Determining White Dwarf Variability

Participant: Shania Wolf
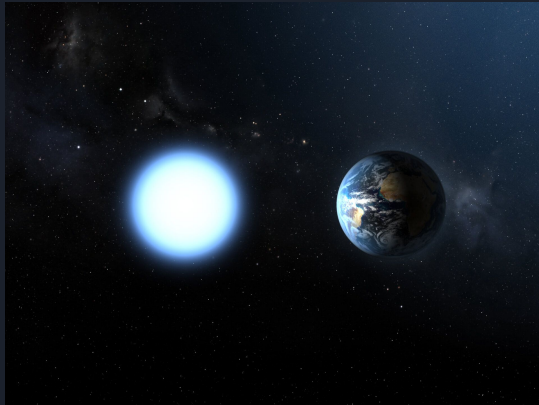Advisers: Dr. Kilic, Alekzander Kosakowski
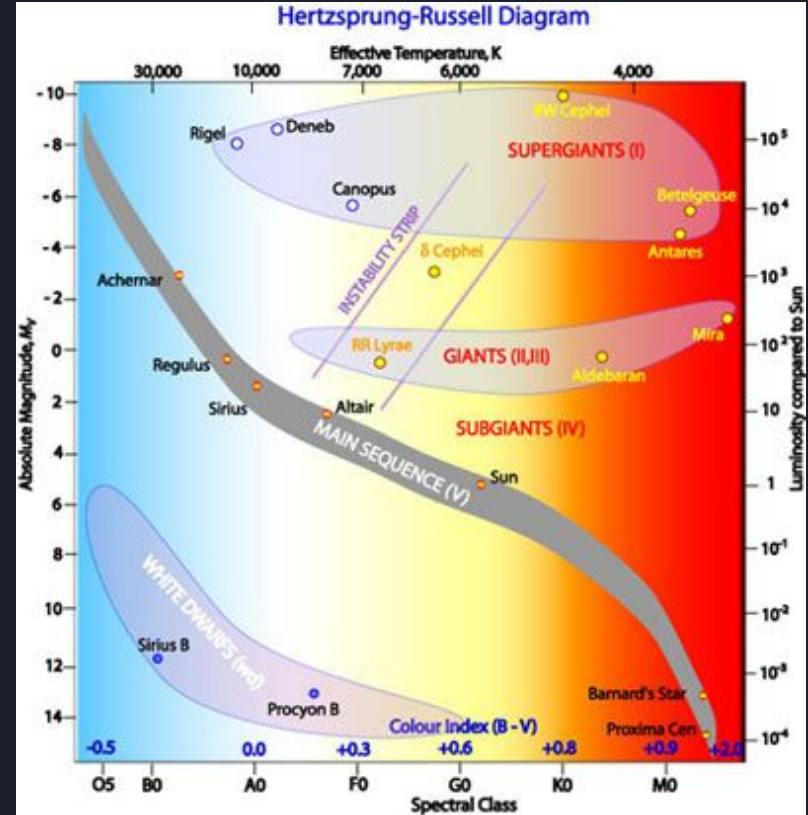
Overview:

- Introduction
  - White dwarfs, variable stars
- The Missions:
  - ASASSN & TESS
- Research Goal
- Data Acquisition
- Methods
- ASASSN & TESS Comparisons
- Discoveries
- Future

All About White Dwarfs

- Very small, dim, late-stage stars
  - Fate of low/medium mass MS stars
- Earth-sized radius, but sun-sized mass

Graphic via: ESA.int

Graphic via: AStronomy.Swin.edu

All About Variable Stars

- Varying brightness
  - Intrinsic
    - Caused by the star itself
    - Ex: Pulsations, eruptions
  - Extrinsic
    - Other bodies affecting star
    - Ex: Eclipsing binaries, sunspots
- Any stellar type

time: 0.00 d

Graphic via: Exoplanet.sg

TESS Mission

Main science objective:

- Discover transiting exoplanets orbiting stars >12th magnitude

Camera specs:

- Pixel scale: 21 arcseconds per pixel

Cadence: How often they take images & sky coverage

Pros:

- Space based
- Less noise
- Continuous data

Cons:

- Large pixel scale
- Surveys some regions more frequently than

Graphic via: TESS.MIT.edu

ASAS-SN Mission

Image via: Astronomy.Ohio-State.edu

Main science Objective:
- Discover supernovae and other astronomical transients >17th magnitude

Pixel scale:
- 7.8 arcseconds per pixel

CAdence

Pros:
- Small pixel scale
- Can survey entire sky every day

Cons:
- Ground-Based
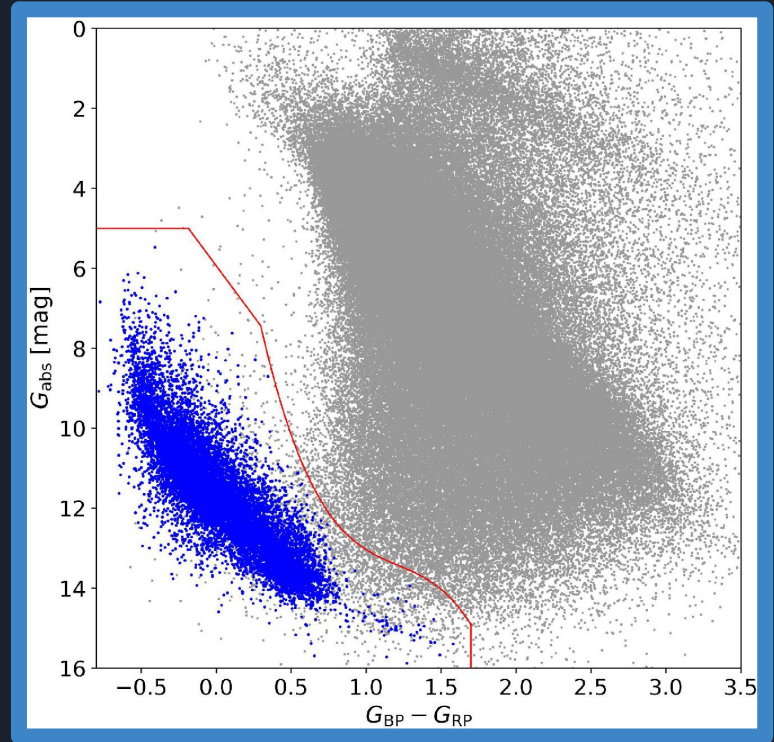 - Aliasing
- Can only observe at night
- Noisy

Research Goal:

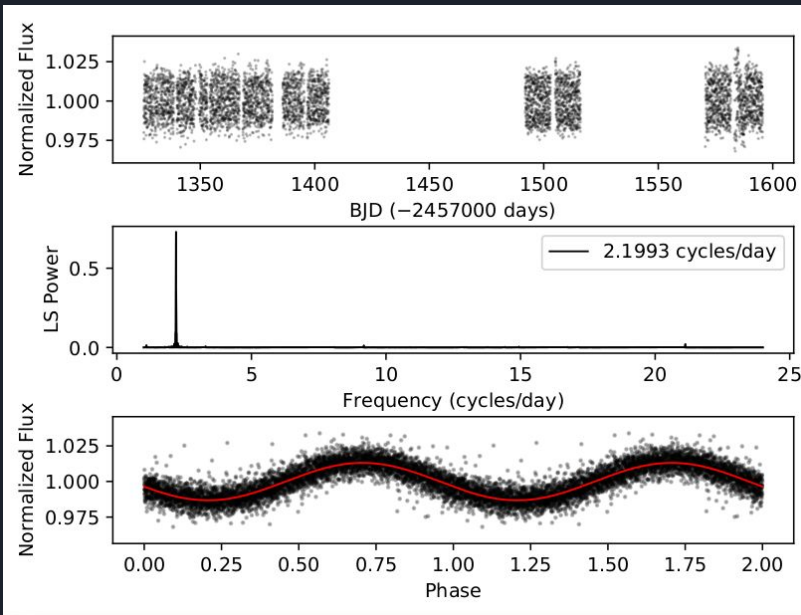Discover variable white dwarfs using ASASSN & TESS targets

Data Acquisition

- Obtained from ASAS-SN & TESS Surveys
  - White dwarfs determined from Gentile-Fusillo et al. (2019) based on GAIA
    - DR2
  - There are 500,000 WD in dataset
  - Our total targets: 8,500
   - <17th magnitude due to ASASSN & TESS restrictions


Gentile-Fusillo et al. (2019)

# Methods:

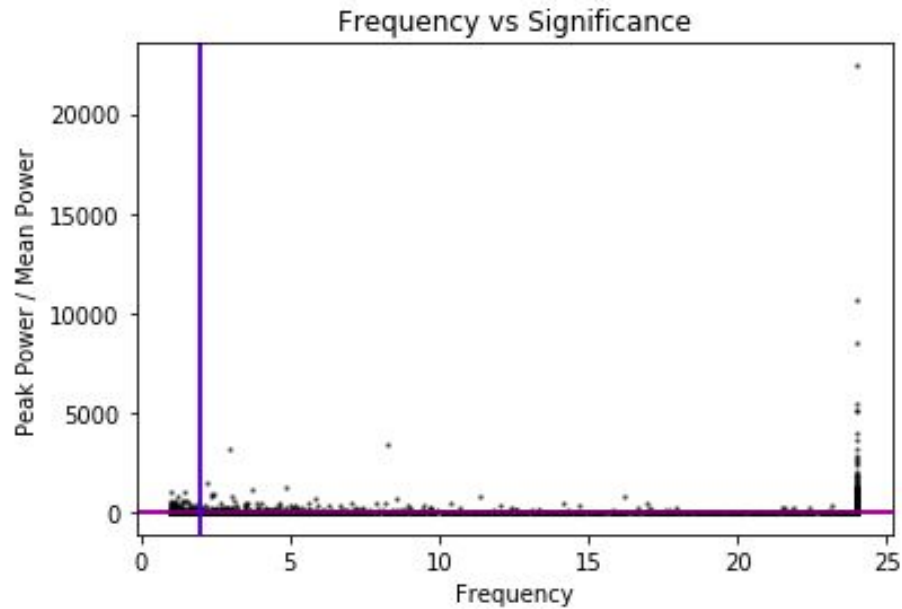Target: 4670655408301574144

- Data plotted using code by Alekzander Kosakowski & Shania Wolf
  - Produces light curves ->
    - Detection of variable targets
      - Lomb-Scargle
    - Significance >20
      - Significance is peak/mean power
      - < 20 start getting into noise
- Check literature for targets
  - Simbad, Vizier
- If not, we likely discovered the target
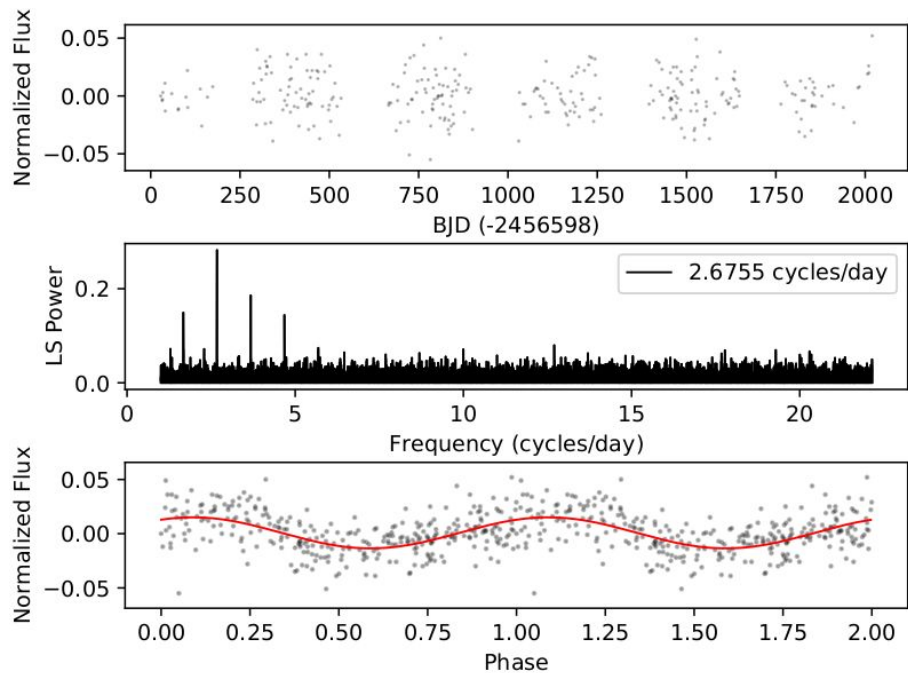
ASASSN Targets' Significance
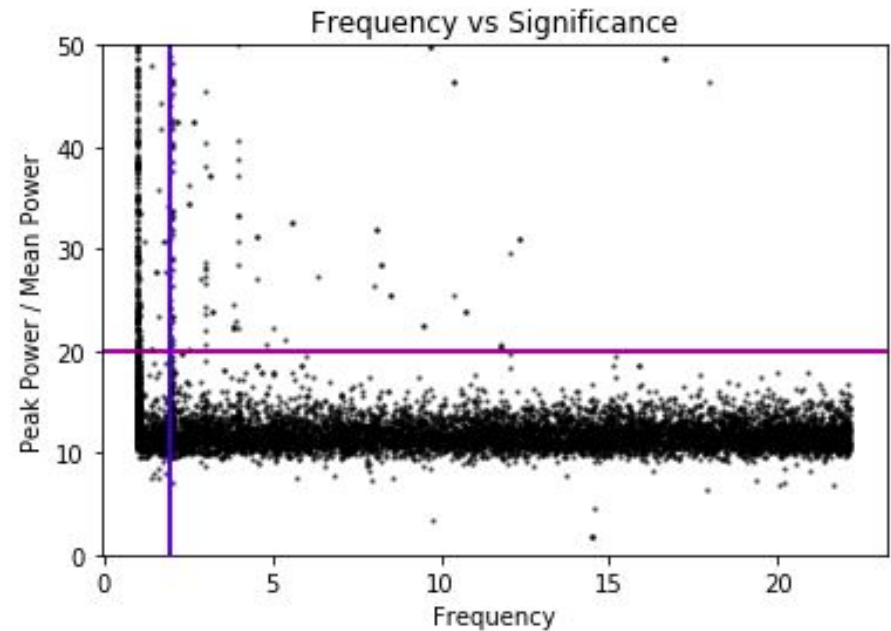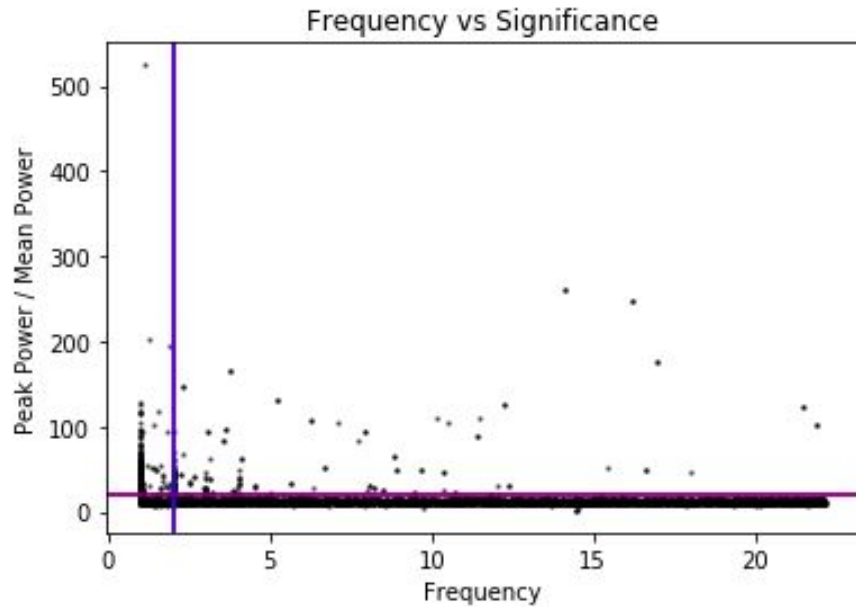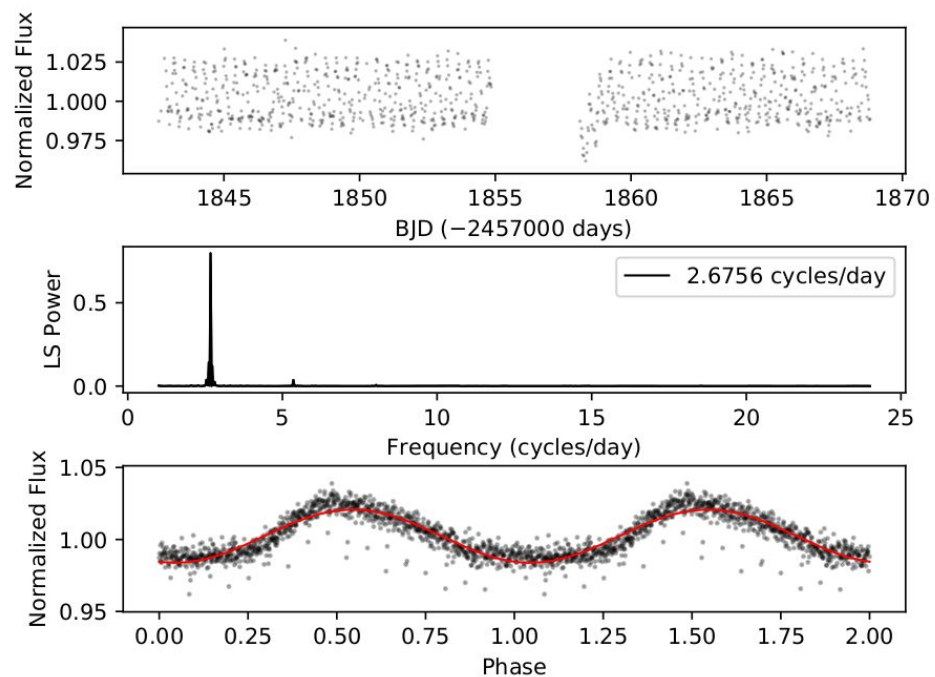
TESS Targets' Significance
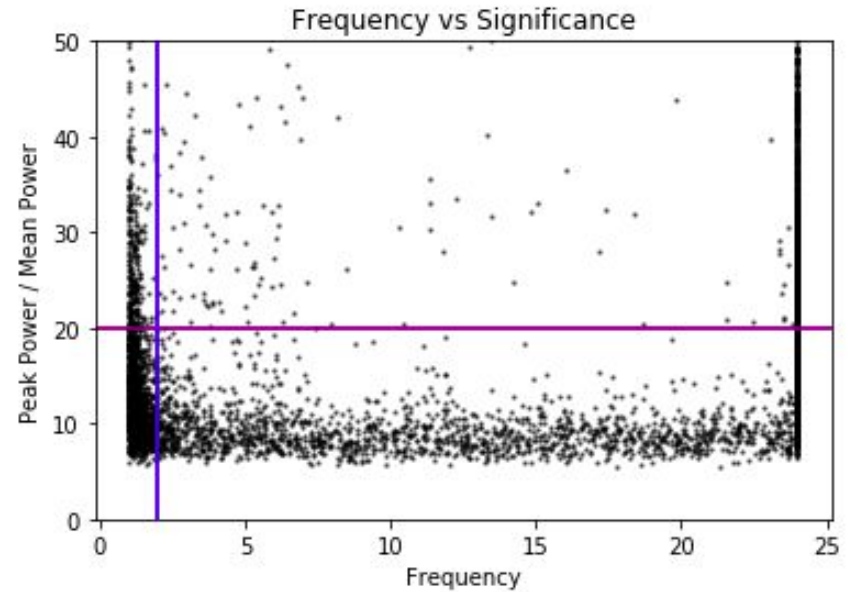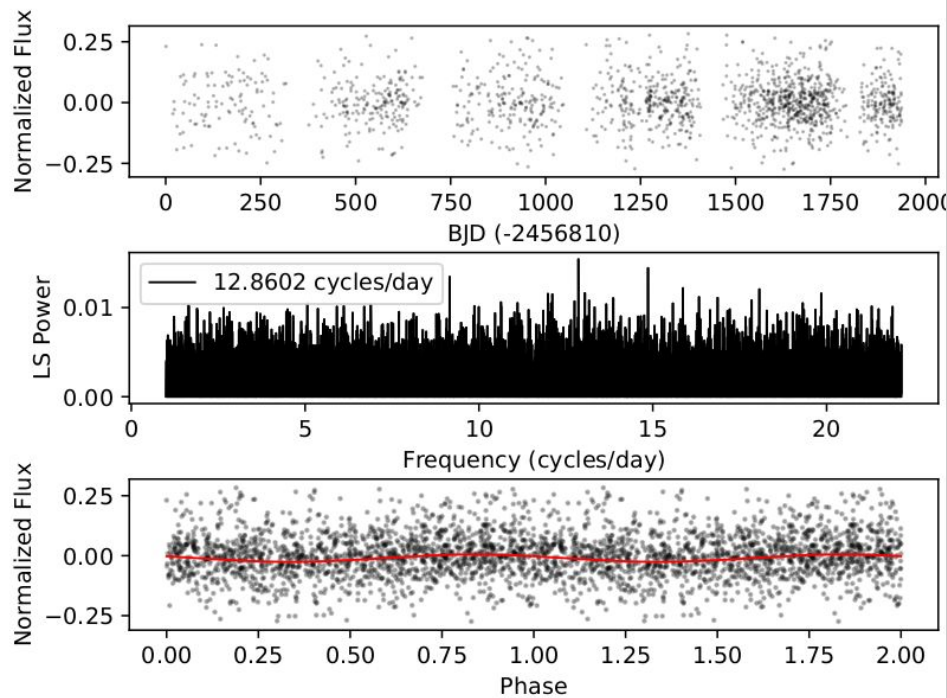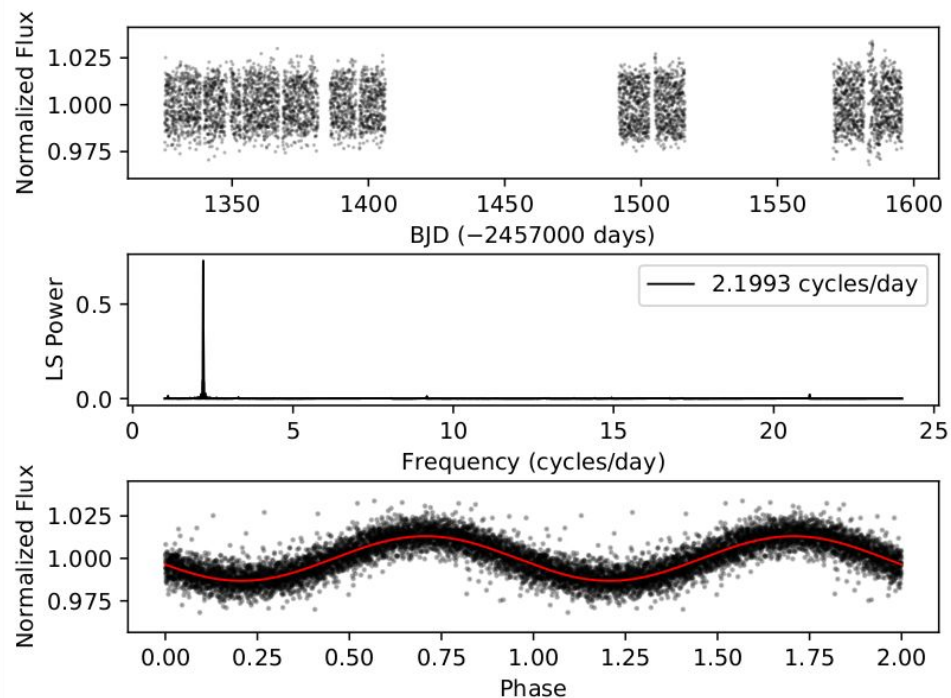
Target Comparison: 1099005032089977984

ASASSN

TESS

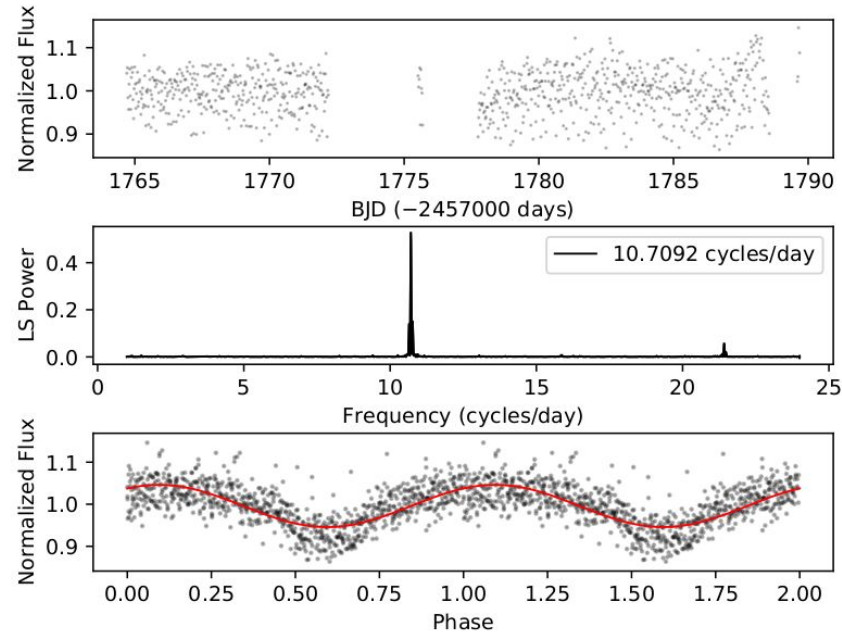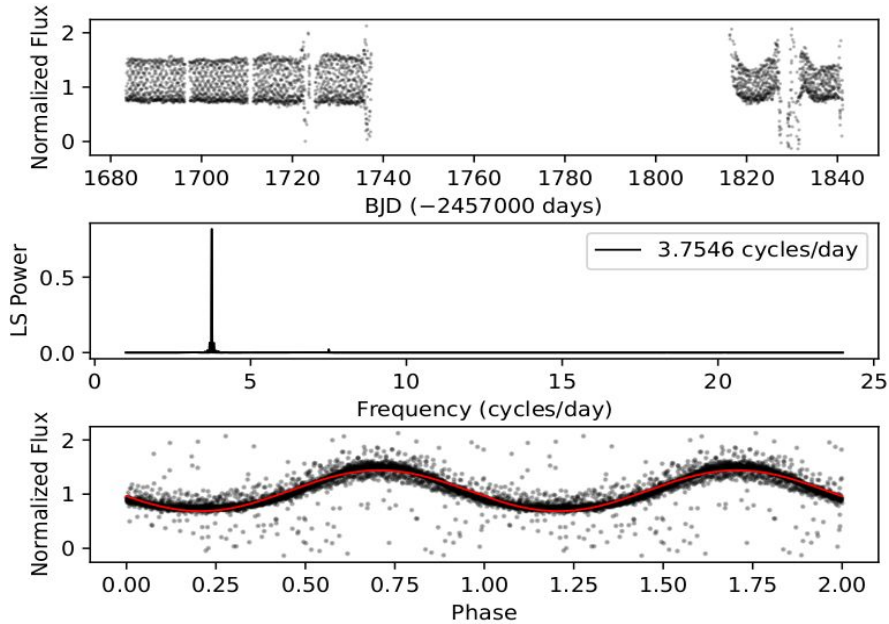Target Comparison: 4670655408301574144

Discoveries

By the Numbers:

- 44 variables found by both ASASSN & TESS
- 98 variables found by ASASSN
- 179 variables found by TESS
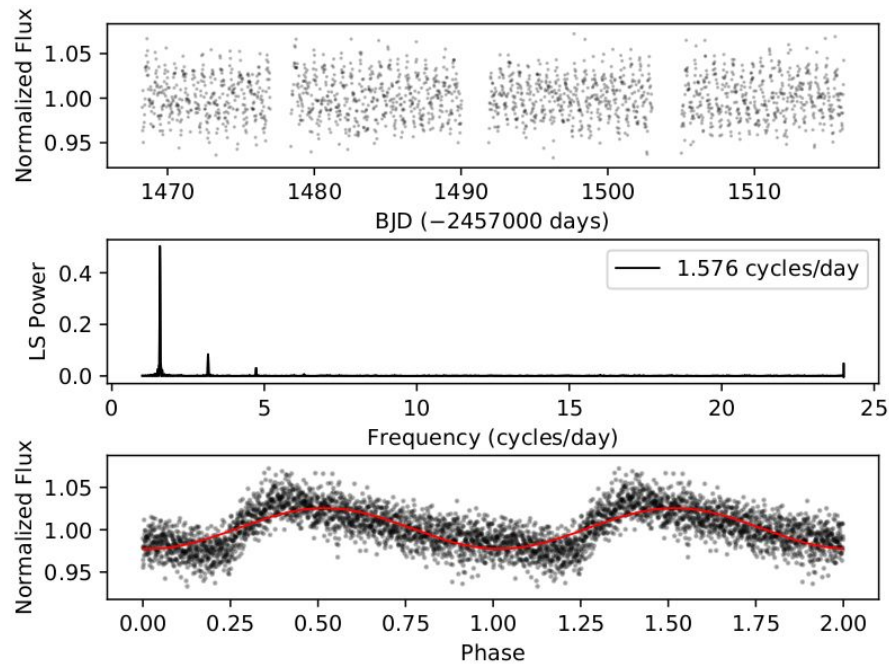
Interesting Findings:

Cataclysmic Variable: 2134077749400112128

Eclipsing Binary: 2791084432881749760

Interesting Findings:

RR Lyrae: 5574654180530308736

What's Next?

- Expand limits on significance
- Follow up observations on discoveries
  - If no spectroscopy
- Constrain parameters of each object
- Publish

Acknowledgements:

Image via: Palomar Observatory/STScI/WikiSky

Questions?