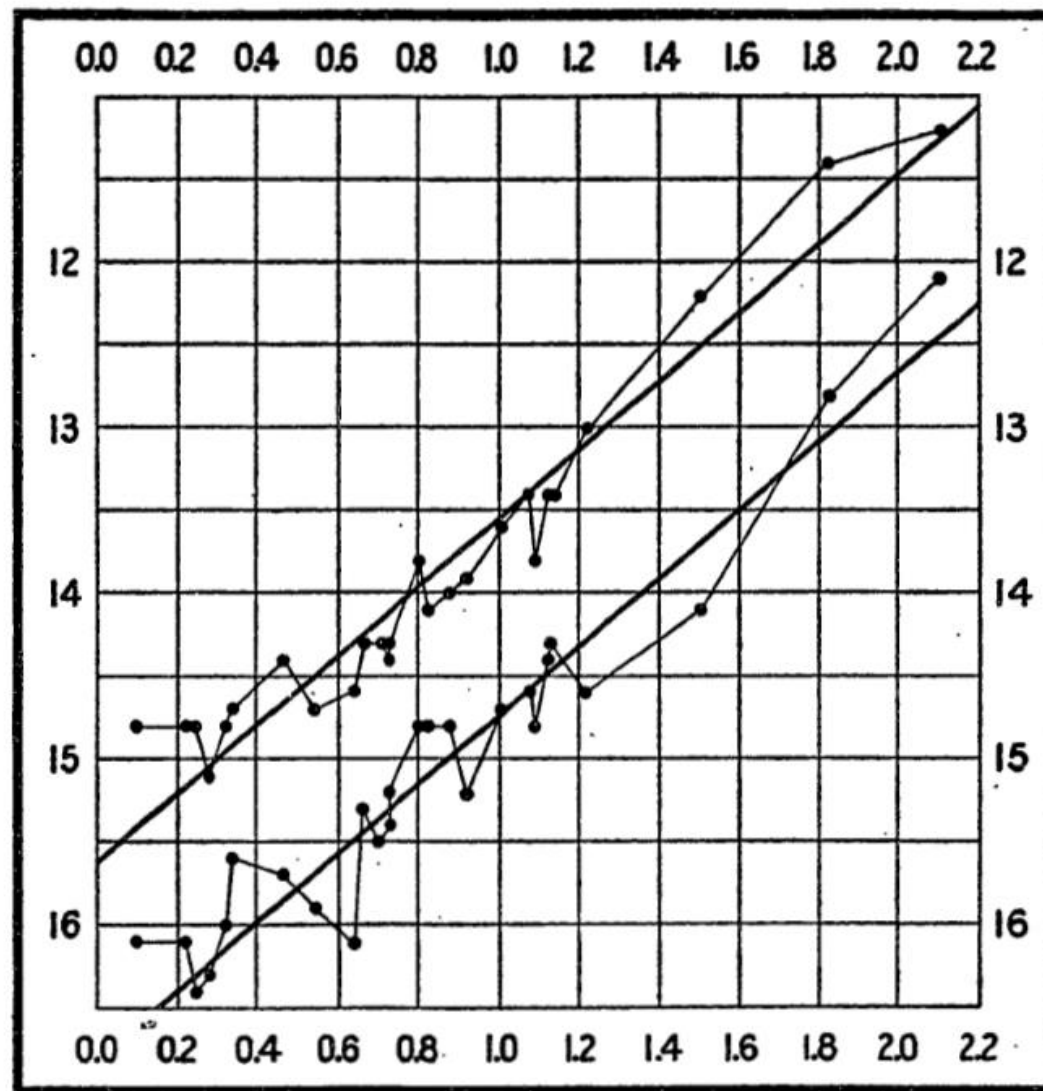
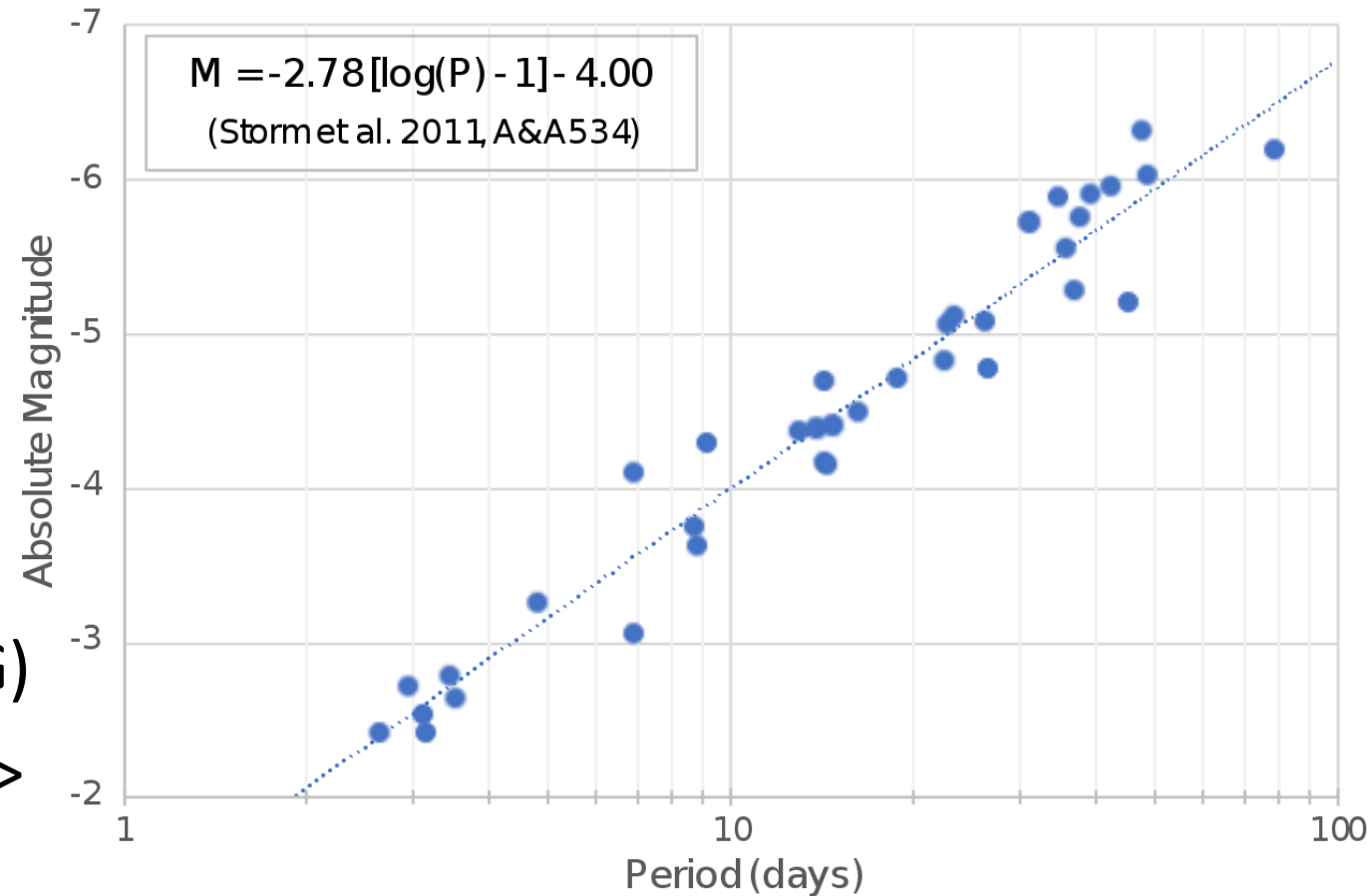


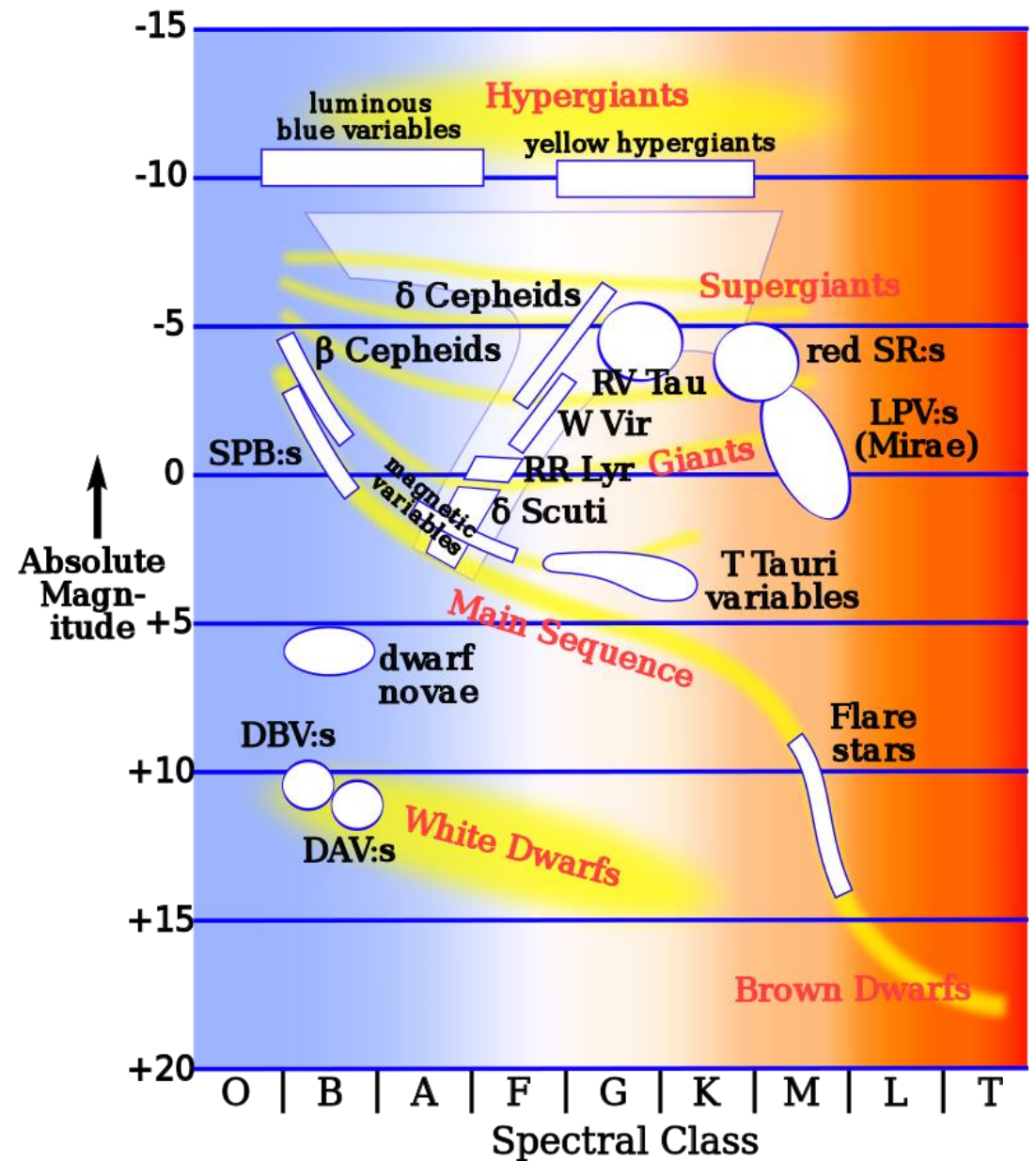
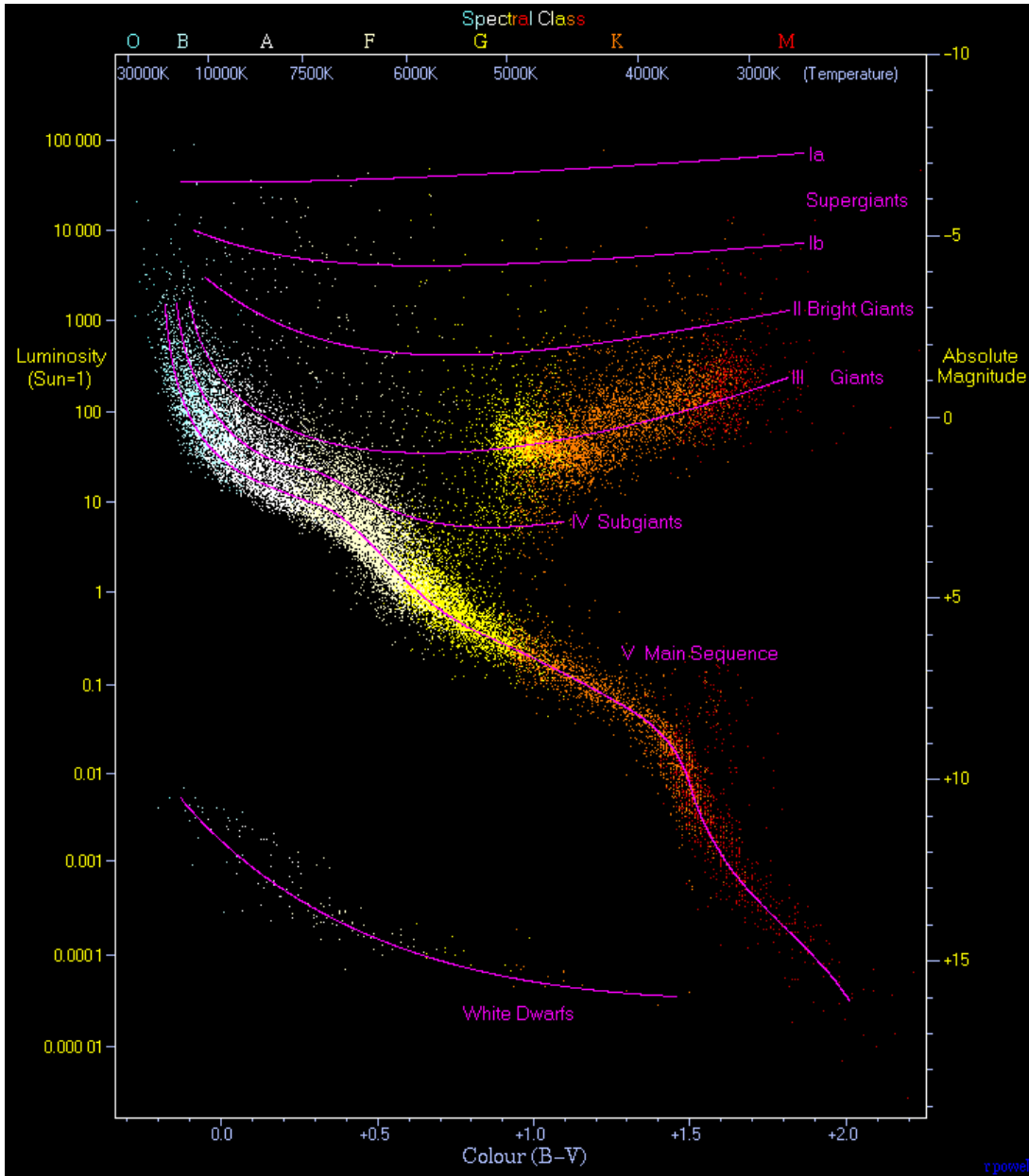
FIG. 2.

Što su period-luminozitet relacije?

- X-os: logaritam perioda
- Y-os: apsolutna magnituda M
- $M = m + 5(\log(p)+1)$
- Nekada poznavanje udaljenosti nije nužno (LMC)
- Problem ekstinkcije -> Wesenheit indeksi (W_JK, W_G)
- Mire -> efekti raspršenja mali -> Wesenheit indeksi za LMC



Promjenjive zvijezde dugih perioda (LPV) i Mire



LPV:

- Mire (P>100 dana, V amplitude >2.5 mag., osnovni mod(?))
 - Kvaziperiodičke promjenjive zvijezde
 - Zvijezde koje stohastički mijenjaju sjaj
 - OSARG (OGLE Small Amplitude Red Giants)
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- Mire: kratka evolucijska faza (cca. 10^5 godina), odbacivanje velike količine materije -> AGB zvijezde

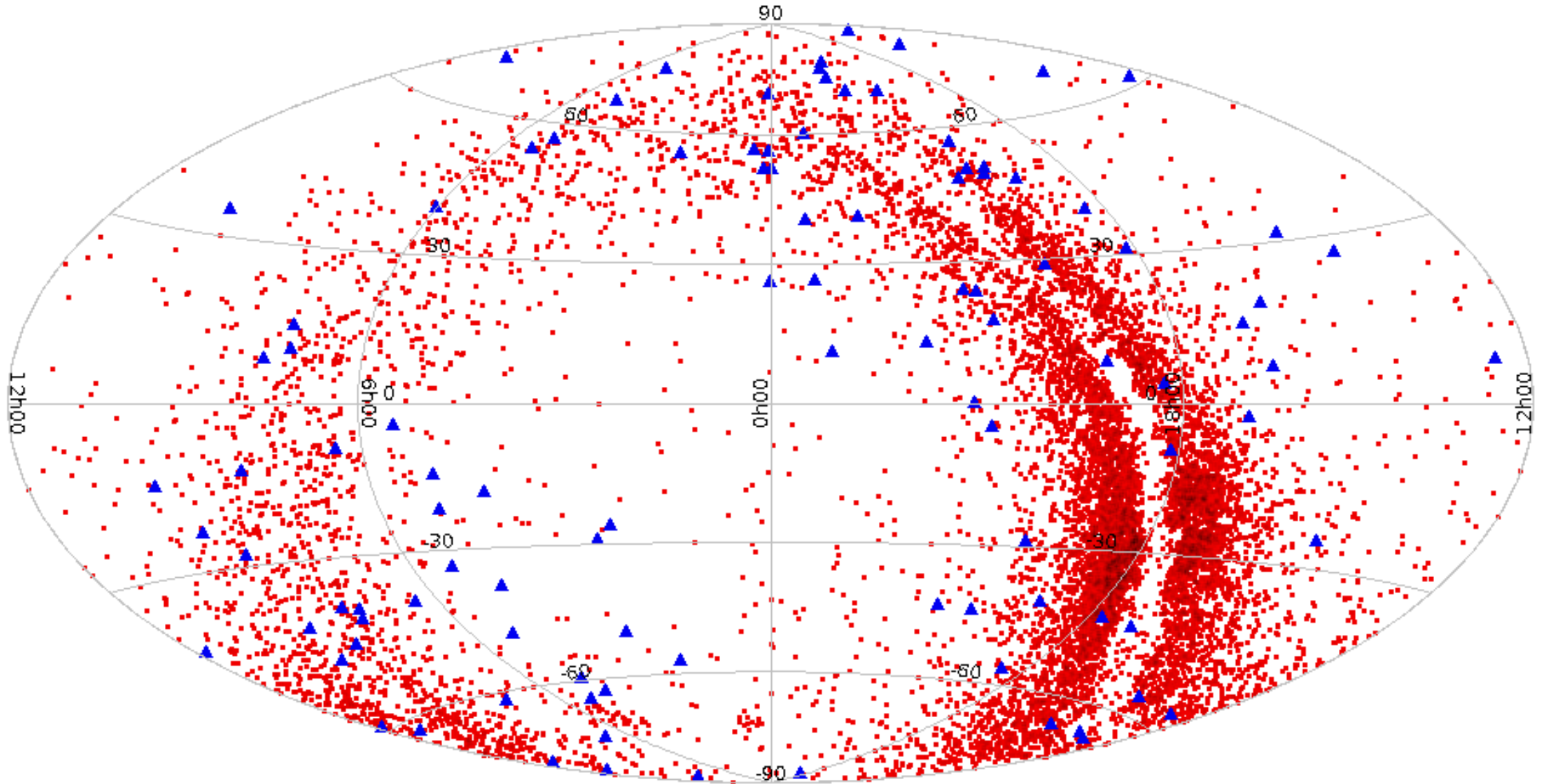
Ranija istraživanja

- Wood et al 1999 -> pet PL relacija (A-E)
- Soszinsky et al. 2007, 2005; Trabucchi et al. 2021 -> PL relacije za LMC
- Bedding and Zijlstra 1998; Tabur et al. 2010 -> Hipparcos paralakse (zvijezde bliske Suncu)

Korišteni katalogi

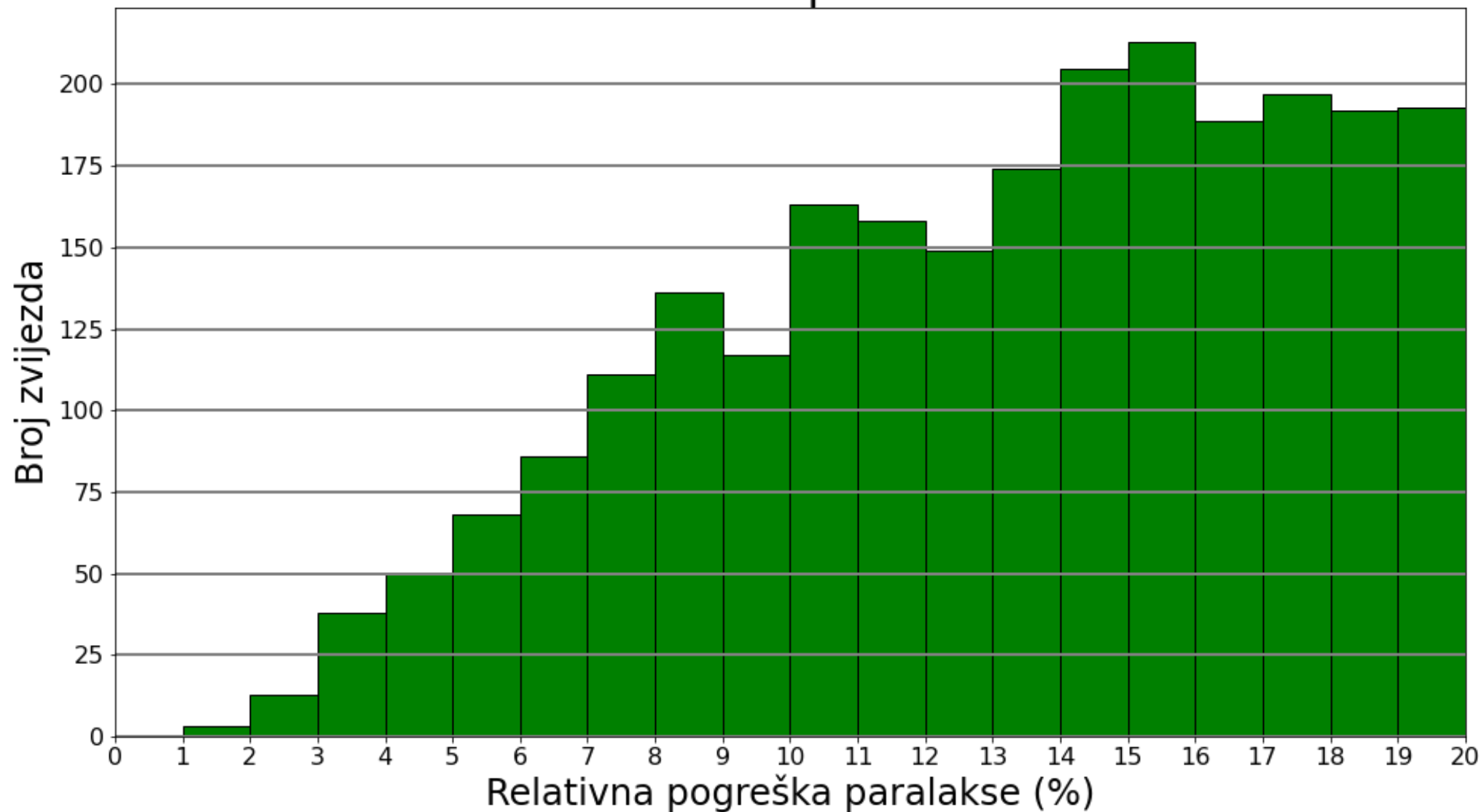
- ASAS-SN (All-Sky Automated Survey for Supernovae) -> fazne krivulje, periodi i V magnitude
- 2MASS (Two Micron All Sky Survey)-> J, H, K magnitude
- Gaia EDR3 (Early Data Release 3) -> periodi, paralakse, crvene i plave magnitude
- Odabir kataloga nije trivijalan (Poteškoće sa OGLE-om)

ASAS-SN 10329 Mira -> 104 Mire



Priprema podataka

Gaia EDR3 paralakse



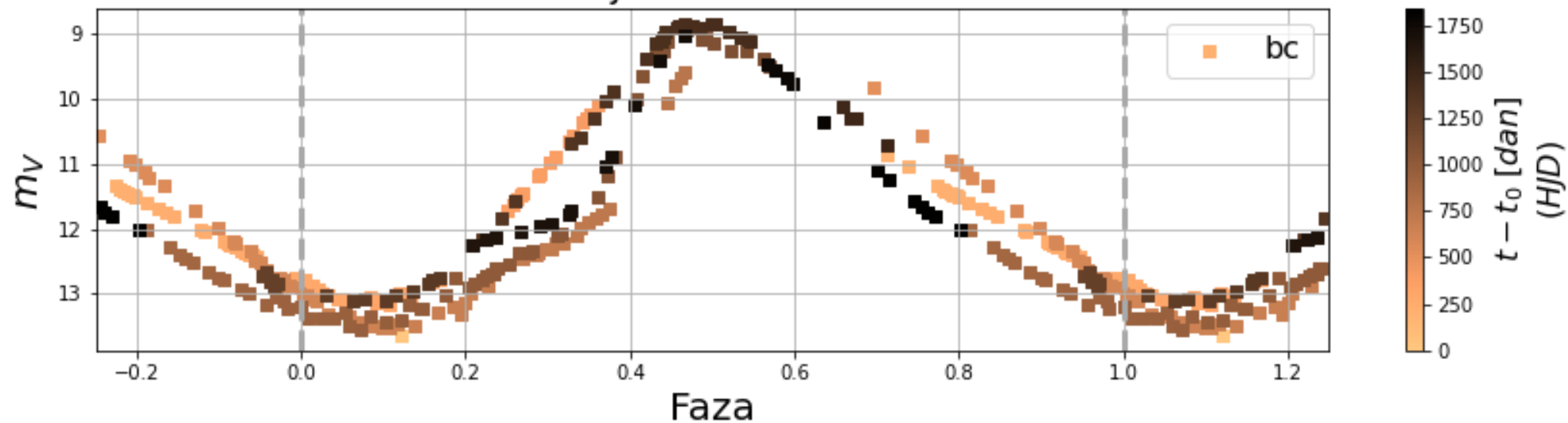
Fazne krivulje

- Krivulje ovisnosti sjaja zvijezde o fazi (vremenu)
- Vizualno ispitali fazne krivulje 104 zvijezde
- Dva perioda: Gaia i ASAS-SN
- Kriteriji: V amplitude veće 2.5 mag., $P > 100$ dana, sinusoidalni oblik fazne krivulje, nedostaje manje od 25% krivulje

f319db01-0e34-5eaa-8f8c-fe47f60a2a4a fazna krivulja

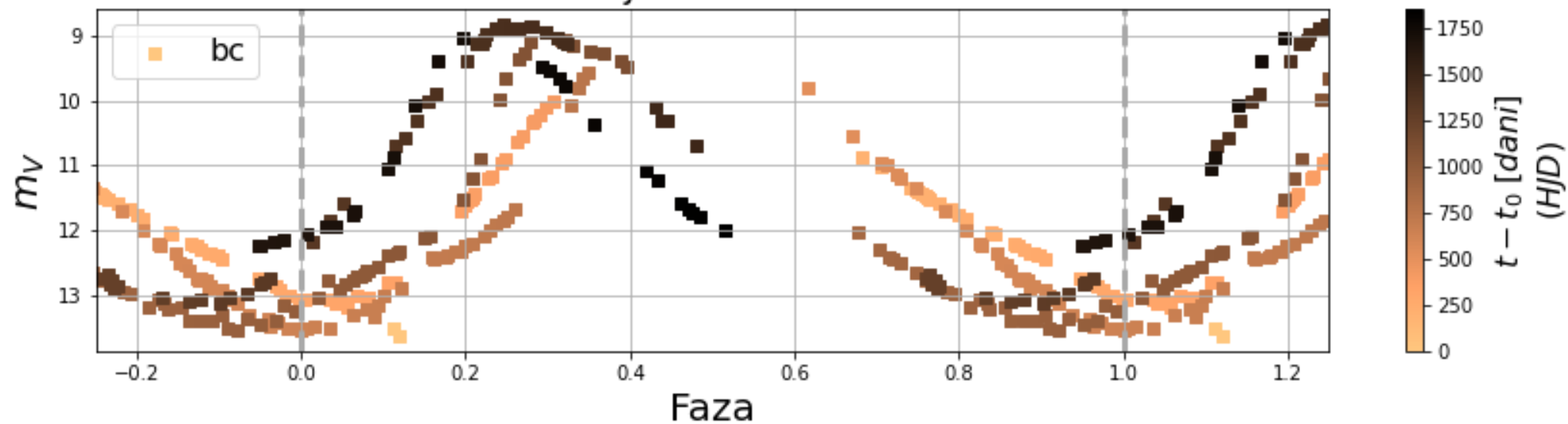
ASAS-SN period = 324.7701717 dana

Broj ciklusa: 5.69



Gaia period = 342.0194230393326 dana

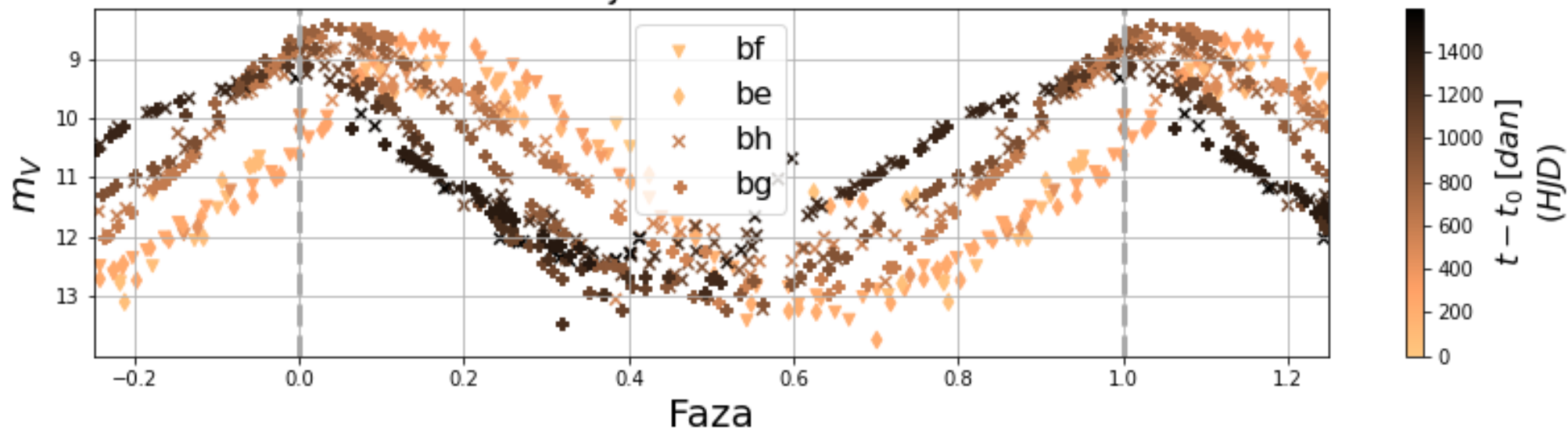
Broj ciklusa: 5.4



c8acadd7-3c15-5122-9dc3-8b823400ab7e fazna krivulja

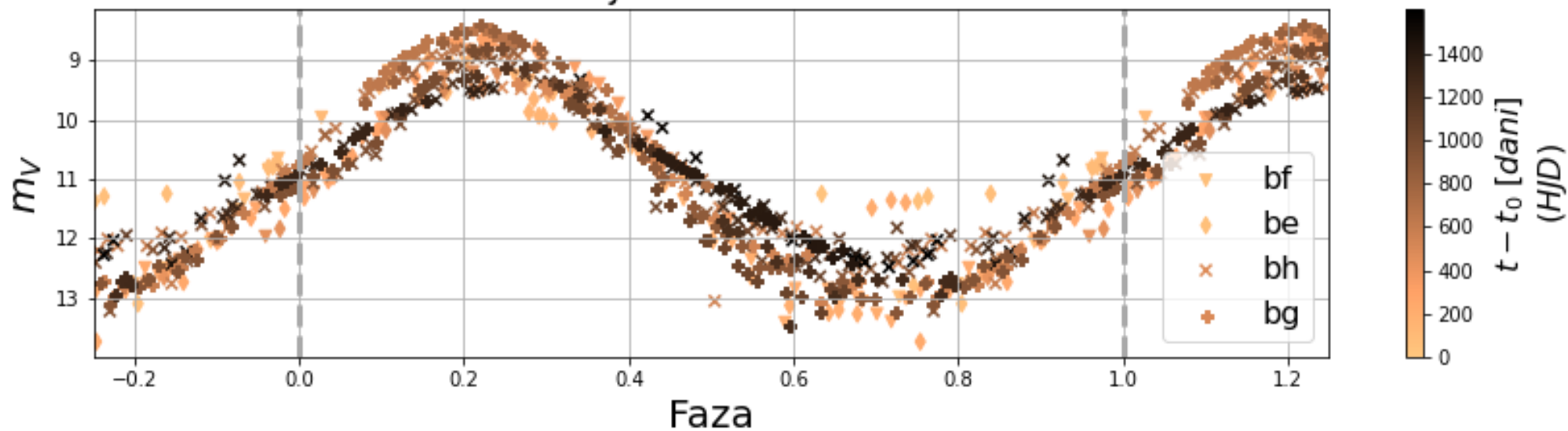
ASAS-SN period = 177.1501504 dana

Broj ciklusa: 9.03



Gaia period = 170.3250945462337 dana

Broj ciklusa: 9.39

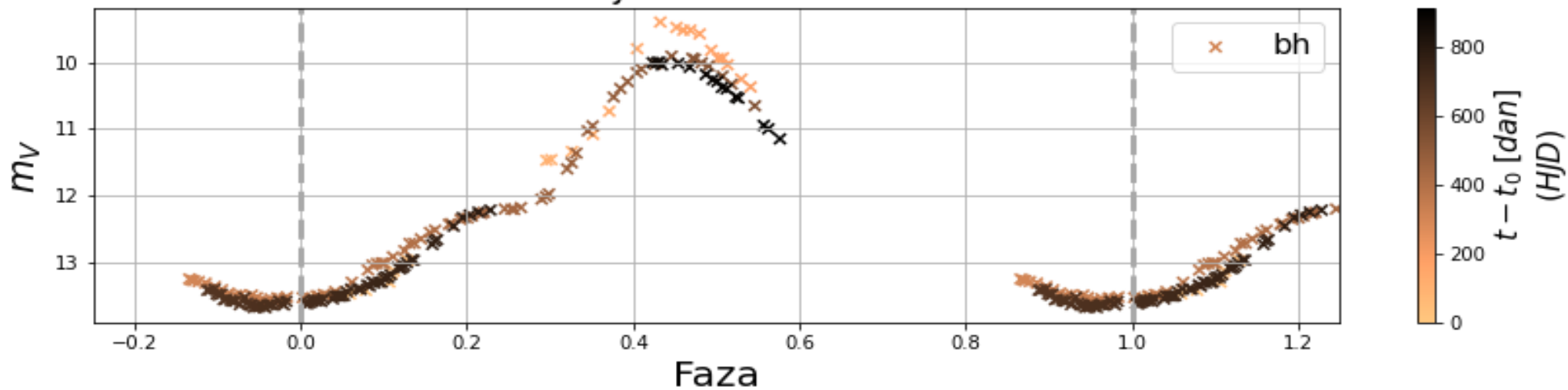


Zanimljiv primjer:

02762f3e-d519-5dde-ba4c-f59a05016178 fazna krivulja

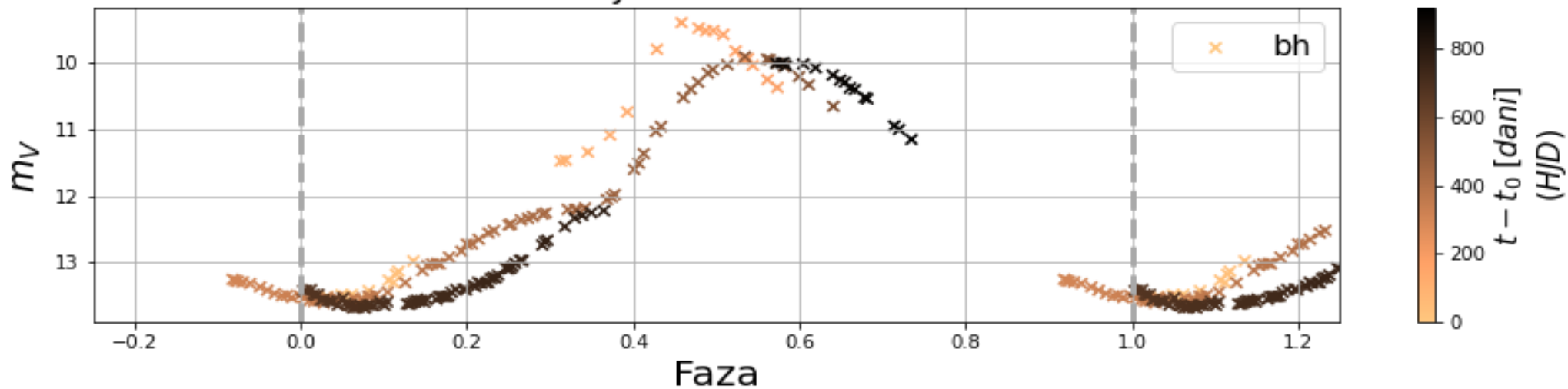
ASAS-SN period = 358.1752852 dana

Broj ciklusa: 2.56



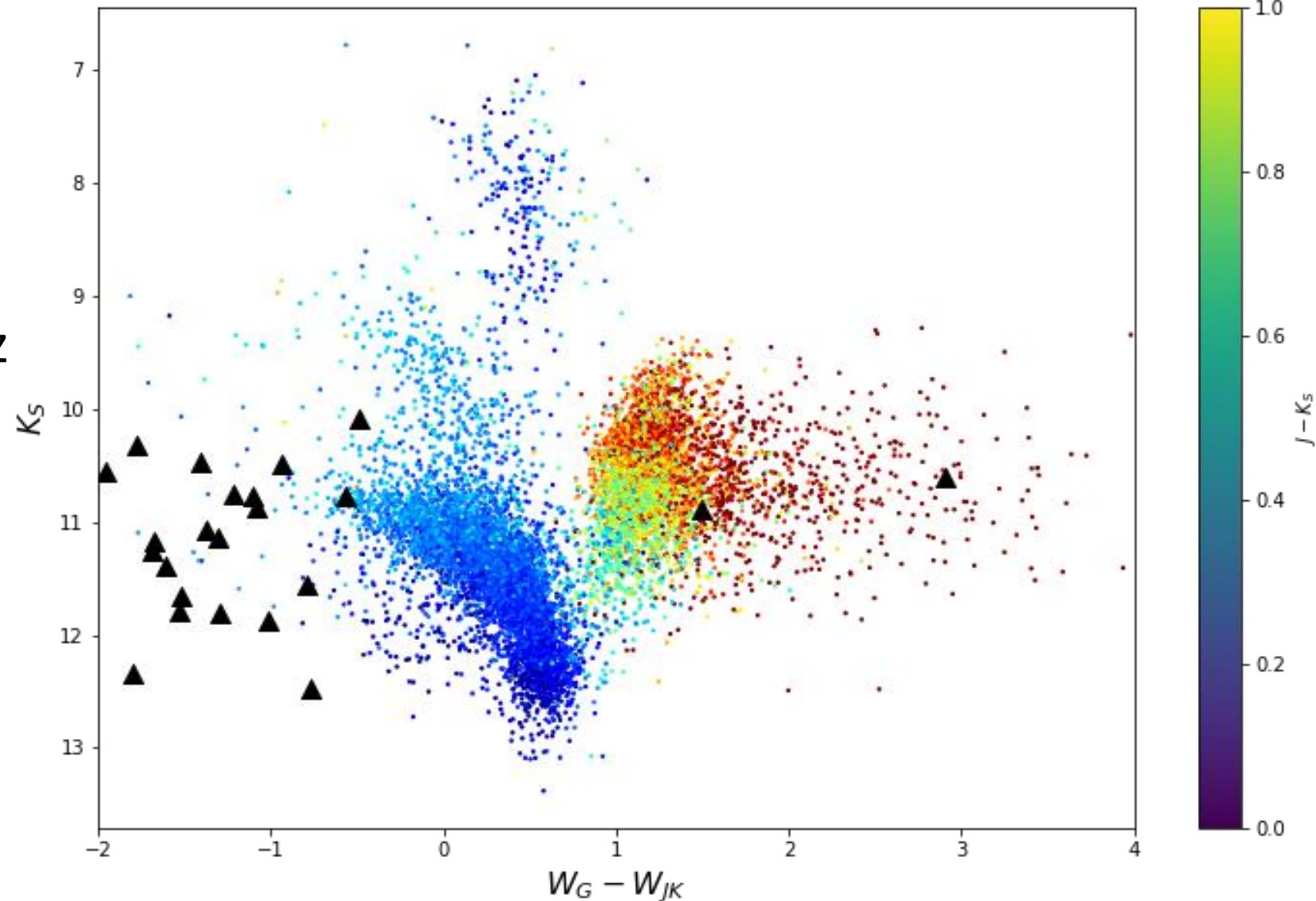
Gaia period = 337.30855636241387 dana

Broj ciklusa: 2.71



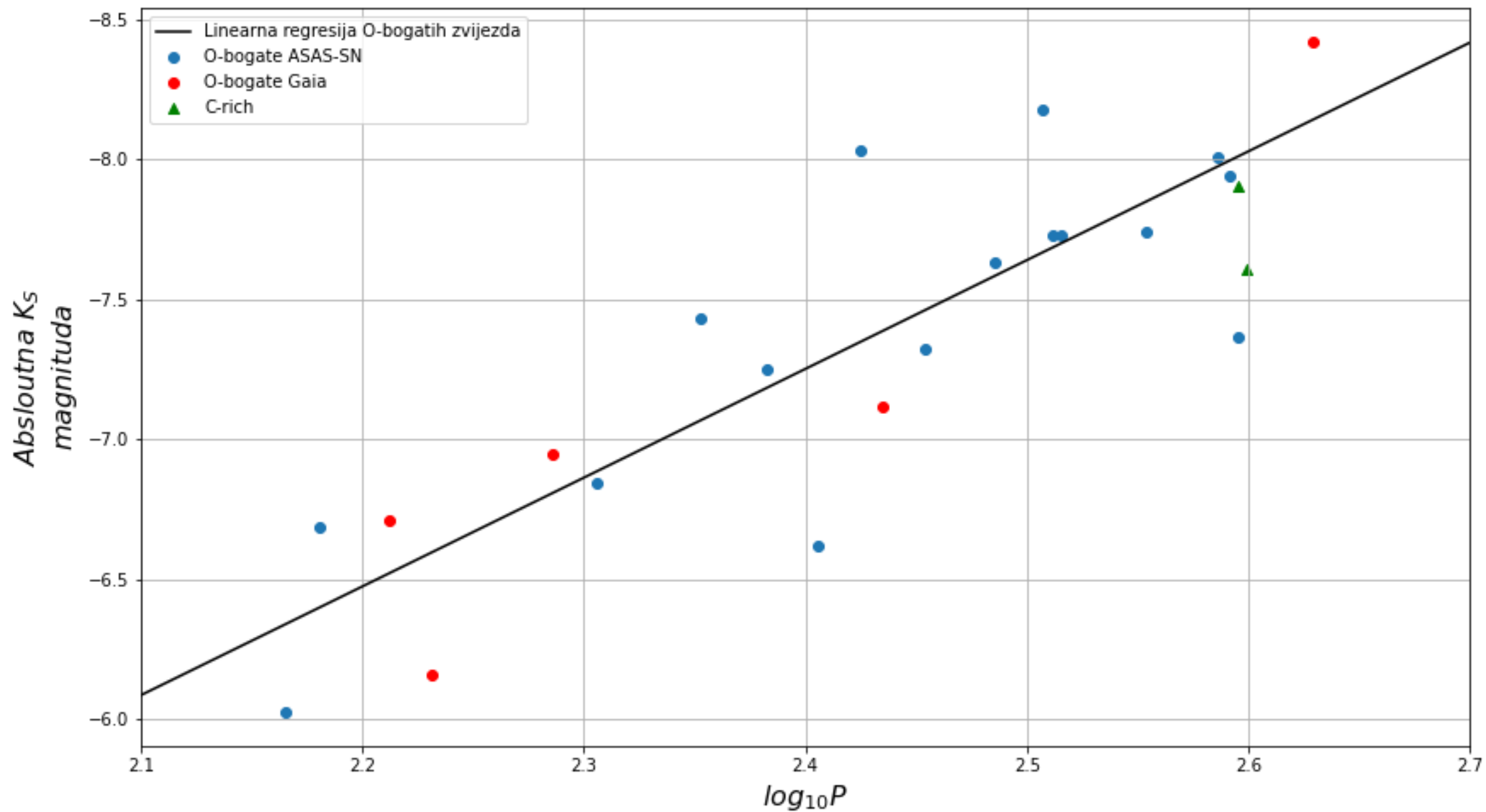
Dodatne strukture unutar PL relacija?

- Podjela na C-bogate i O-bogate zvijezde
- Rekonstrukcija grafa iz Lebzelter et al. (2018)

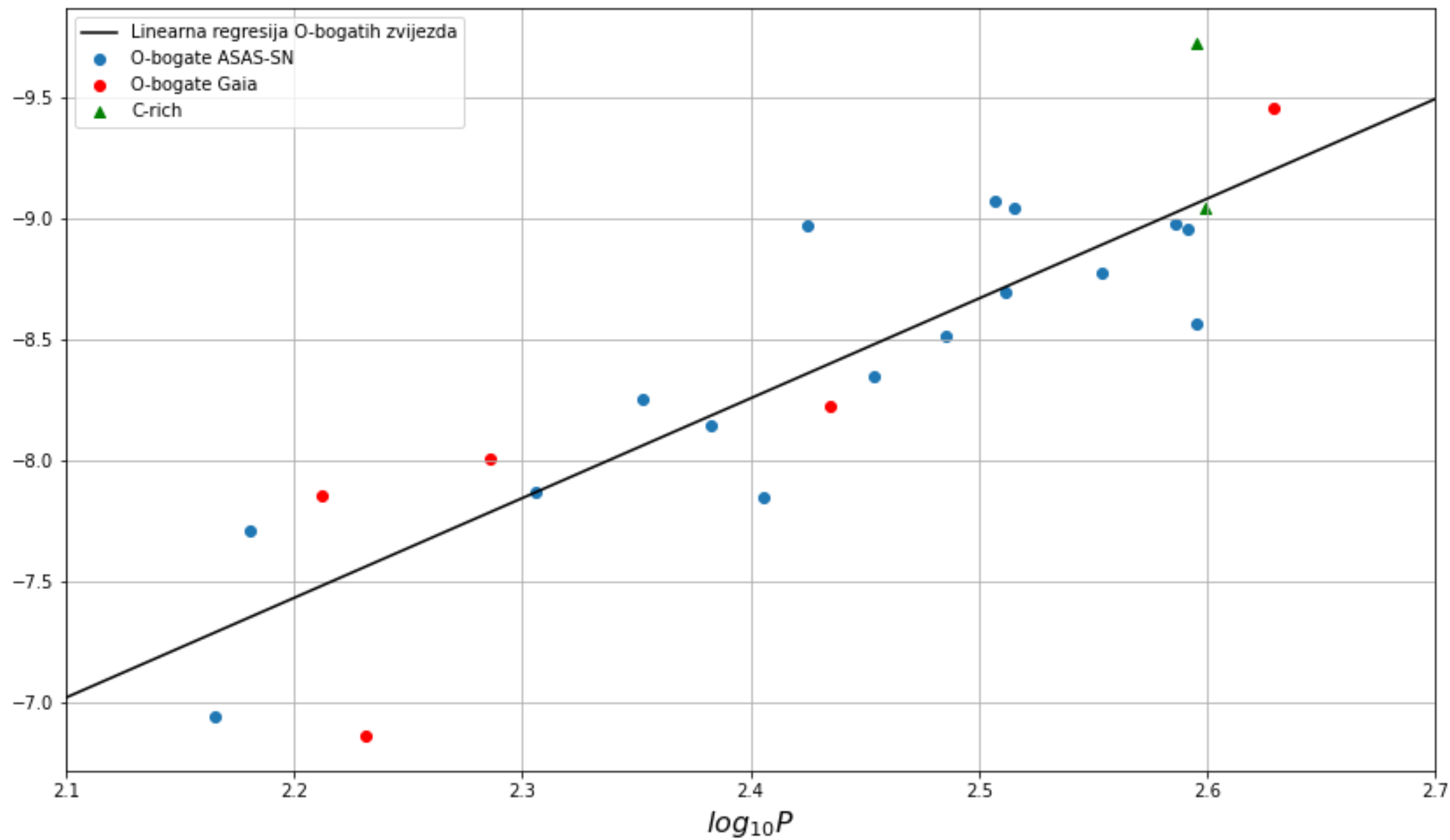


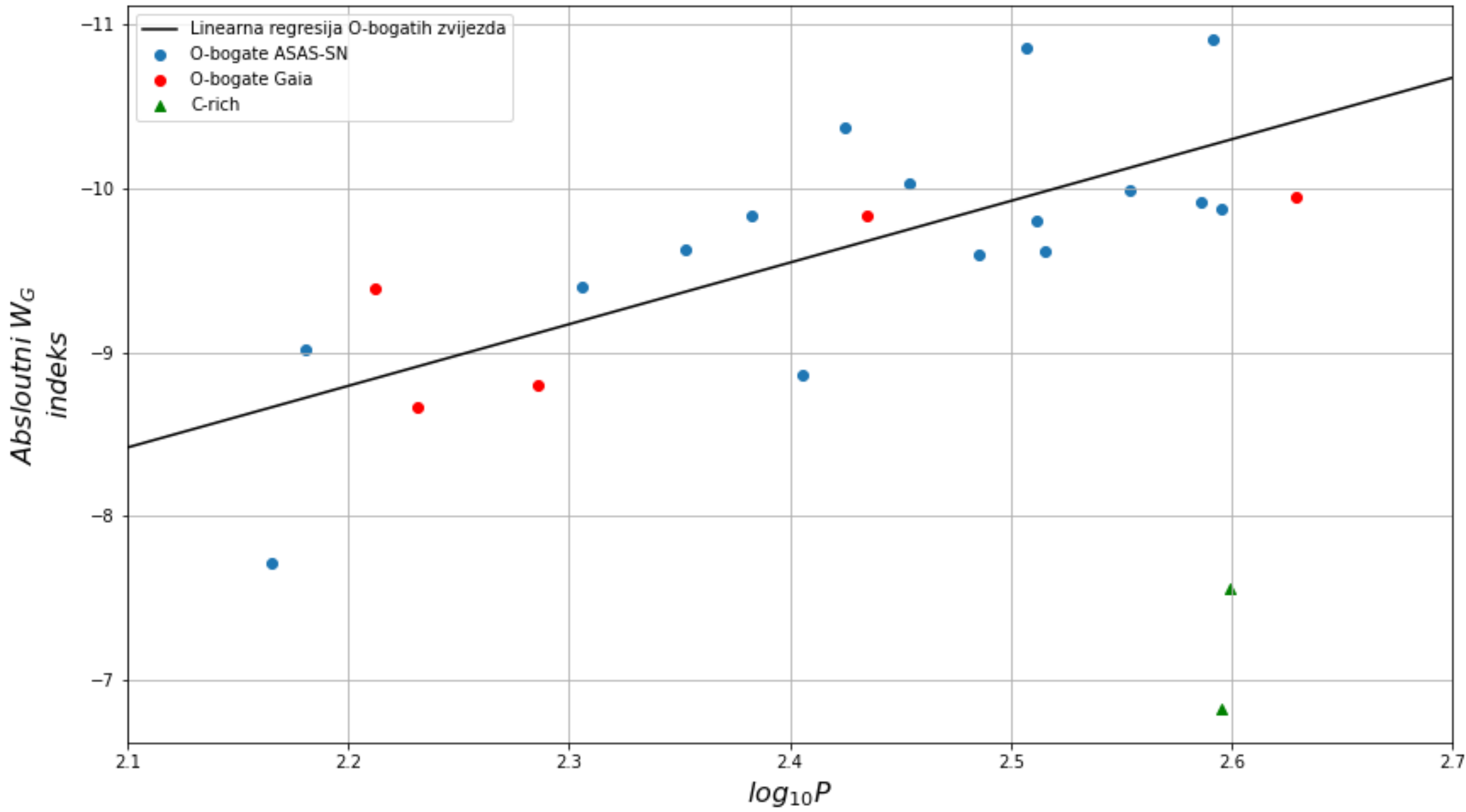
Konačni rezultati (23 zvijezde)

	Naši rezultati		Soszyński (2007.)	
	a	b	a	b - μ
K_S	-3.9 ± 0.5	-5.7 ± 0.2	-4.17 ± 0.08	-5.86 ± 0.04
W_{JK}	-4.1 ± 0.5	-6.6 ± 0.2	-4.34 ± 0.09	-6.61 ± 0.04
W_G	-3.8 ± 0.8	-0.5 ± 2	-	-



Absloutni W_{JK}
indeks





Zaključak

- Galaktičke Mire prate slične PL relacije kao i njihovi susjedi iz LMC-a
- Potencijalna metoda razlikovanja O- i C-bogatih zvijezda na temelju $\log(P)$ - W_G grafa
- Buduća istraživanja: poboljšanje neodređenosti rezultata i povećanje uzorka
- Kako? Modelom krivulja sjaja zvijezda tipa Mira