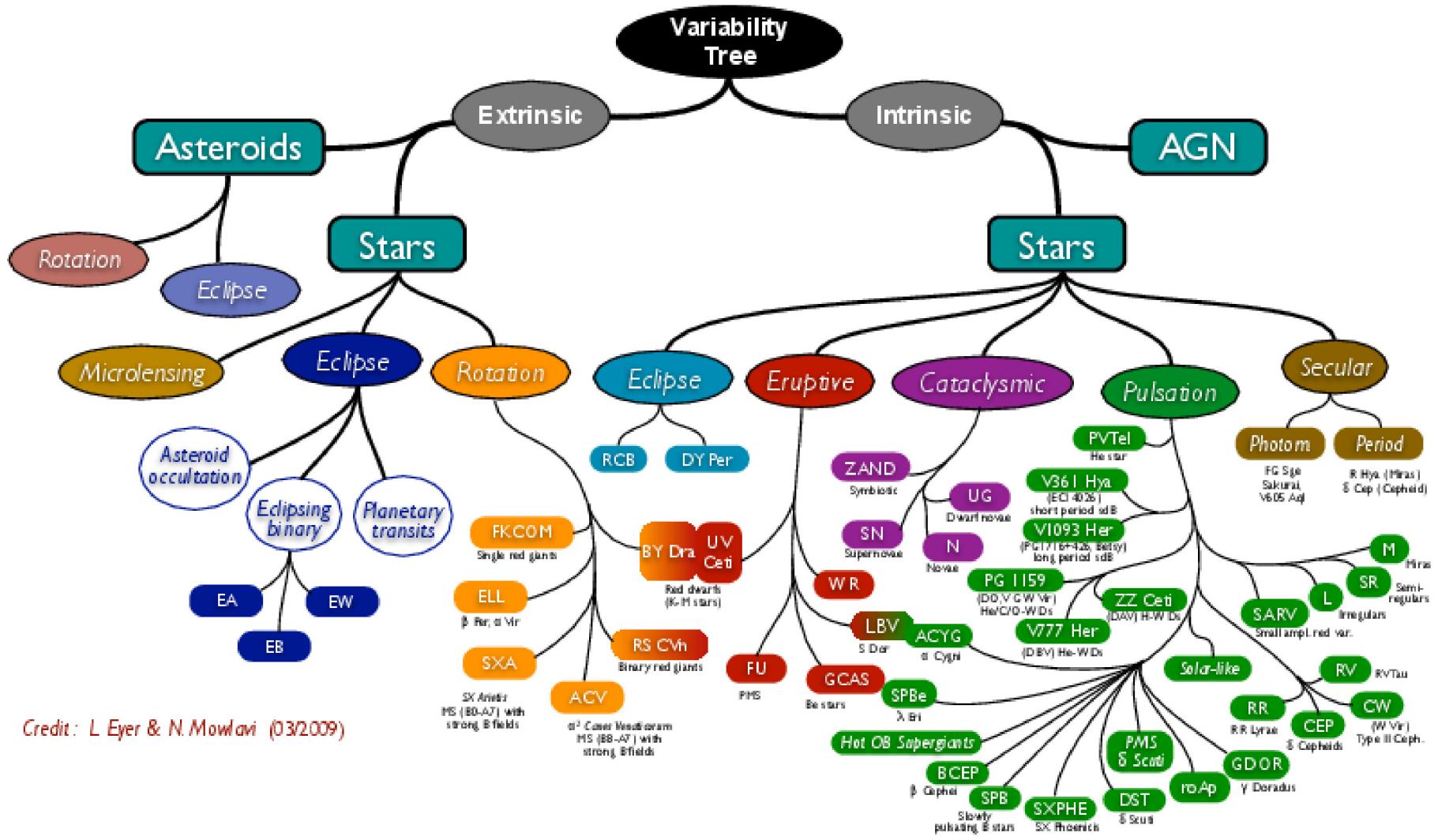


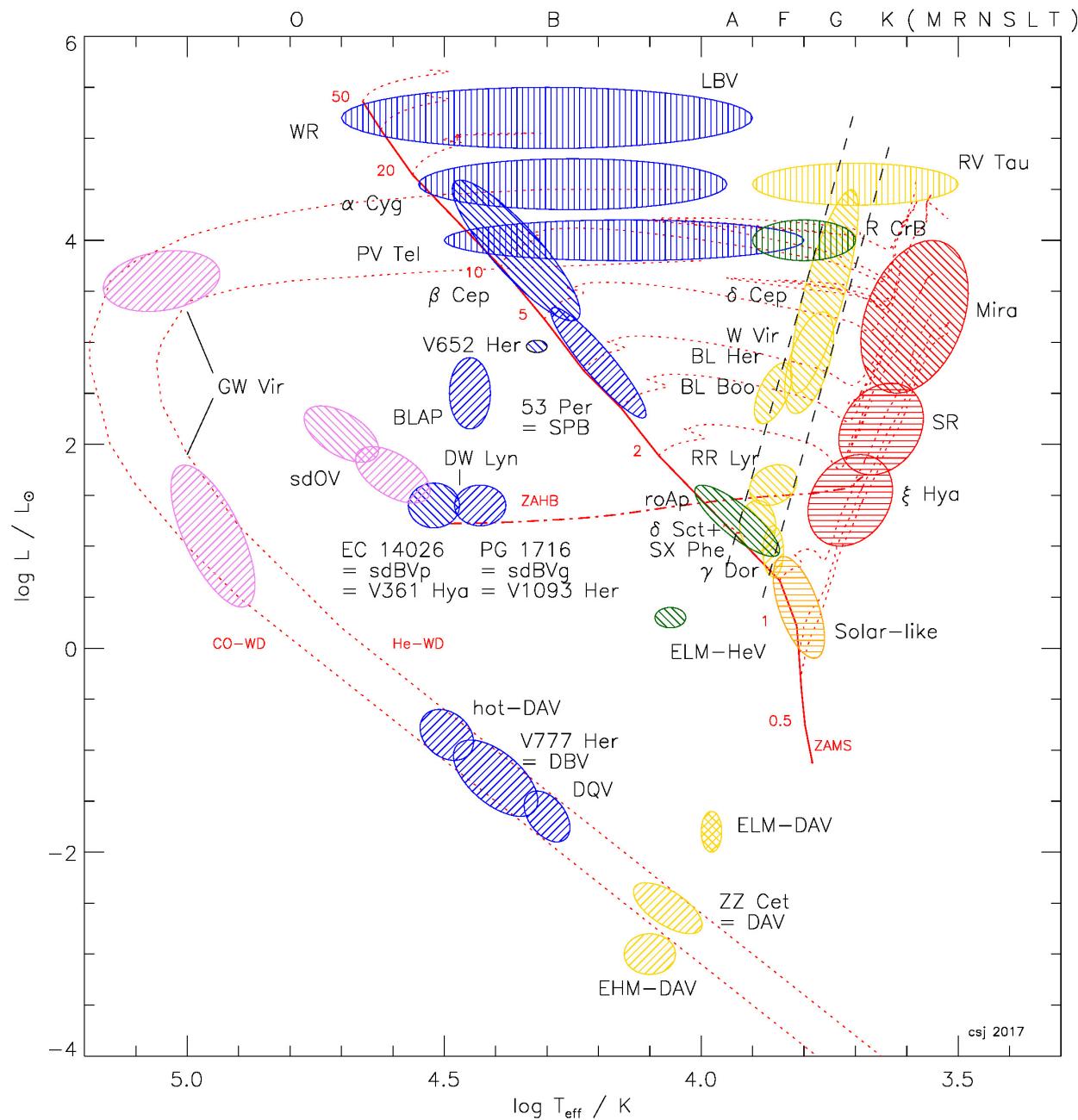
Uzbudljiv svet pulsirajućih zvezda i šta možemo da istražujemo u ovoj oblasti

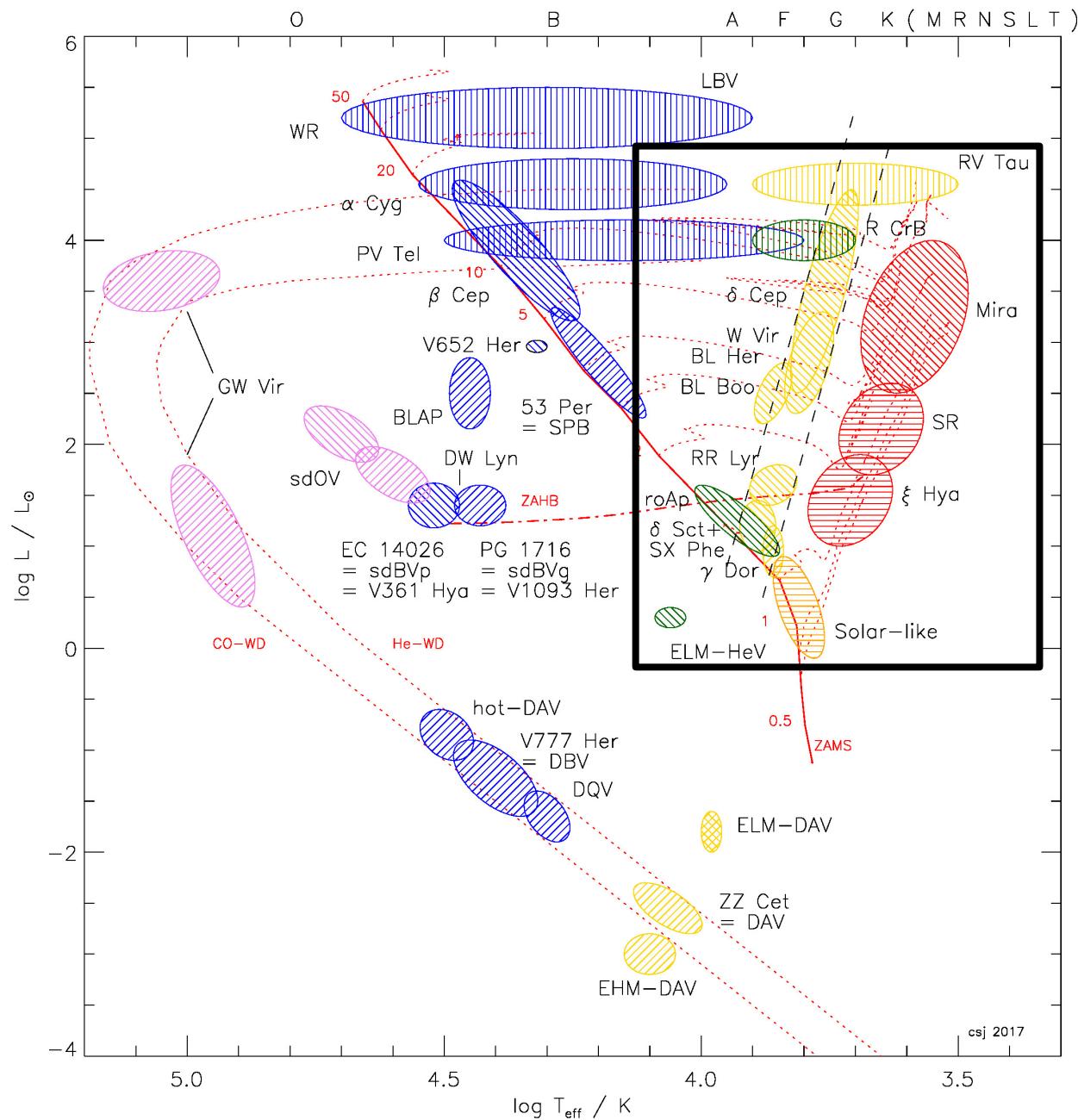
Monika I. Jurkovic

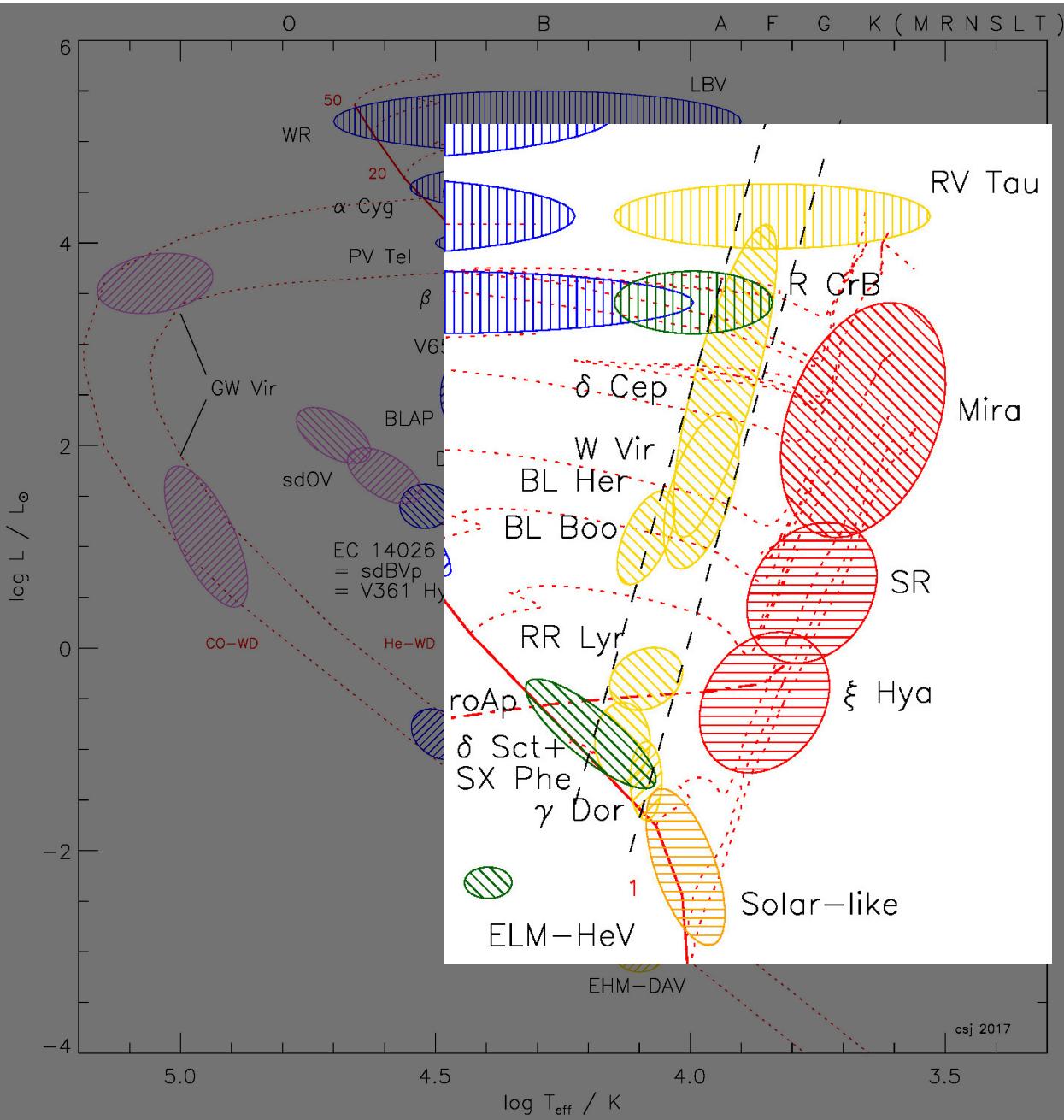
Seminar na Katedri za astronomiju
Matematički fakultet

07.05.2019.





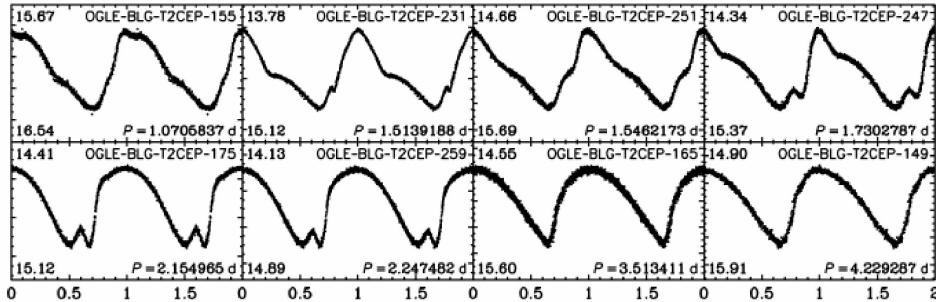




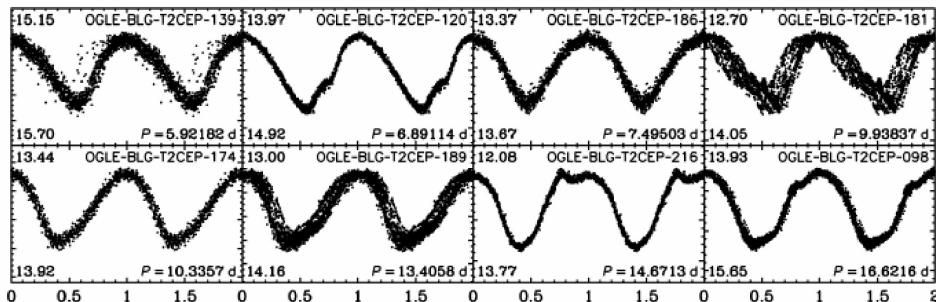
Cefeide tipa II

- Za cefeide tipa II se pretpostavlja da su stare zvezde niske metaličnosti
- Masa: $\sim 0,5 M_{\odot}$
- Starost: više od 10 milijardi godina

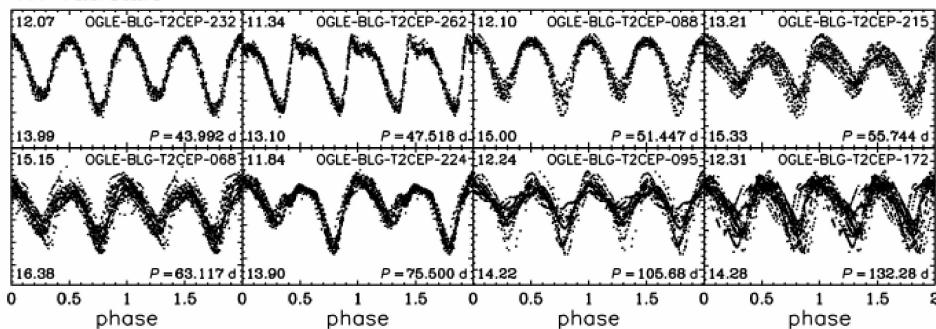
BL Her stars



W Vir stars



RV Tau stars



- Podtipovi:

- BL Herculis

- $1 < P \text{ (dara)} < 4 - 5$

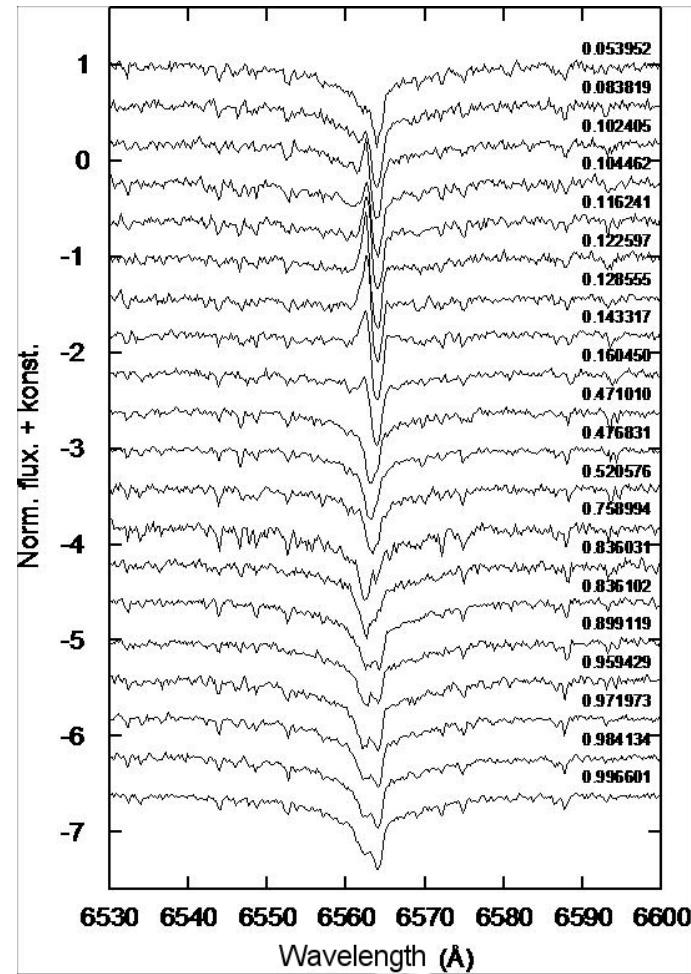
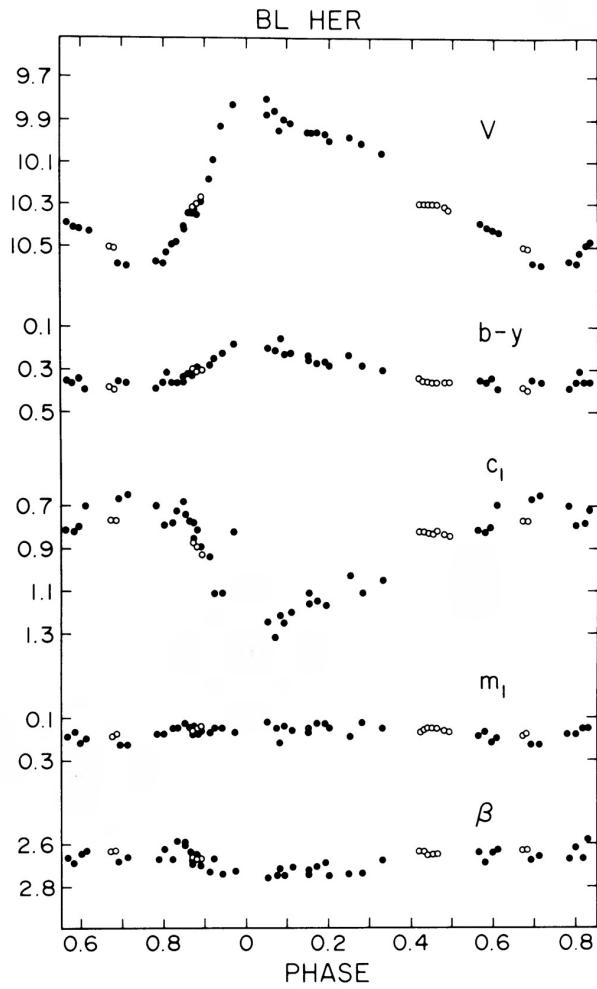
- W Virginis

- $4 - 5 < P \text{ (dara)} < 20$

- RV Tauri

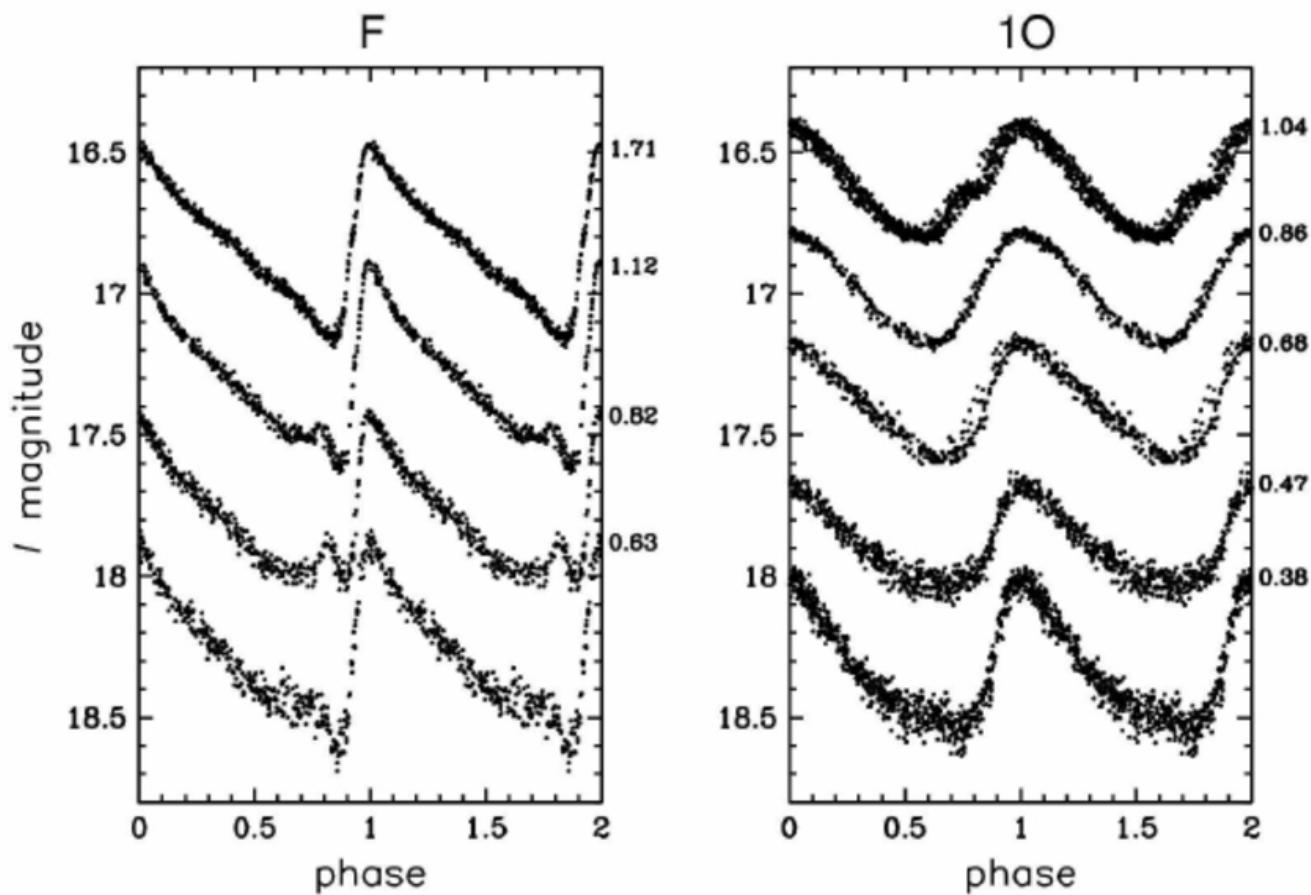
- $20 < P \text{ (dara)} < 100,$
 150

Jedan primer: BL Her



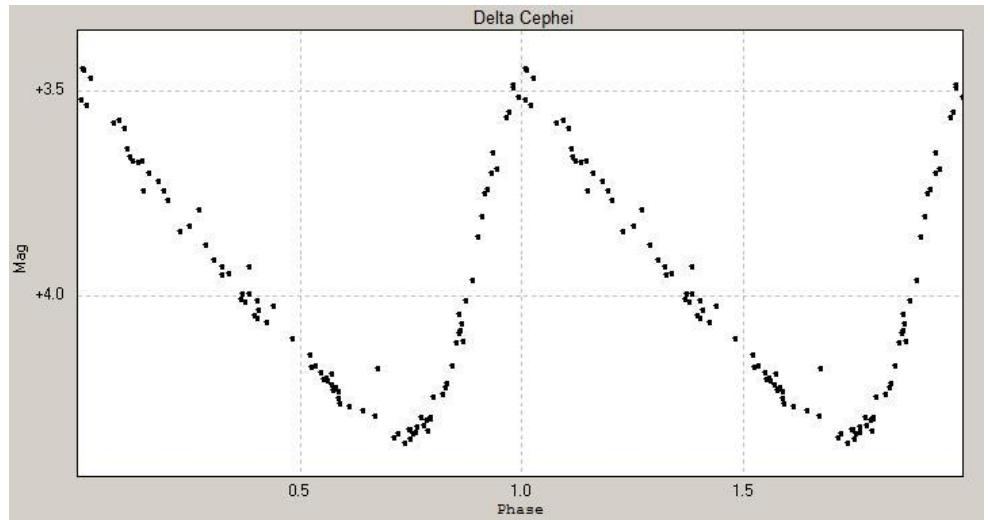
Anomalne cefeide

- Masa: $\sim 1,2 M_{\odot}$
- Starost: 1 – 5 milijardi godina
- Zvezde sa niskom metaličnošću
- Njihovo poreklo je i dalje otvoreno pitanje, pošto zvezde ovih masa (kao što je i naše Sunce) u Mlečnom putu ne bi trebale da imaju nisku metaličnost



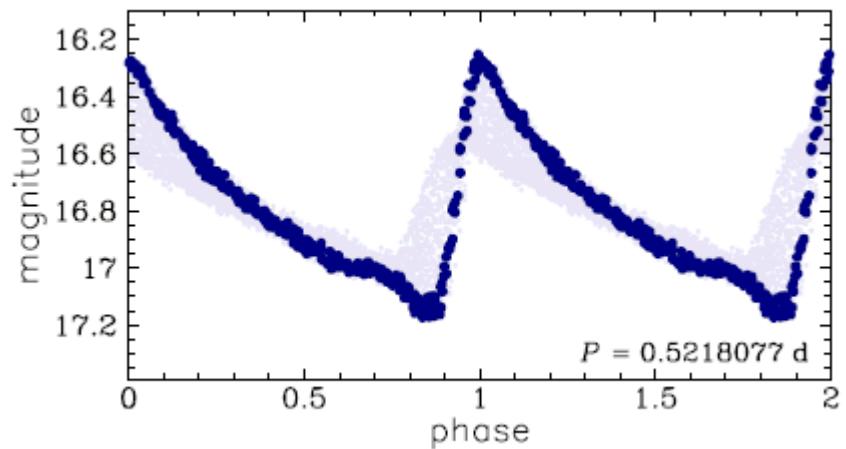
Klasične cefeide

- Period pulsacije:
1 - 100 dana
- Masa: $4 - 20 M_{\odot}$
- Pulsiraju u
osnovnoj modi i
prvoj nadmodi



RR Lyrae promenljive zvezde

- Period pulsacije
0,2 – 2 dana
- Masa: $0,5 M_{\odot}$
- Pokazuju Blaško
efekat

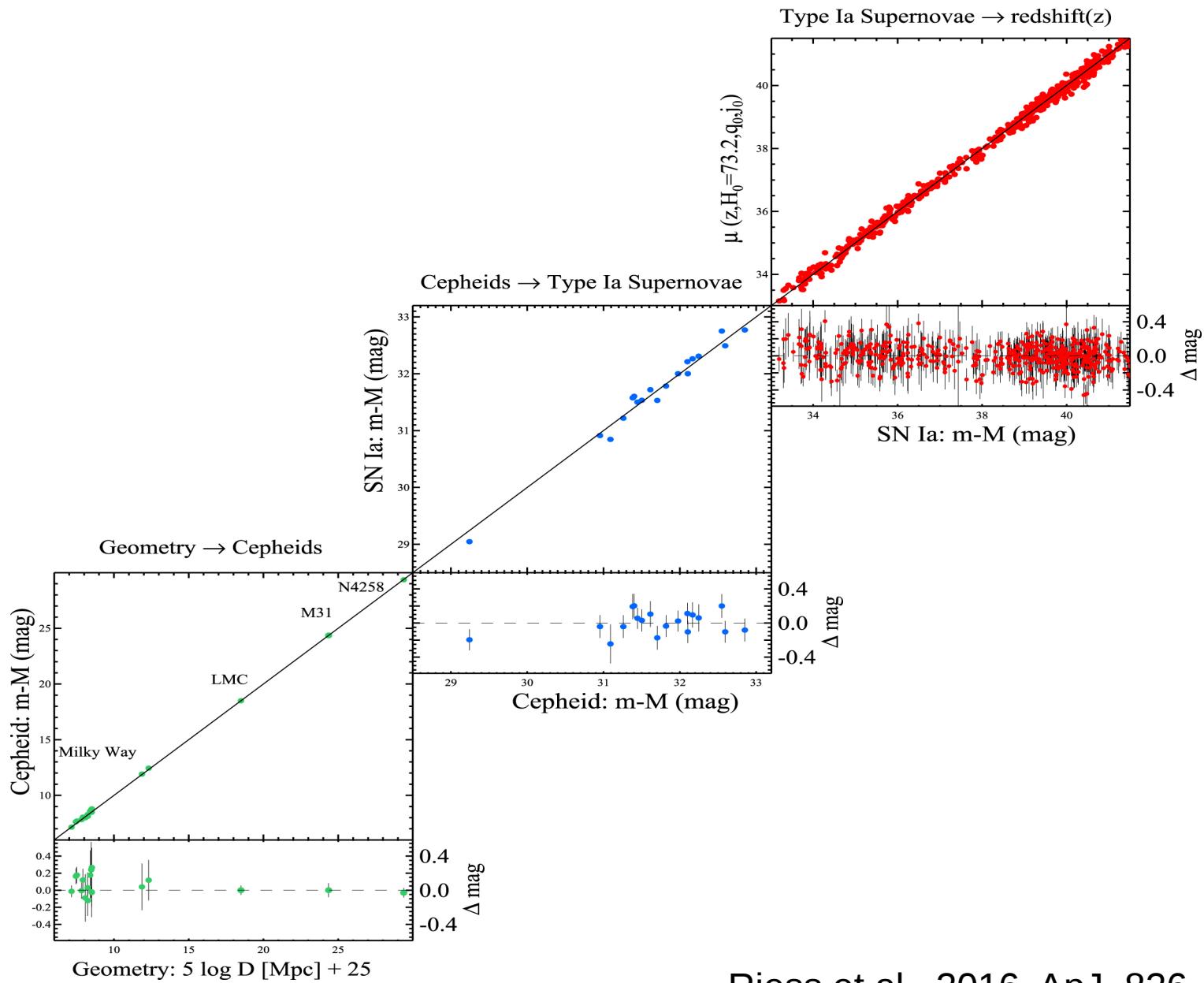


Dugo-periodične promenljive zvezde

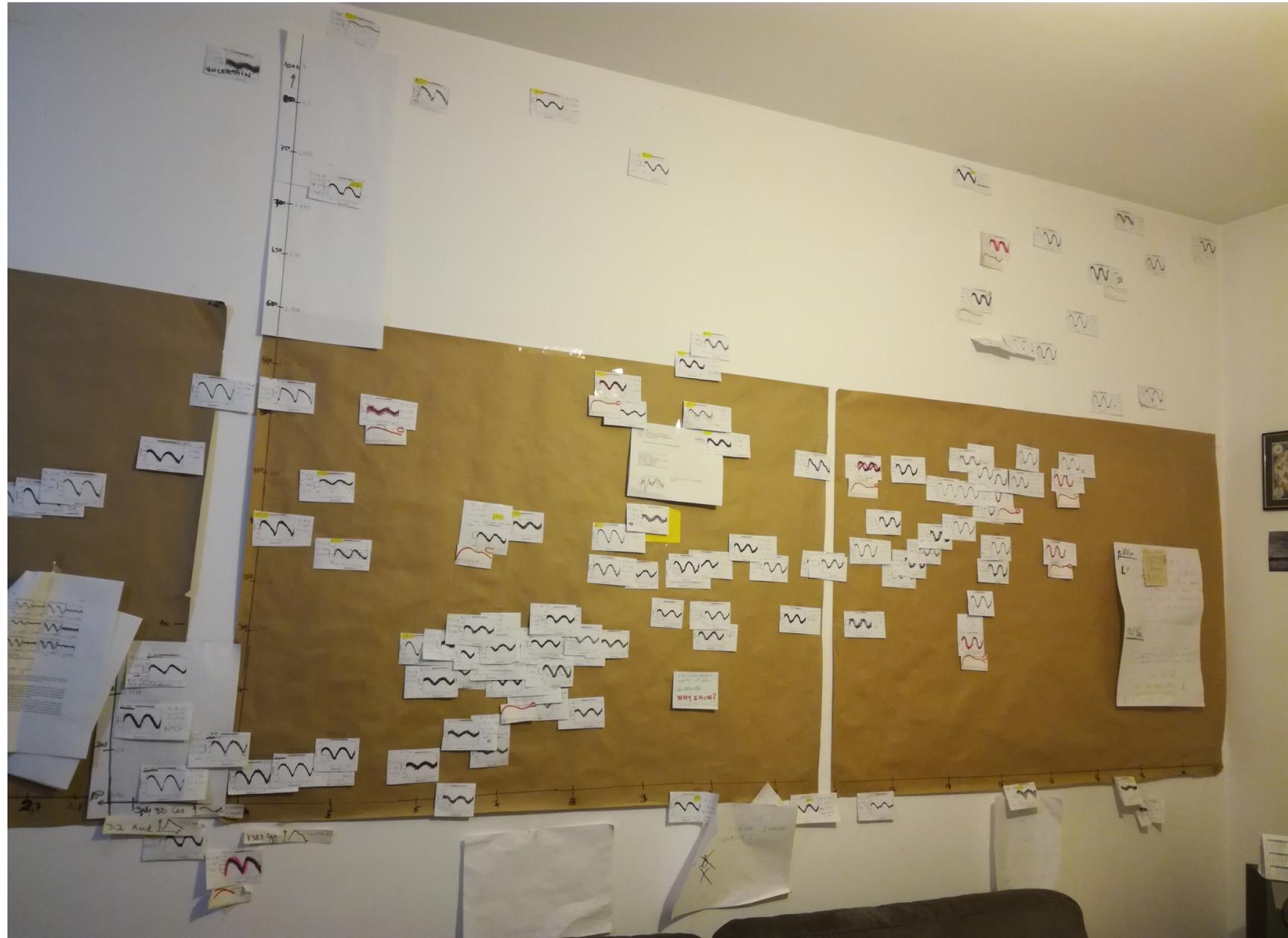
- Semiregularne zvezde
- Mira promenljive zvezde
- Nepoznat im je tačan mehanizam pulsacije
- Na HRD se nalaze izvan zone nestabilnosti

Važnost pulsirajućih zvezda

- PL relacija, koja kalibriše galaktičku skalu daljine
- Modeliranje evolucije i pulsacije
- U sledećih nekoliko godina ćemo moći da vidimo ove promenljive i u drugim (susednim) galaksijama što će nam omogućiti da istražujemo stare generacije zvezda – galaktička arheologija, istraživanje nastanka galaksija



Riess et al., 2016, ApJ, 826, 56



22nd Pulsation conference San Pedro de Atacama

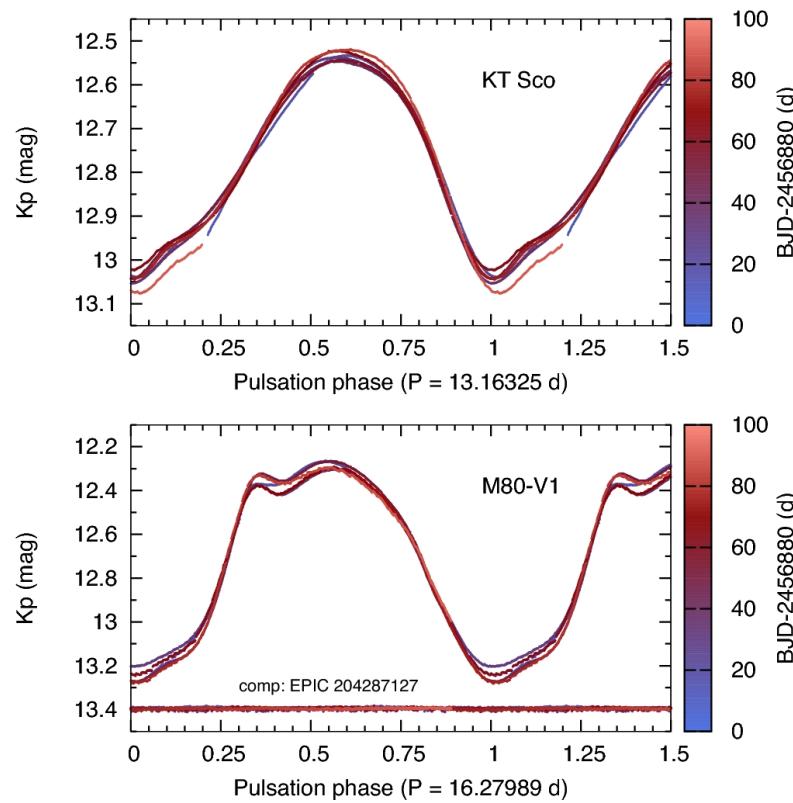
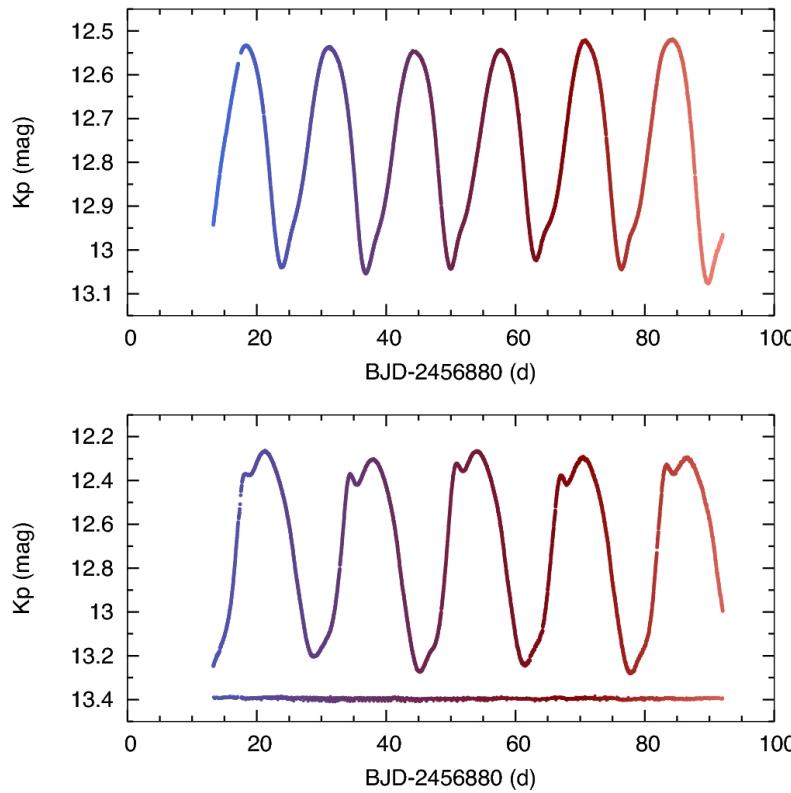
27 NOV - 02 DEC 2016, Chile



Projekti

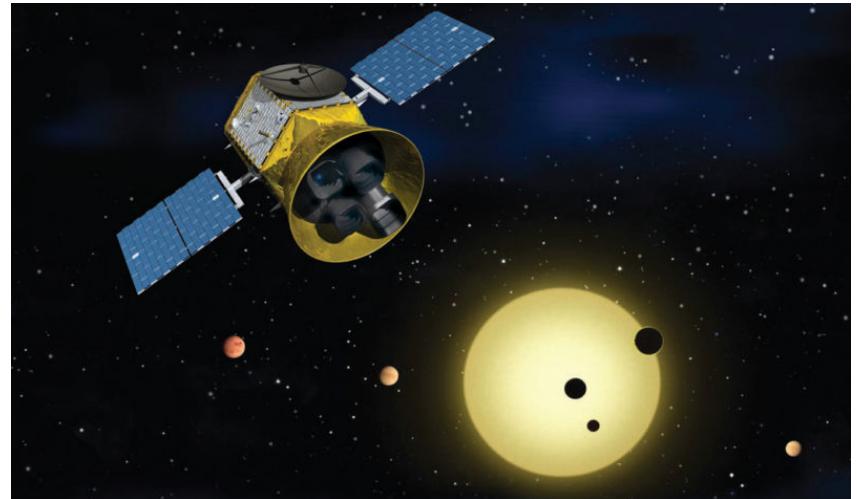
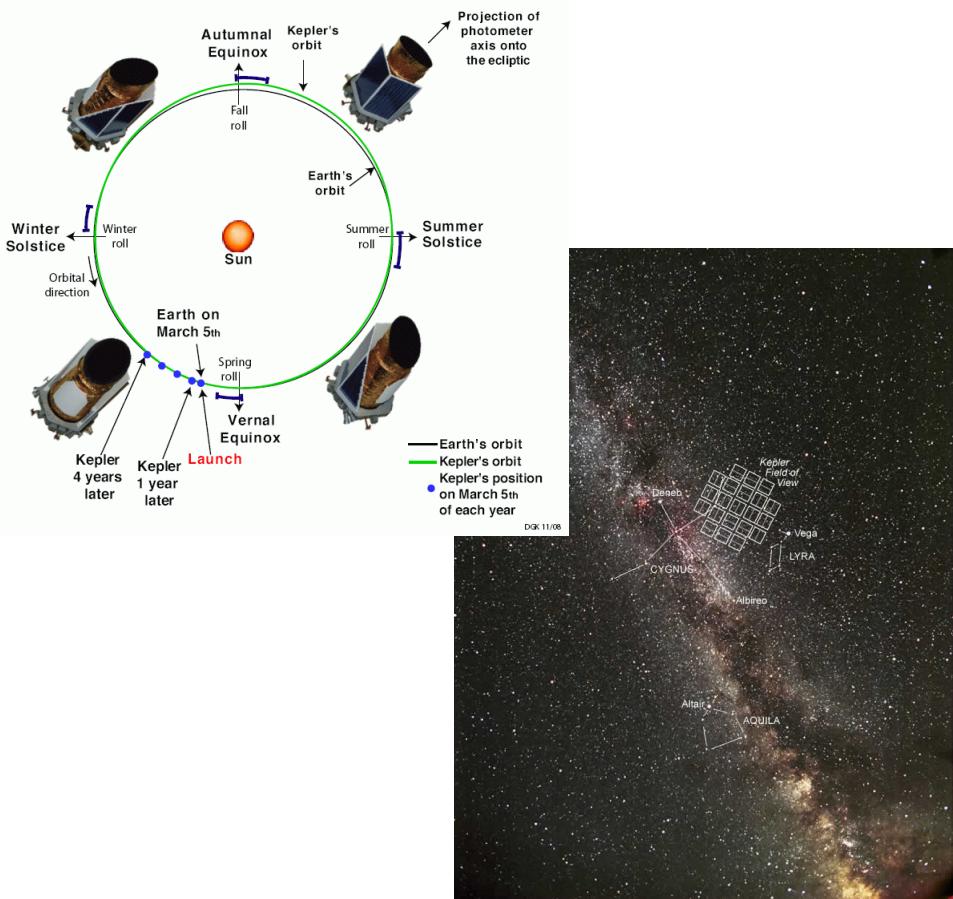
Udvostručenje perioda i druge pulsirajuće frekvencije kod cefeida tipa II

Zvezde tipa W Virginis KT Sco i M80 V1

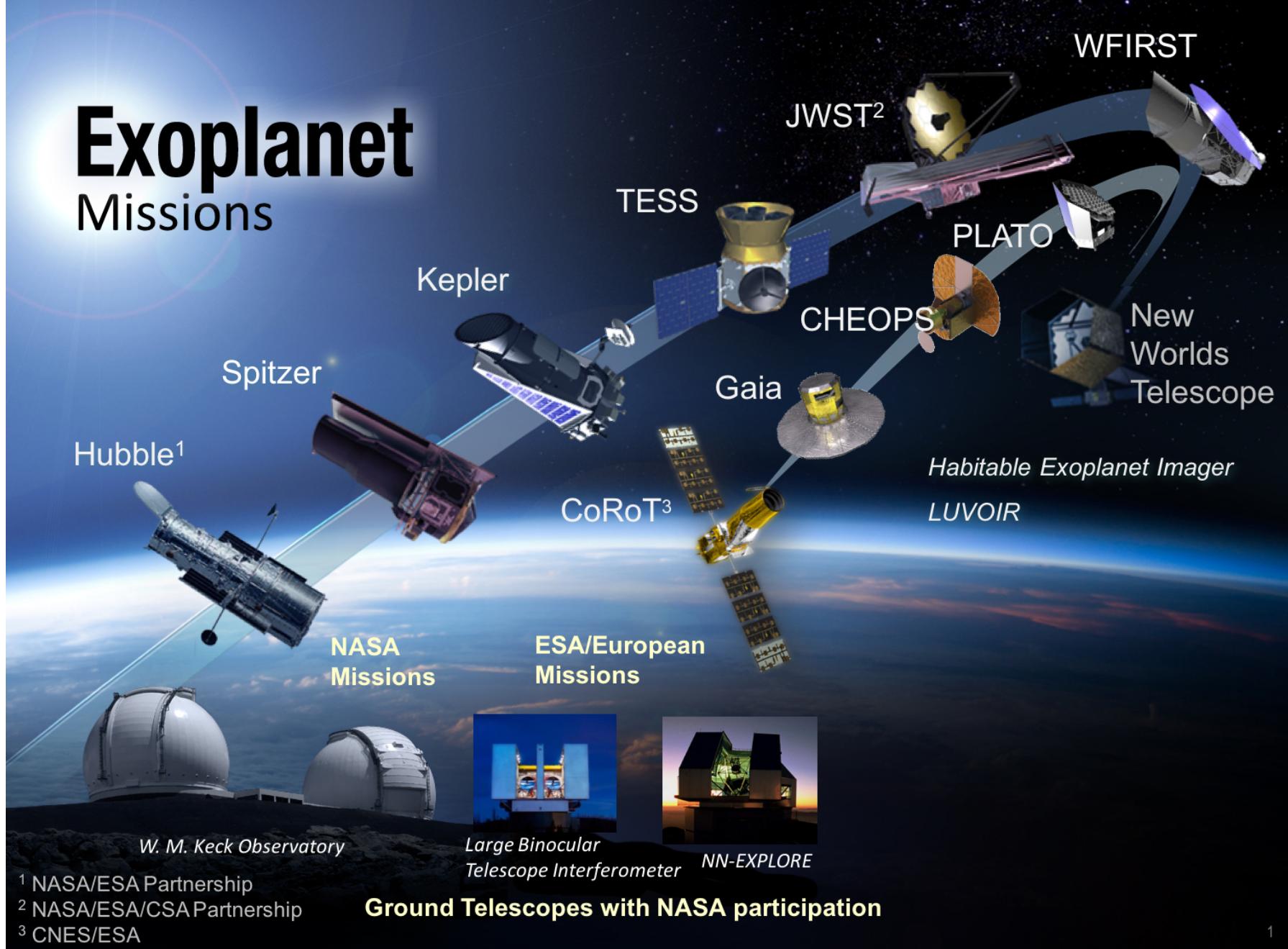


Svemirski teleskopi

- Kepler i K2 misija
- TESS



Exoplanet Missions



The MAST Portal lets you search multiple collections of astronomical data-sets from one place. Use this tool to find astronomical data, including images, spectra, catalogs, timeseries, publication records and more.

Search MAST Portal

MAST API Suite

Astroquery API

A streamlined interface for Python users to access data in MAST. Replicates most functions of the MAST Portal web interface. Access MAST queries using the same function conventions and return types available for all Astroquery services. Integrate easily with Astropy functionality and other Python analysis tools.

```
{'service': 'Mast.Caom.Cone',
 'params': {'ra': 254.28746,
            'dec': -4.09933,
            'radius': 0.2},
 'format': 'json',
 'pagesize': 2000,
 'removenullcolumns': True,
 'timeout': 30,
 'removemcache': True}
```

Webservice API

Programmatic access to MAST data through HTTPS requests. The most direct way to programmatically access data in MAST, it is language agnostic, requiring only the ability to send/receive HTTPS requests.

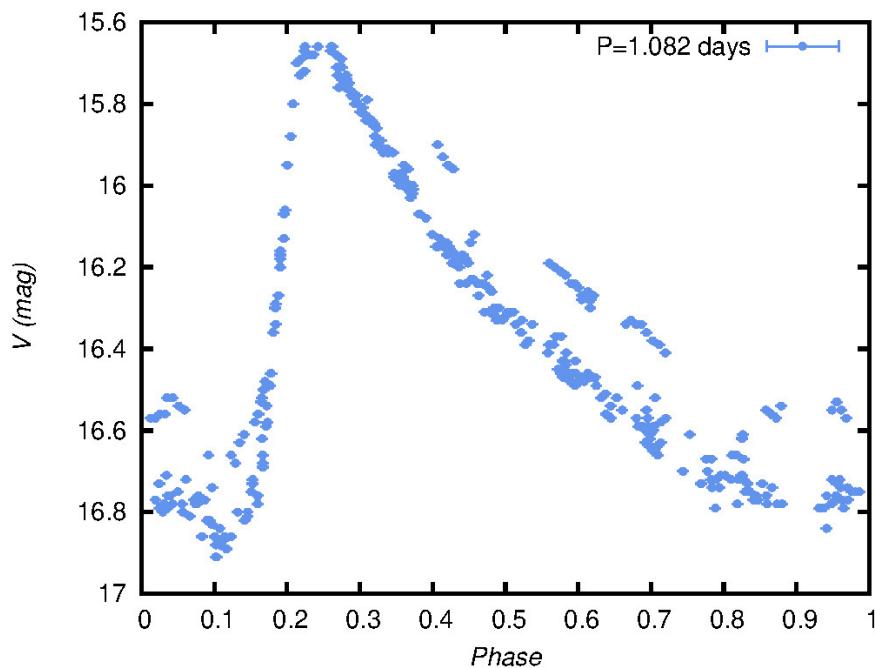
Classic API

Search MAST using HTTP GET requests. The results can be returned in a variety of formats including HTML, VOTable XML format, Excel spreadsheet, and comma-separated values, which can simplify ingesting results into user-written programs.

More Search Options

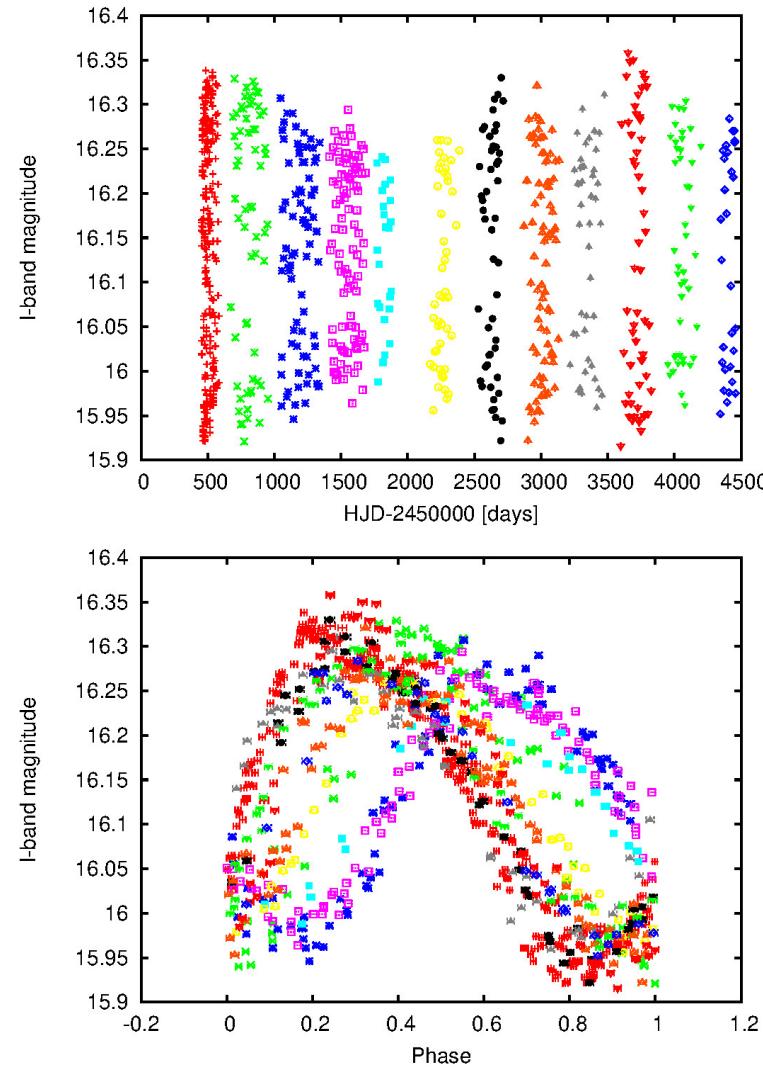
Da li anomalne cefeide imaju Blaško efekat?

FY Vir



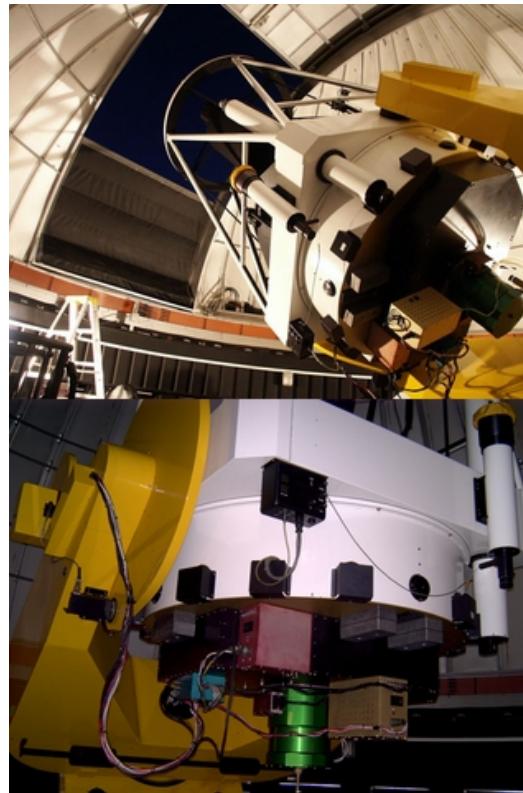
„Shape-shifter“ W Virginis

OGLE-LMC-T2CEP-127



Groenewegen & Jurkovic, "Luminosities and infrared excess in Type II and anomalous Cepheids in the Large and Small Magellanic Clouds", 2017, A & A, **603**, A70

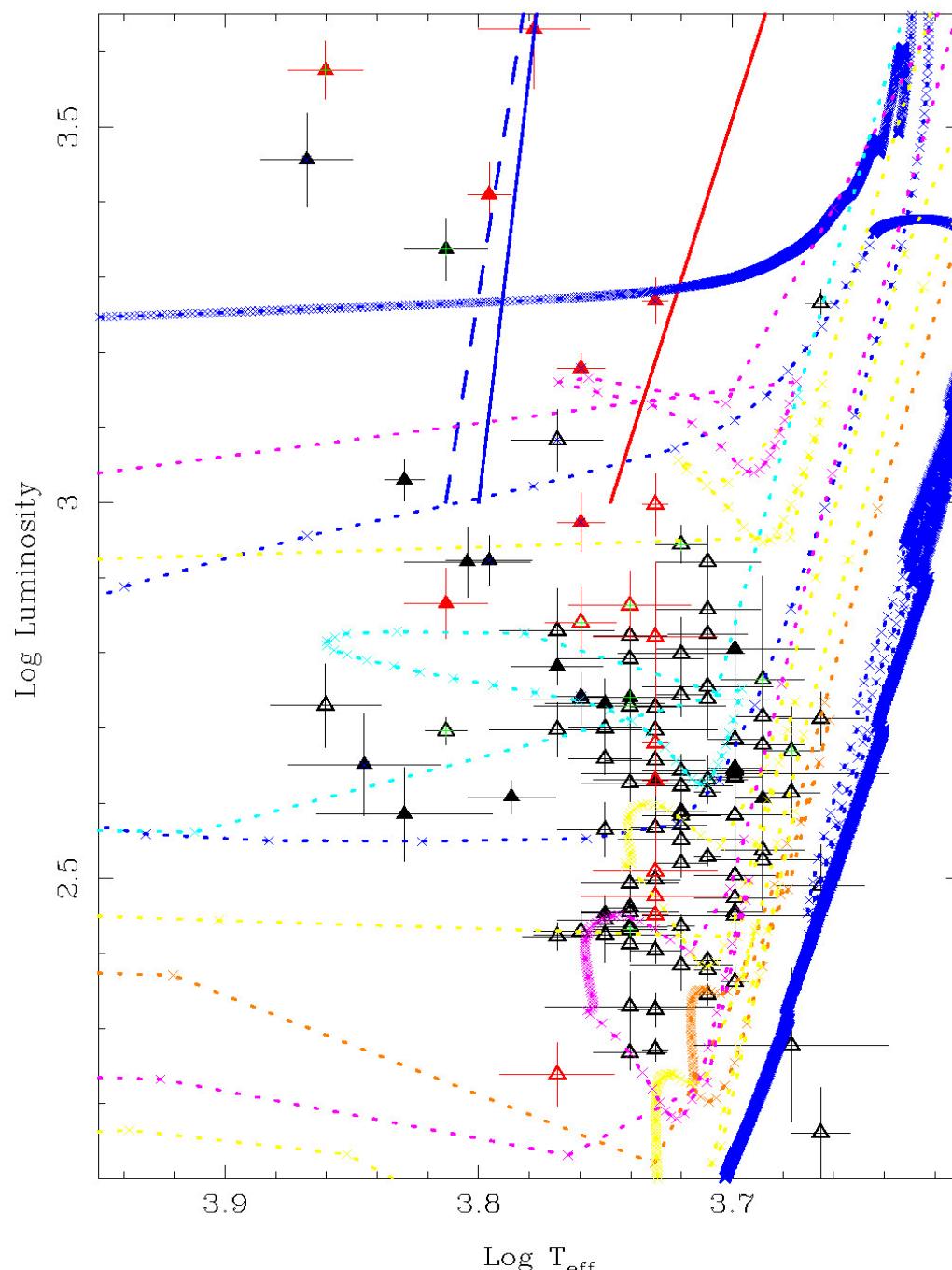
OGLE



- SuperWASP
- NSVS
- ASAS, ASAS-SN
- INTEGRAL
- RAVE

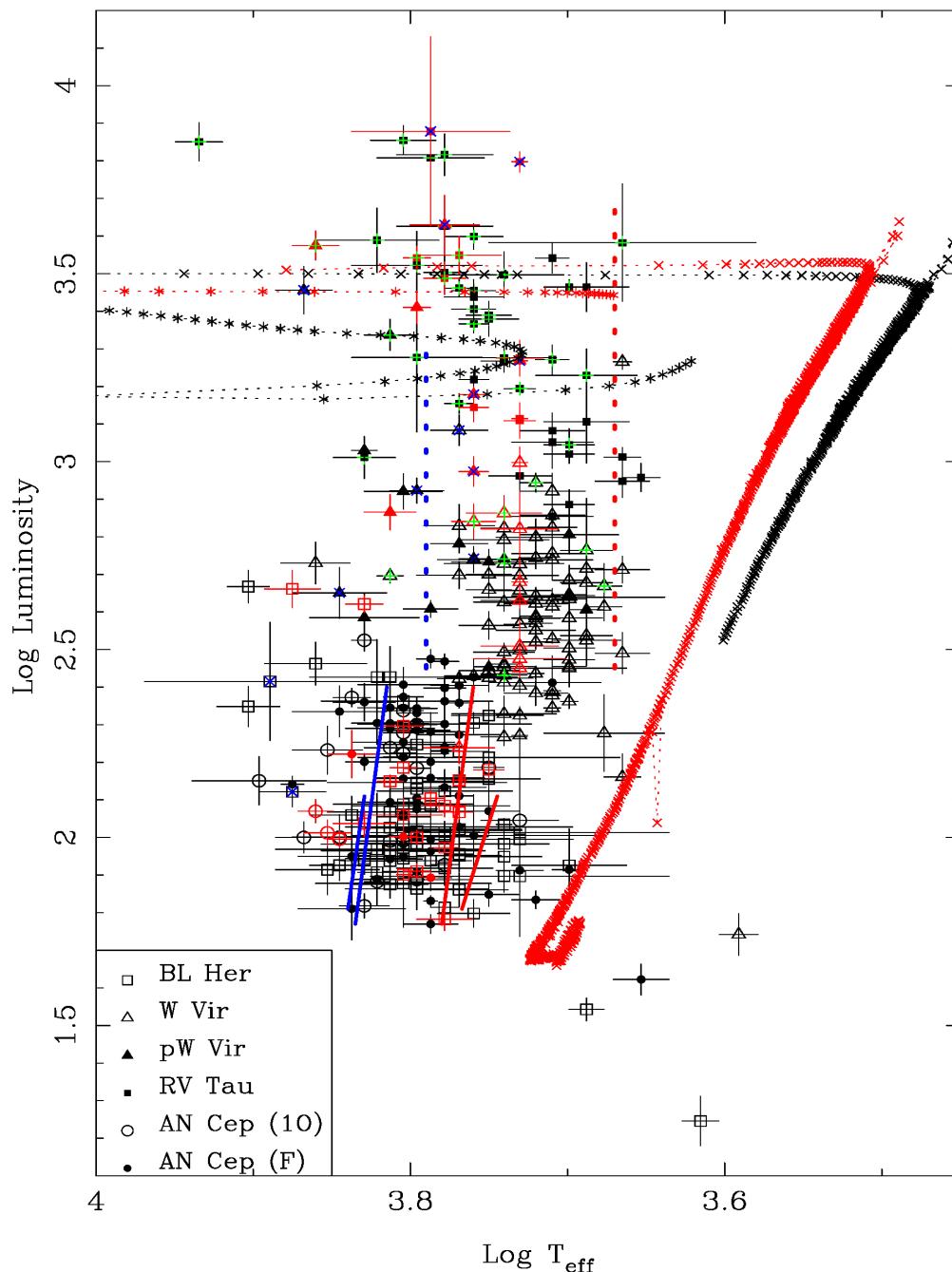
Pereklo zvezde tipa W Virginis

HRD - WVir

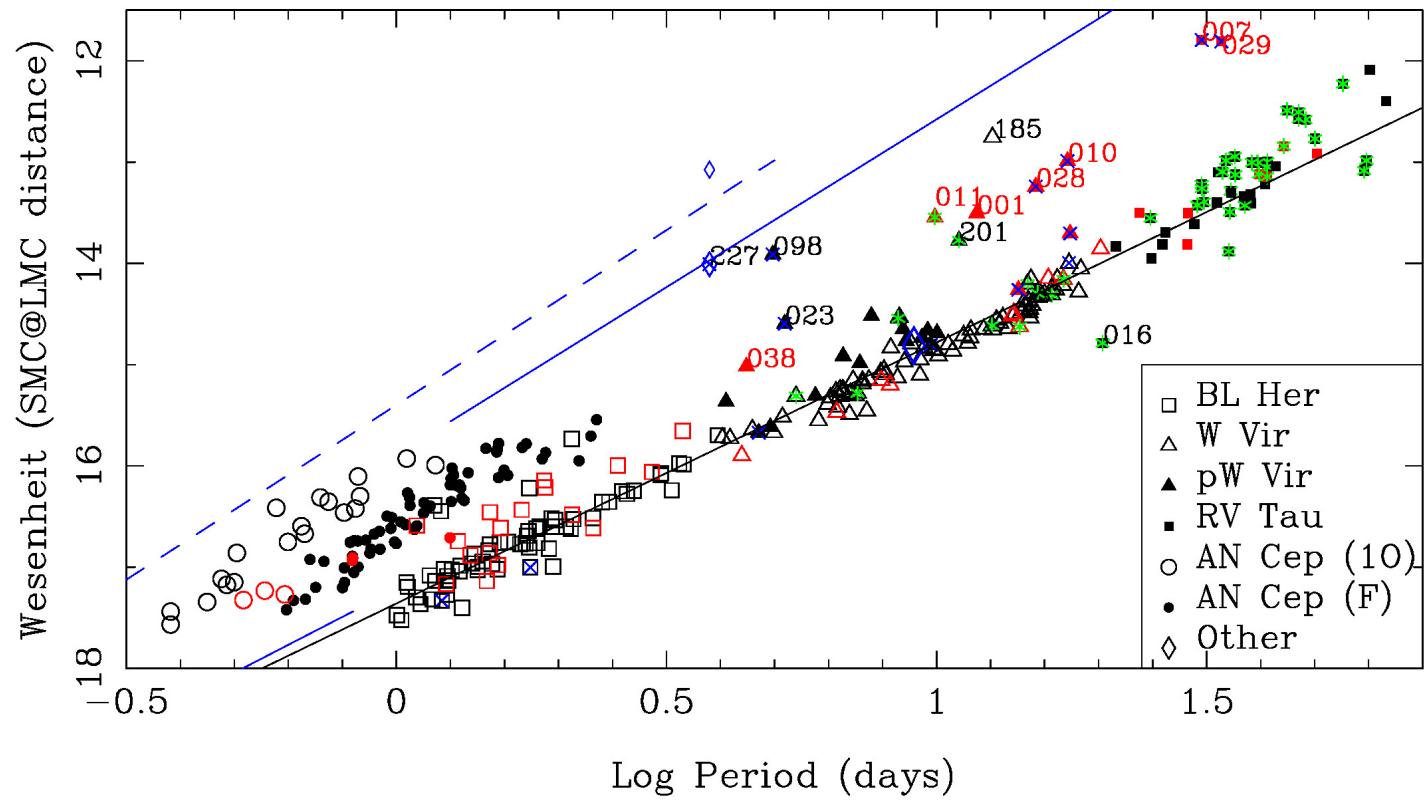


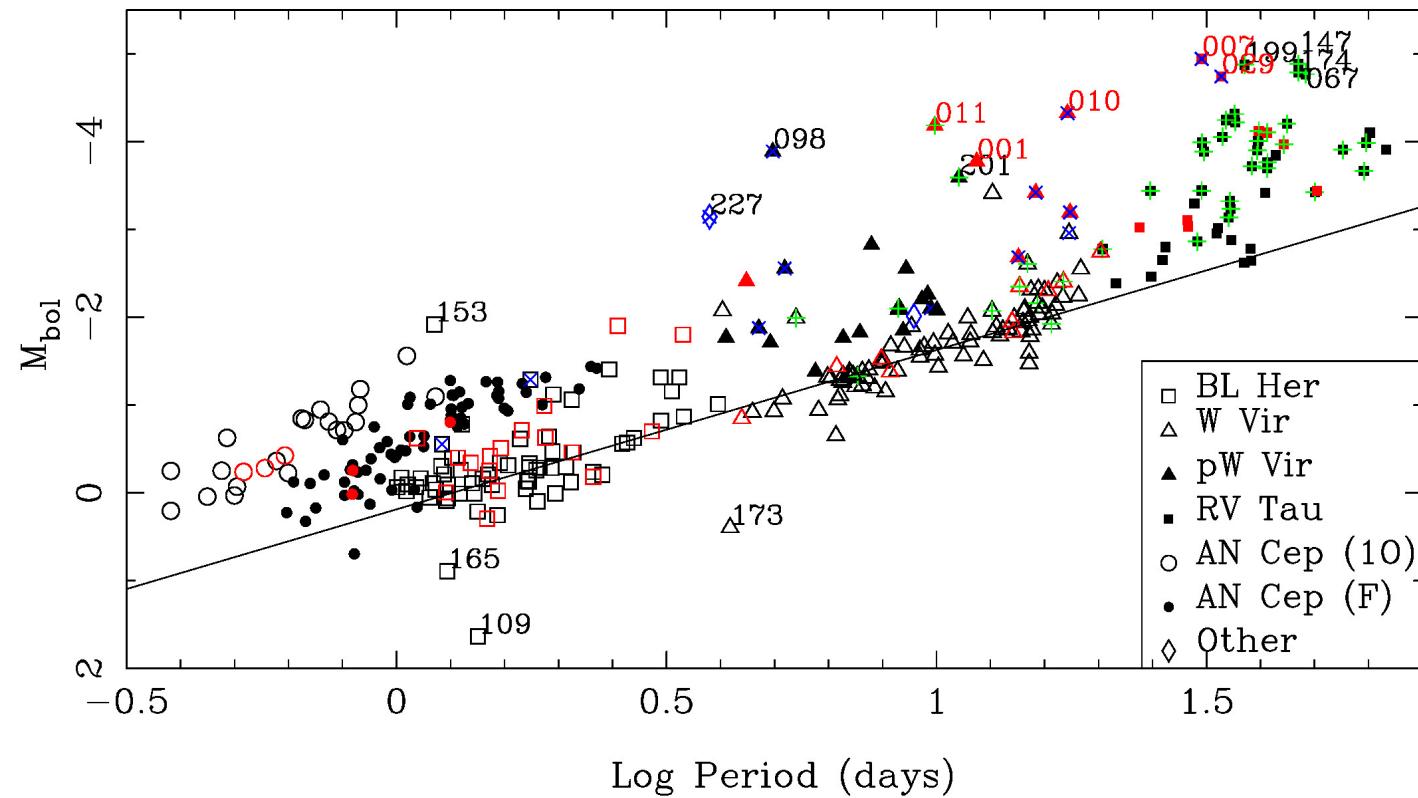
Groenewegen &
Jurkovic, "Luminosities
and infrared excess in
Type II and anomalous
Cepheids in the Large
and Small Magellanic
Clouds", 2017, A & A,
603, A70

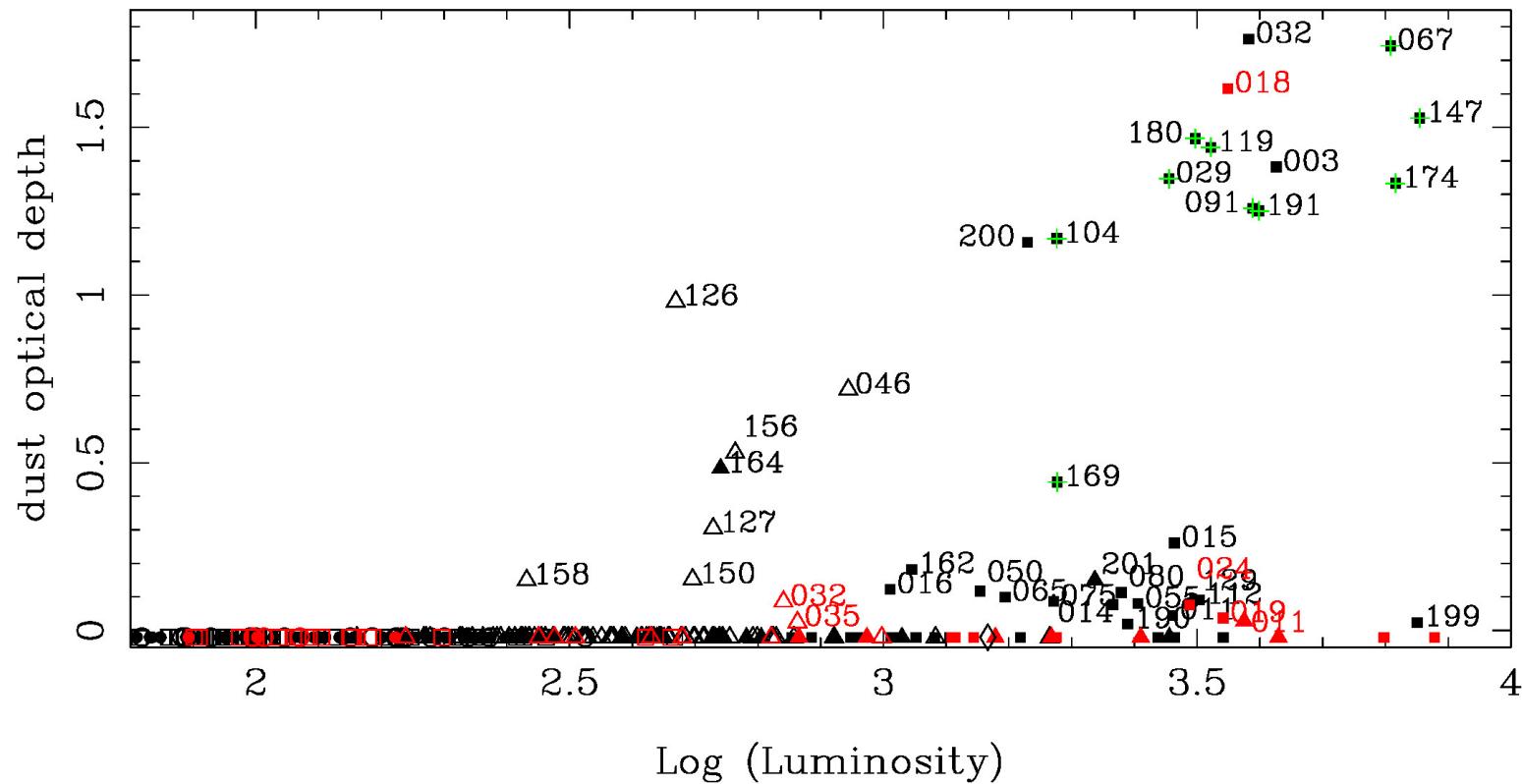
Projekti vezani za zvezde tipa RV Tauri

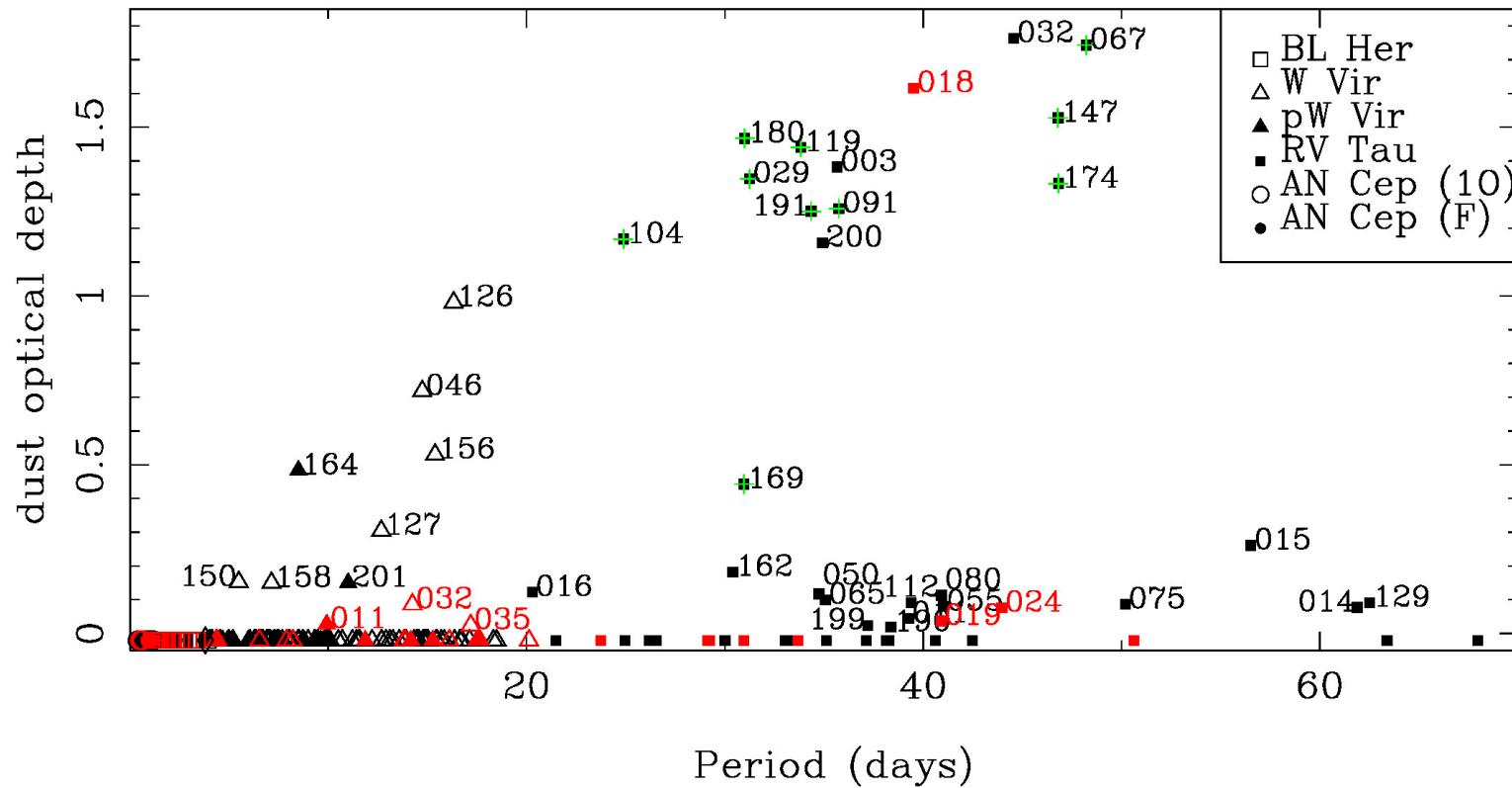


Groenewegen &
Jurkovic, "Luminosities and infrared excess in
Type II and anomalous
Cepheids in the Large
and Small Magellanic
Clouds", 2017, A & A,
603, A70

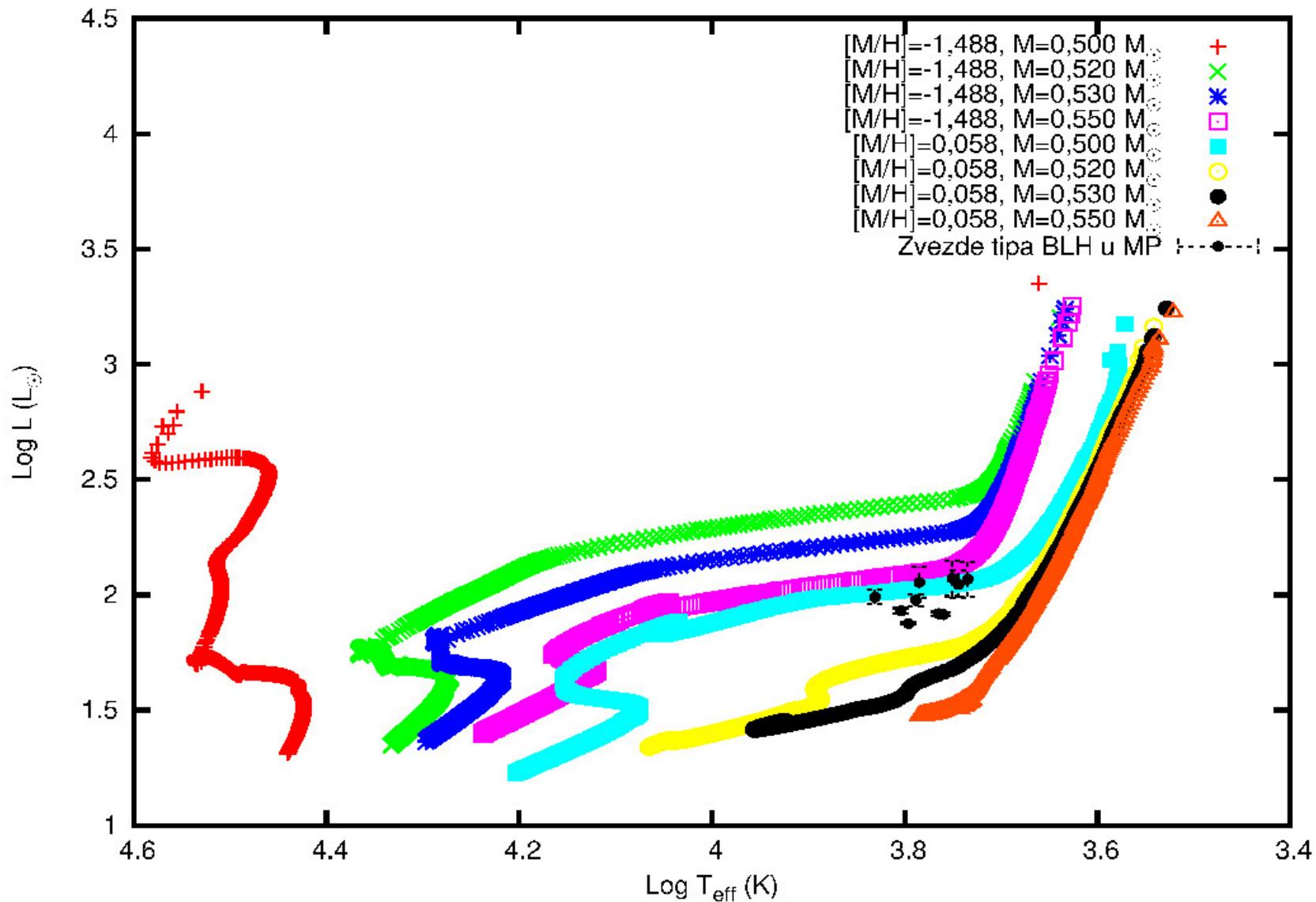








Metaličnost cefeida tipa II i anomalnih cefeida

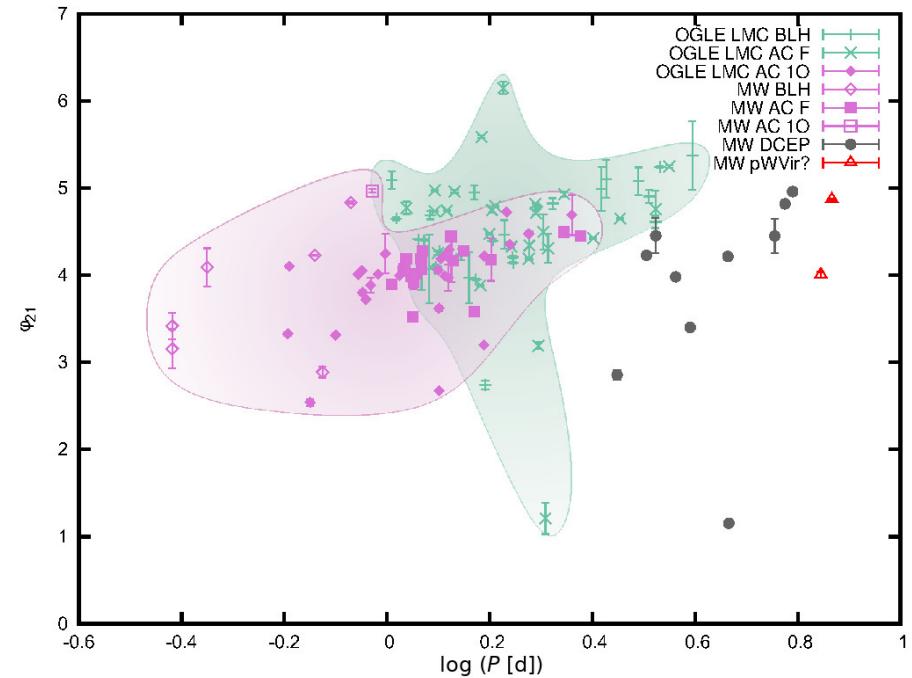
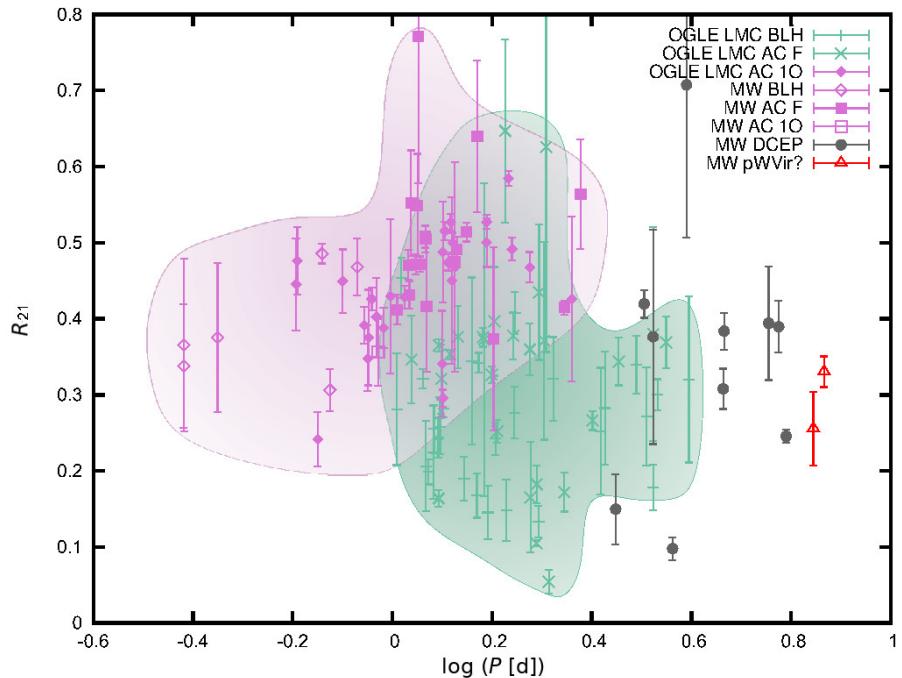


Jurkovic, "Anomalous Cepheids Discovered in a Sample of Galactic Short Period Type II Cepheids", 2018, SAJ, 197, 13

Klasifikacija

Log P vs. R₂₁i

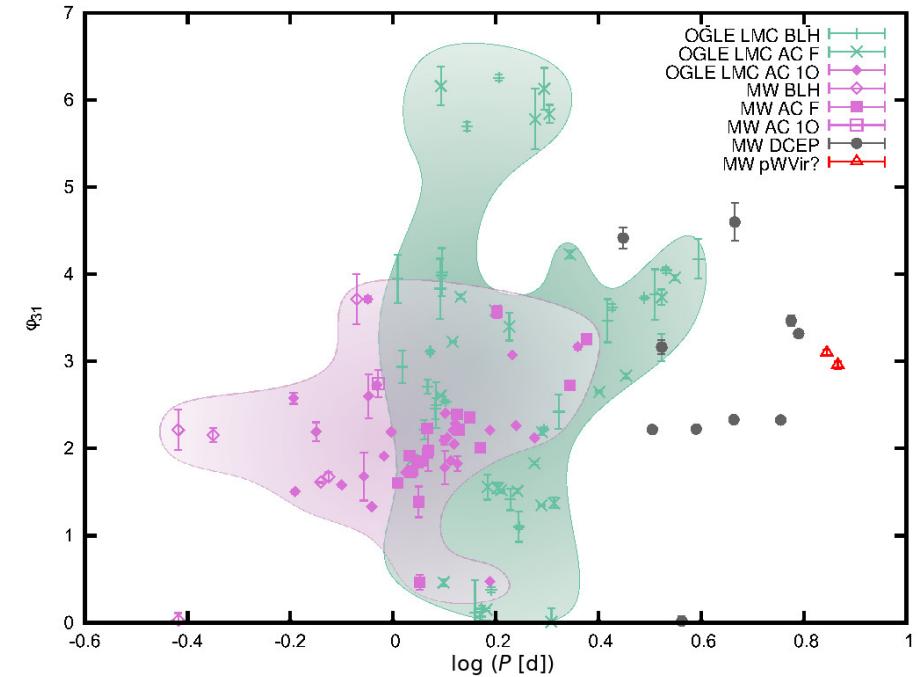
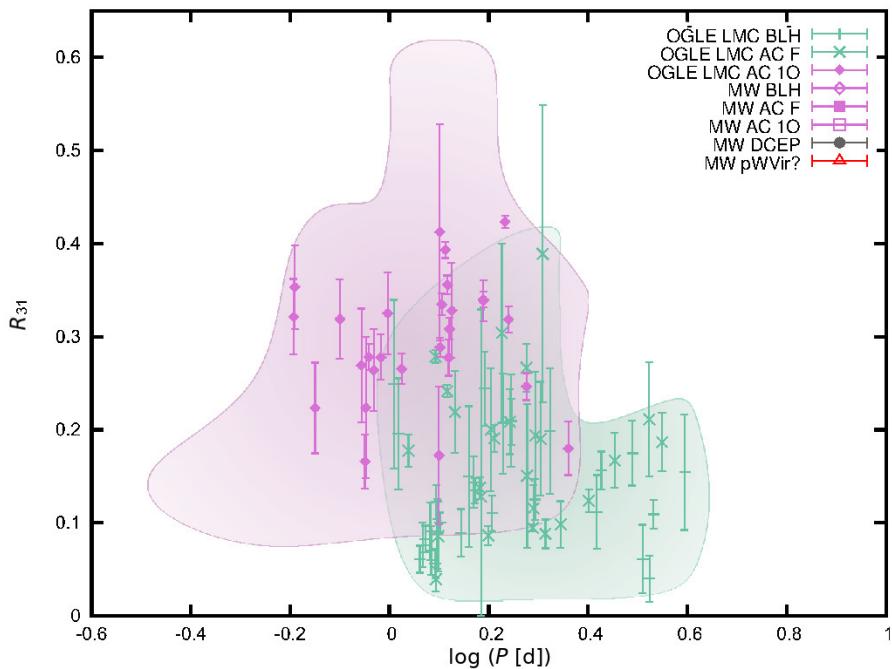
log P vs. φ₂₁



Jurkovic, "Anomalous Cepheids Discovered in a Sample of Galactic Short Period Type II Cepheids", 2018, SAJ, 197, 13

Log P vs. R₃₁ i

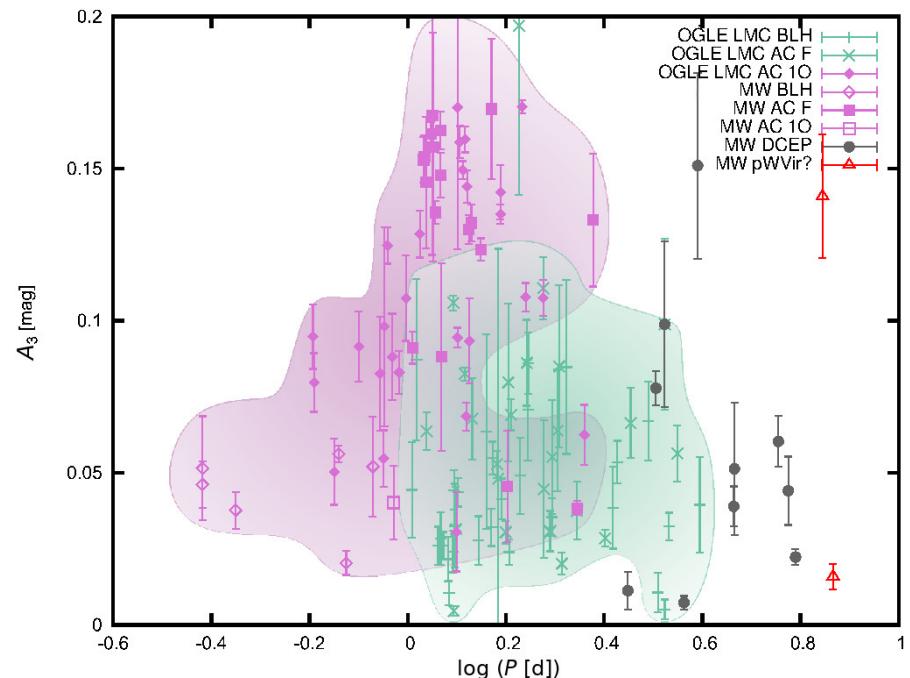
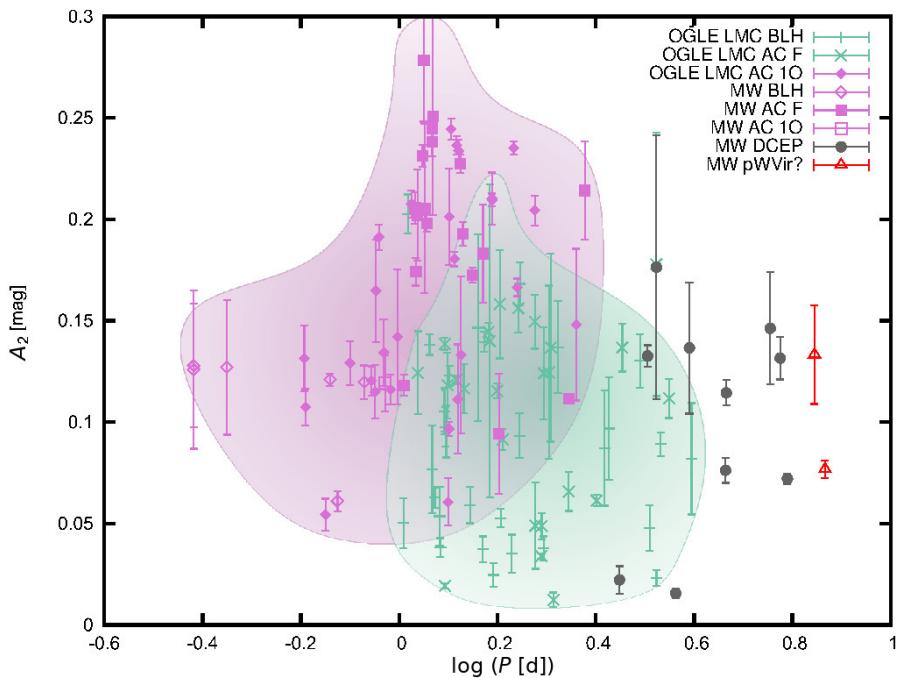
log P vs. φ₃₁



Jurkovic, "Anomalous Cepheids Discovered in a Sample of Galactic Short Period Type II Cepheids", 2018, SAJ, 197, 13

Log P vs. A₂ i

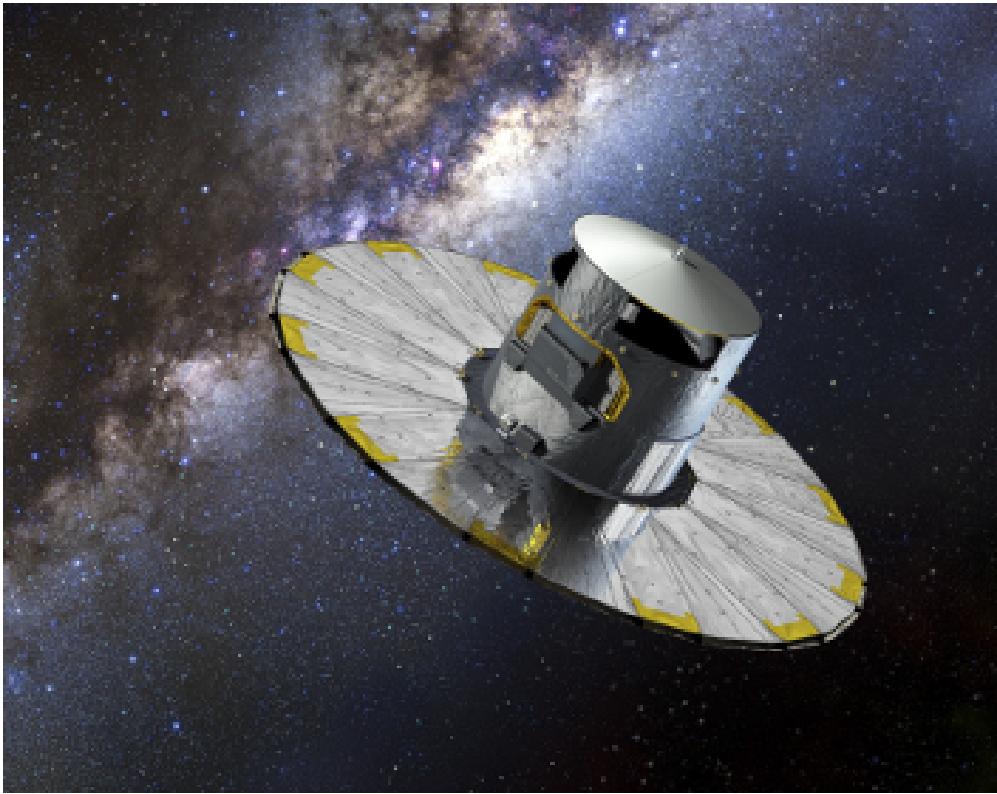
log P vs. A₃

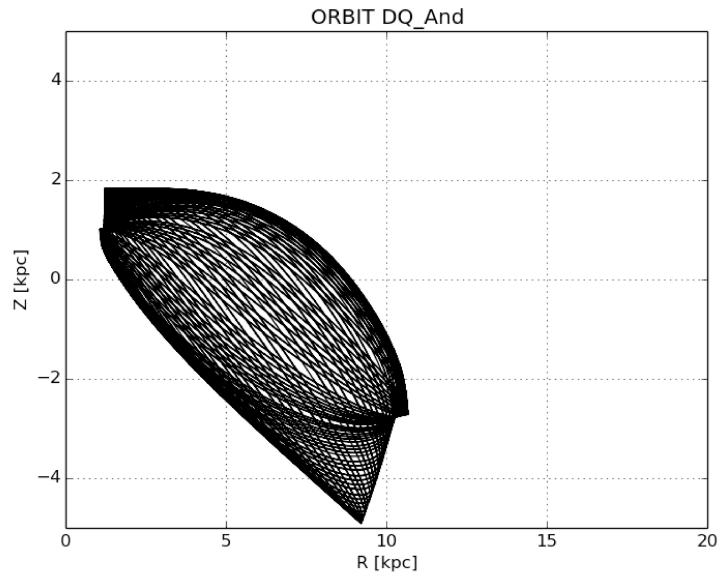
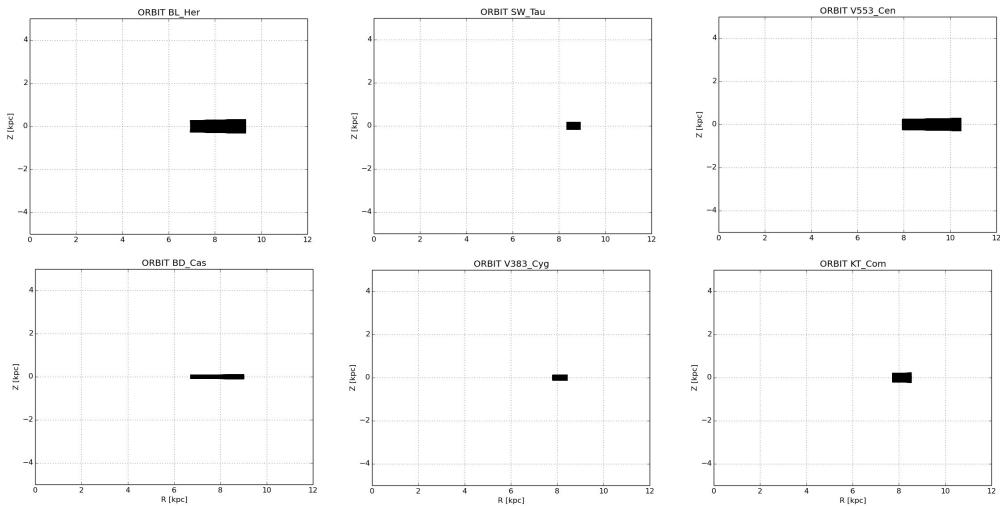
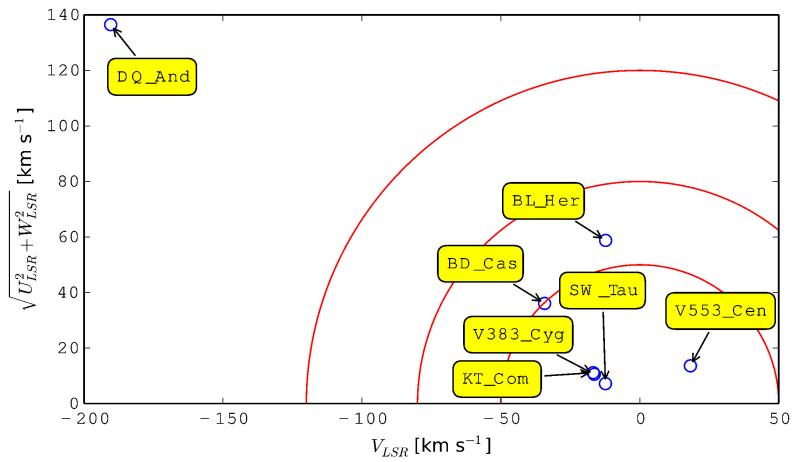


Jurkovic, "Anomalous Cepheids Discovered in a Sample of Galactic Short Period Type II Cepheids", 2018, SAJ, 197, 13

Galaktička pripadnost cefeida tipa II i anomalnih cefeida

Gaia svemirski teleskop

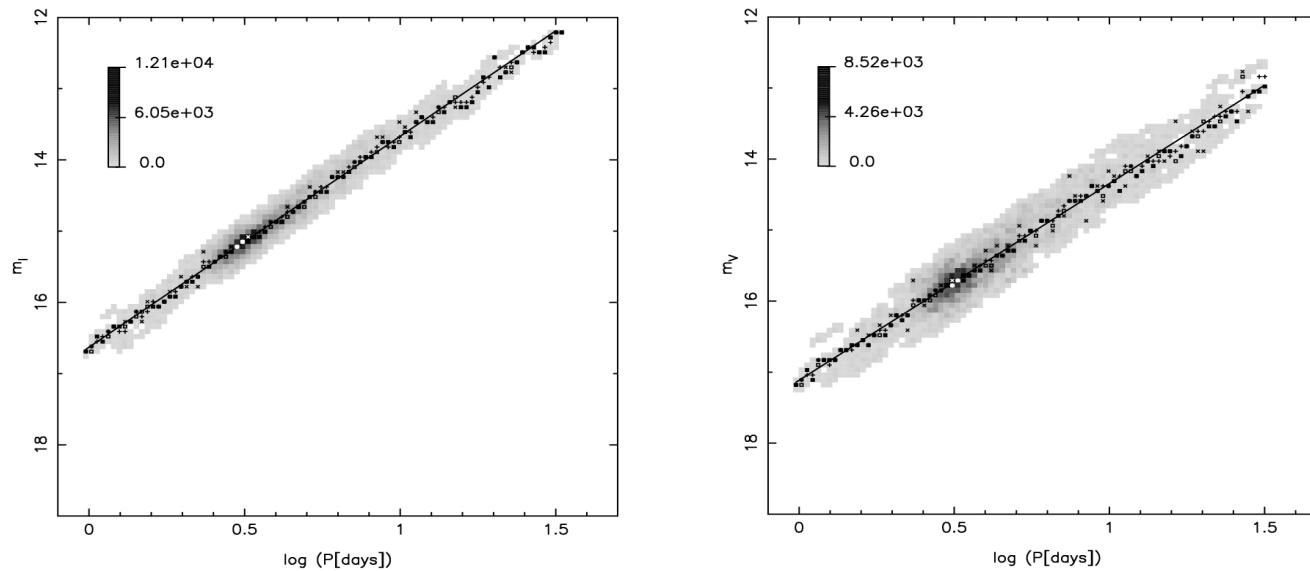


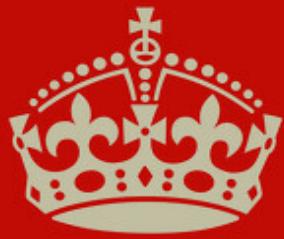


Projekat sa dr Branislavom Vukotićem:

statistika gustine podataka za PL relaciju ili bilo
koje druge parametre promenljivih zvezda

Figure 3. Greyscale reconstructed data PDF for an extinction corrected sample of fundamental mode LMC Cepheids from ...





KEEP CALM
AND
THANK YOU
FOR YOUR
ATTENTION