

# MULTIPERIODIC PHENOMENA IN VARIABLE STARS

or (in other words)

## ASTEROSEISMOLOGY OF CLASSICAL PULSATORS

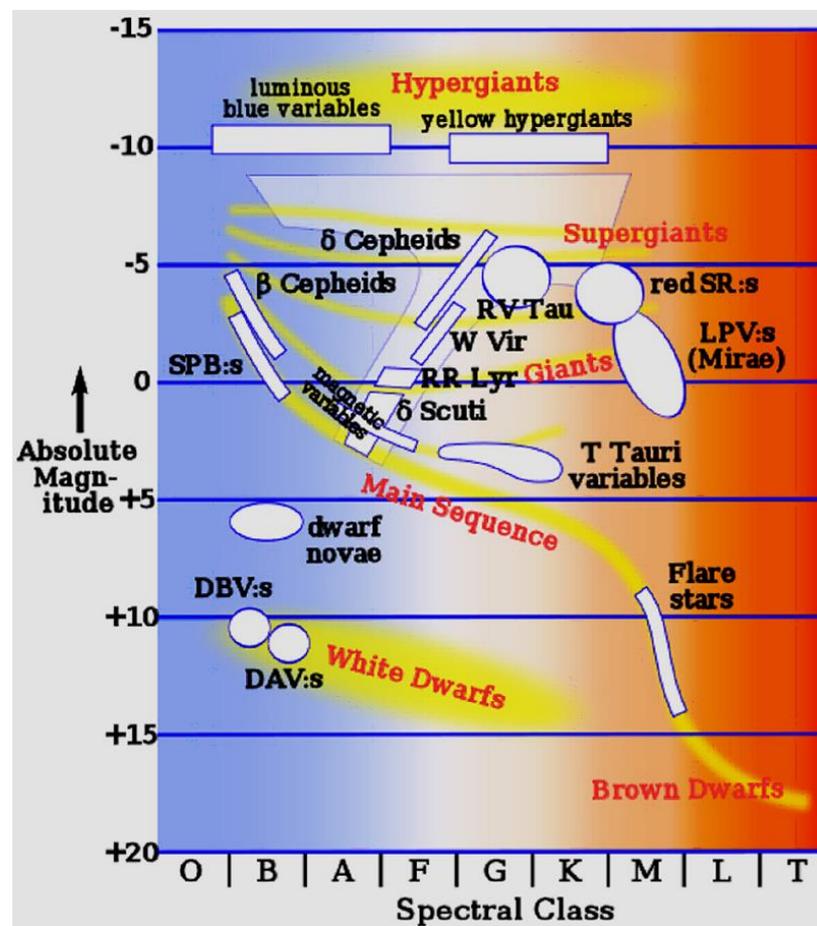
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(*time-series analysis*)

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(*stellar models*)

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**LSST collaboration** : Transient/Variable Stars  
**Subgroup**: Pulsating Variables

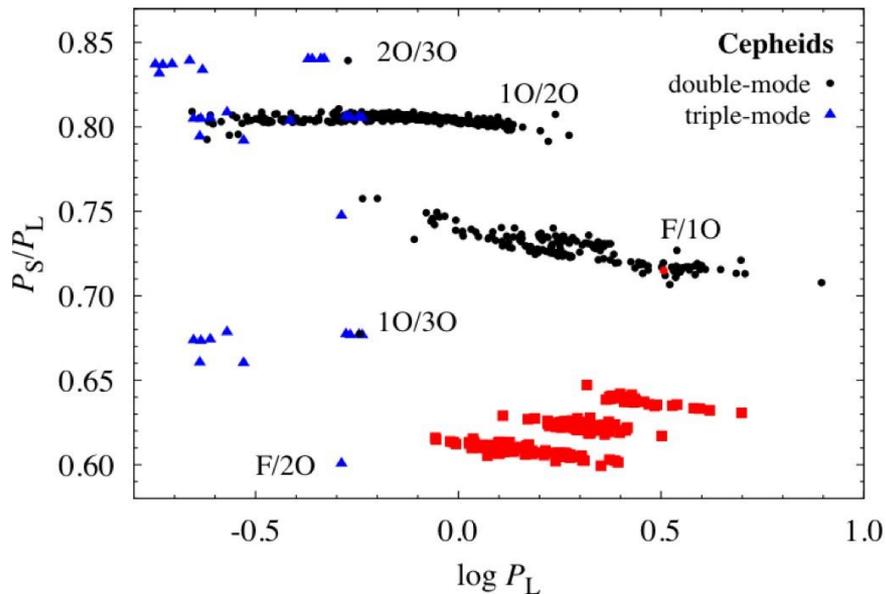


# Scientific goals: Cepheids

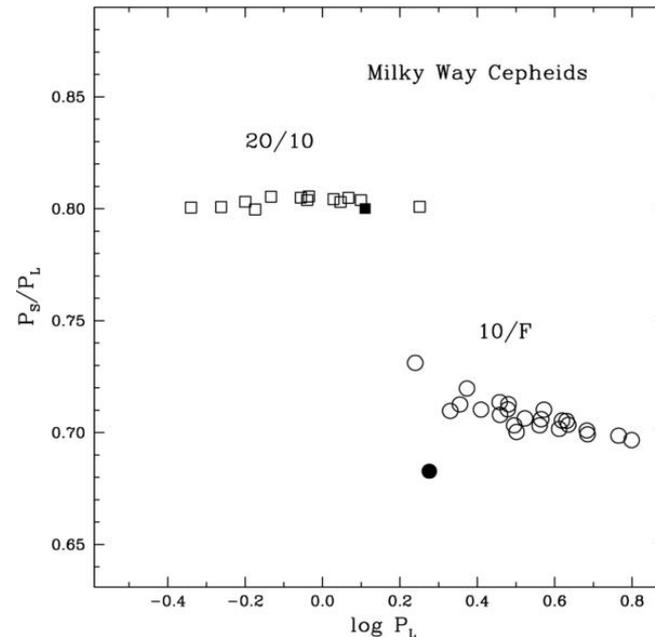
Search for rare period ratios: 0.84 and 0.68 (20/30, 10/30) in Cepheids.

Search for unexplained period ratios in the 0.60-0.64 range in Cepheids.

Unique unexplained period ratio 0.682 (10/F ??) observed in CoRoT 0223989566.



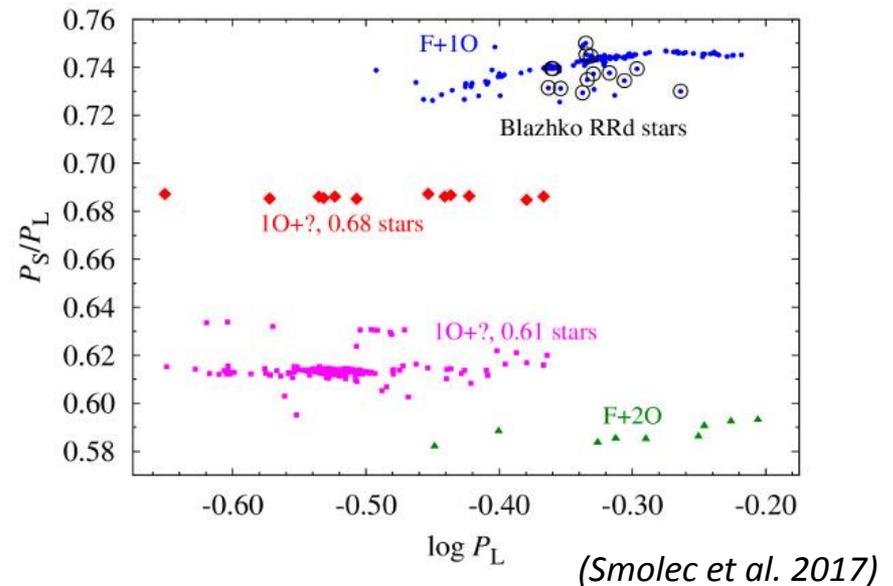
(Smolec et al. 2017)



(Poretti et al. 2014)

## Scientific goals: RR Lyrae stars

Search for unexplained period ratios  
(0.68 and 0.61 stars) in an all-sky survey  
(relatively rare, OGLE sample cannot be  
representative, ...)



## Scientific goals: long-period (AGB) variables

Largely unexplored field, especially far from galactic bulge.

Stars with secondary modulation have larger mid-IR excesses than other AGB stars.

Long term variability due to the presence of a dusty disk? (Wood & Nicholls 2009)

AGB phase better described with the inclusion of the dust formation process modelling in the circumstellar envelope. (Ventura et al. 2012)

Pulsation as tool to study the connection between variability and mass-loss.

Infrared variability as tool to study the connection between pulsation and dust formation.

Expected information on stellar physics from the investigation of multiperiodicity all along the instability strip (RR Lyr stars, Cepheids, Semiregulars, Mirae) with an all-sky, multiband tool as LSST

*Classical* period ratios as probe of the stellar structure and physics.

*Unusual* period ratios as diagnostic of unusual evolutionary patterns and/or pulsational models.

*Infrared variability* and *secondary modulations* as tools to study mass loss and late evolution.

# Other facilities, follow-up

Routinary use of automatic or robotic (like REM) telescopes for improvement of the light curves (Fourier decomposition parameters, linear combinations to rule out duplicity, ...). To be used on selected targets, a few nights per target.

Spectroscopic analysis of selected targets, especially long-period variables.  
JSTW proposals.

## Data analysis

### Timeline

Short-period (less than 10 d) Cepheids can be studied very soon,  
long-period (more than 30 d) variables a bit later.

### Technique development: super Nyqvist regime

Force the detection of variability in the lower part of the instability strip,  
long period high-amplitude Delta Sct and SX Phe stars. The usual LSST  
cadence is not suitable for them, but .... *Kepler docet* ....