

Classification of Variable Stars in Large Databases and delta Scuti Stars in Eclipsing Binaries

Doug Hoffman

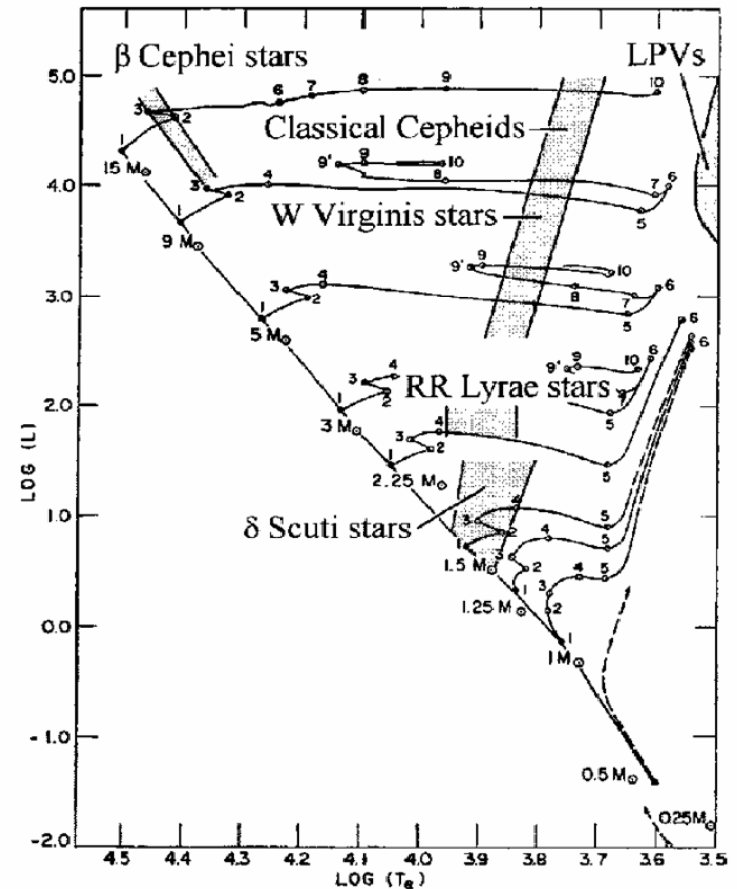
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Automated Identification

- Automated Classification scheme needed to deal with data flow & large catalogs (Kepler, LSST, Pan-STARRS, etc)
- Selected Variable Stars:
 - Delta Scuti
 - RR Lyr
 - W UMa
 - Cepheid
 - Algol
 - Beta Lyrae



ROTSE-I

- Intended to follow-up GRBs & search for “orphan GRBs”
- Approximately 1 year baseline in 1999
- 4 camera lenses
- Limiting magnitude of 15.5 in unfiltered light
- All-sky survey
- 14.5 Million Unique objects
- Data Reduced—NSVS public database



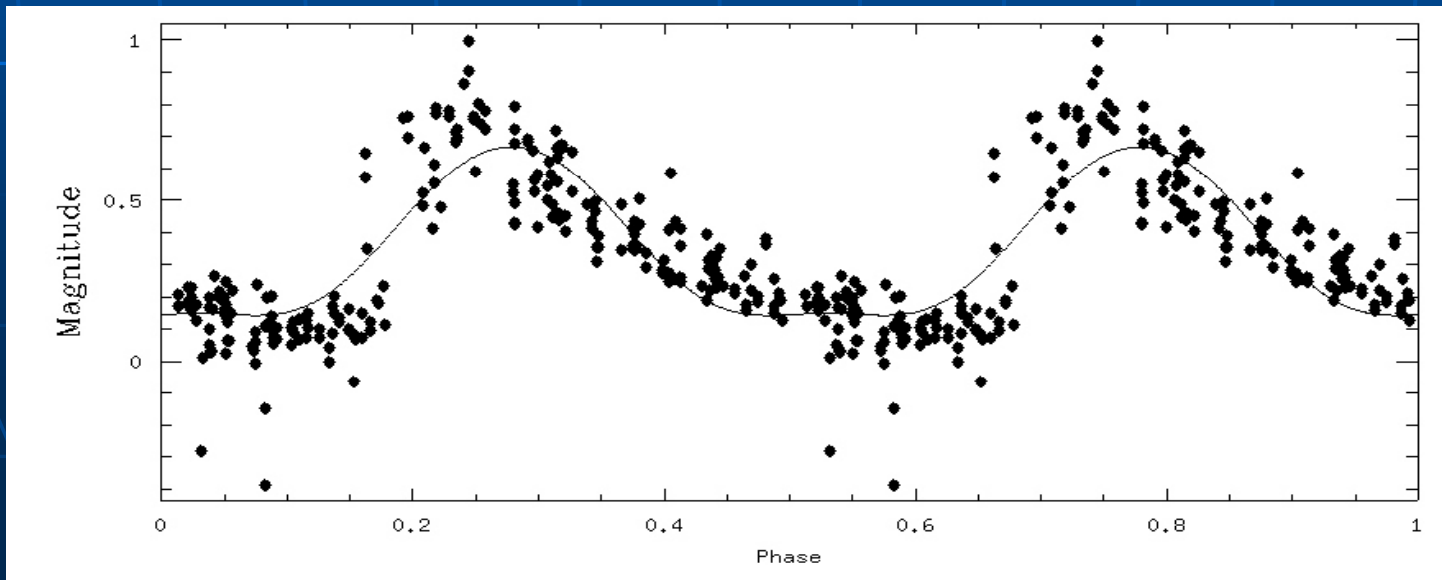
Current Classification Status

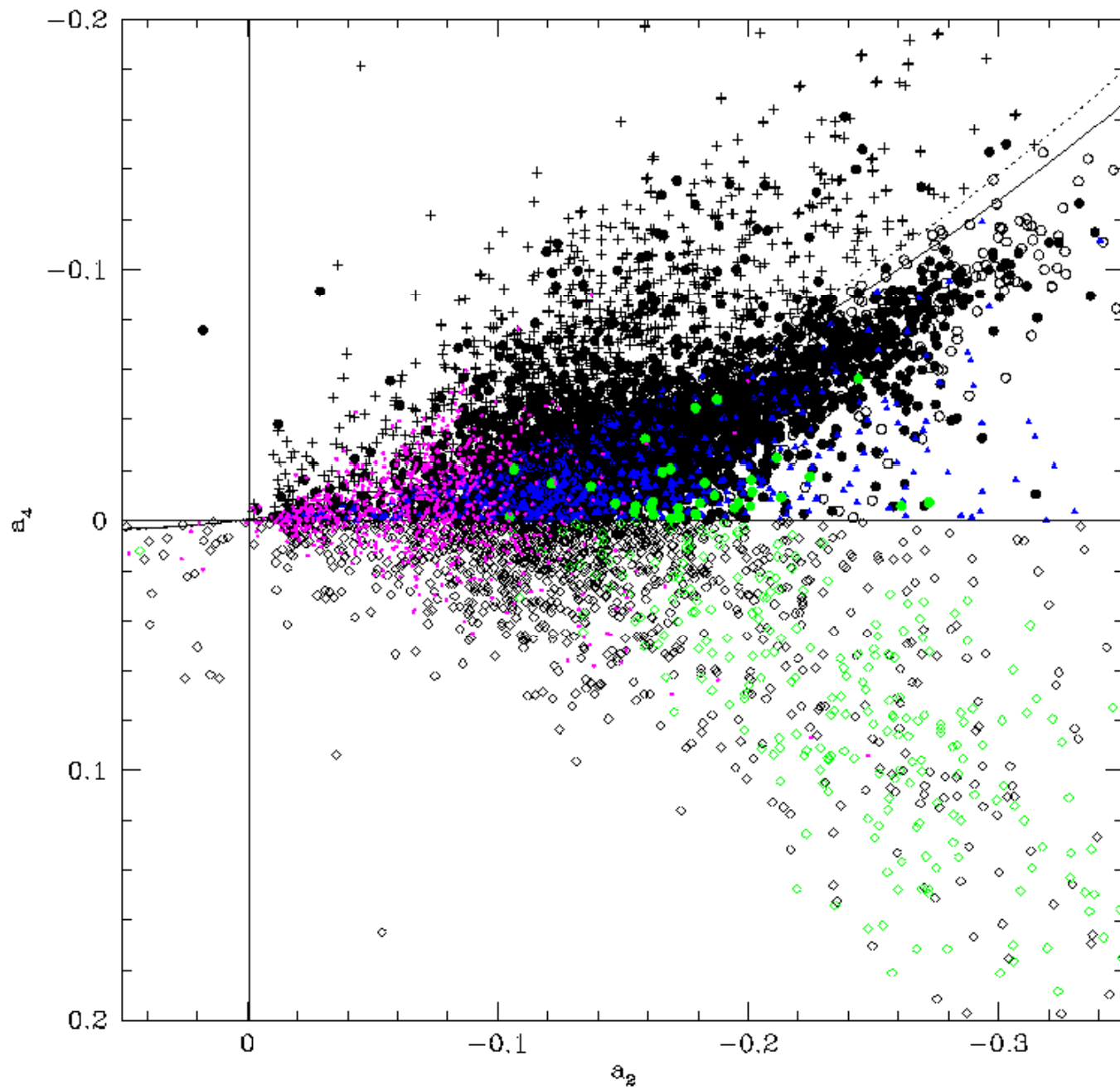
- Identified 409 “new” Algol/Beta Lyrae systems from the NSVS and published
- This first method used a lot of manual input
- Next step: Fourier Coefficient screening
- Fairly reliable way to separate Algol, W UMa, RR Lyr, and Cepheids

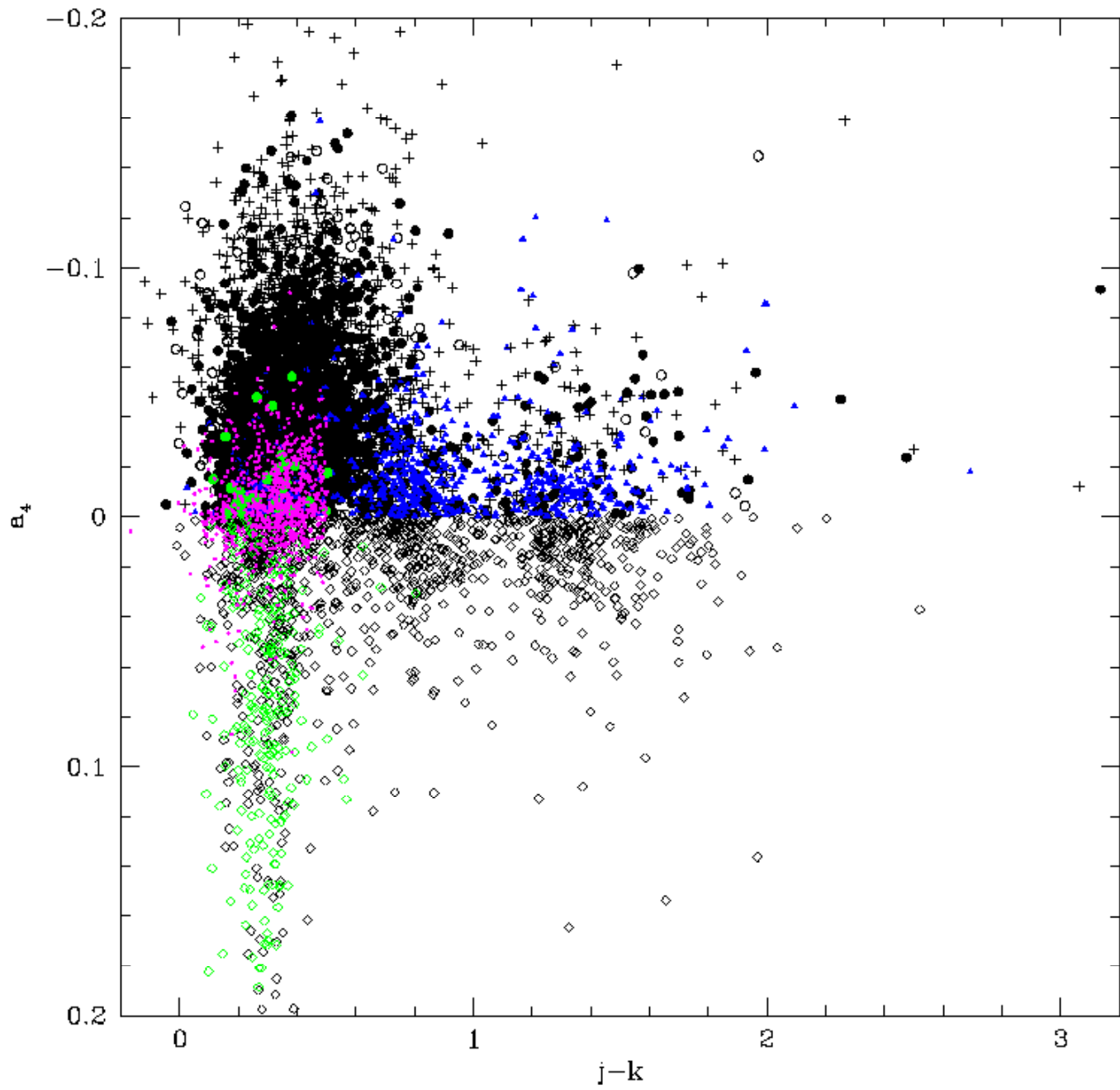
Fourier Coefficients

- First 4 most important
- Positive a_4 indicates non-sinusoidal light curve

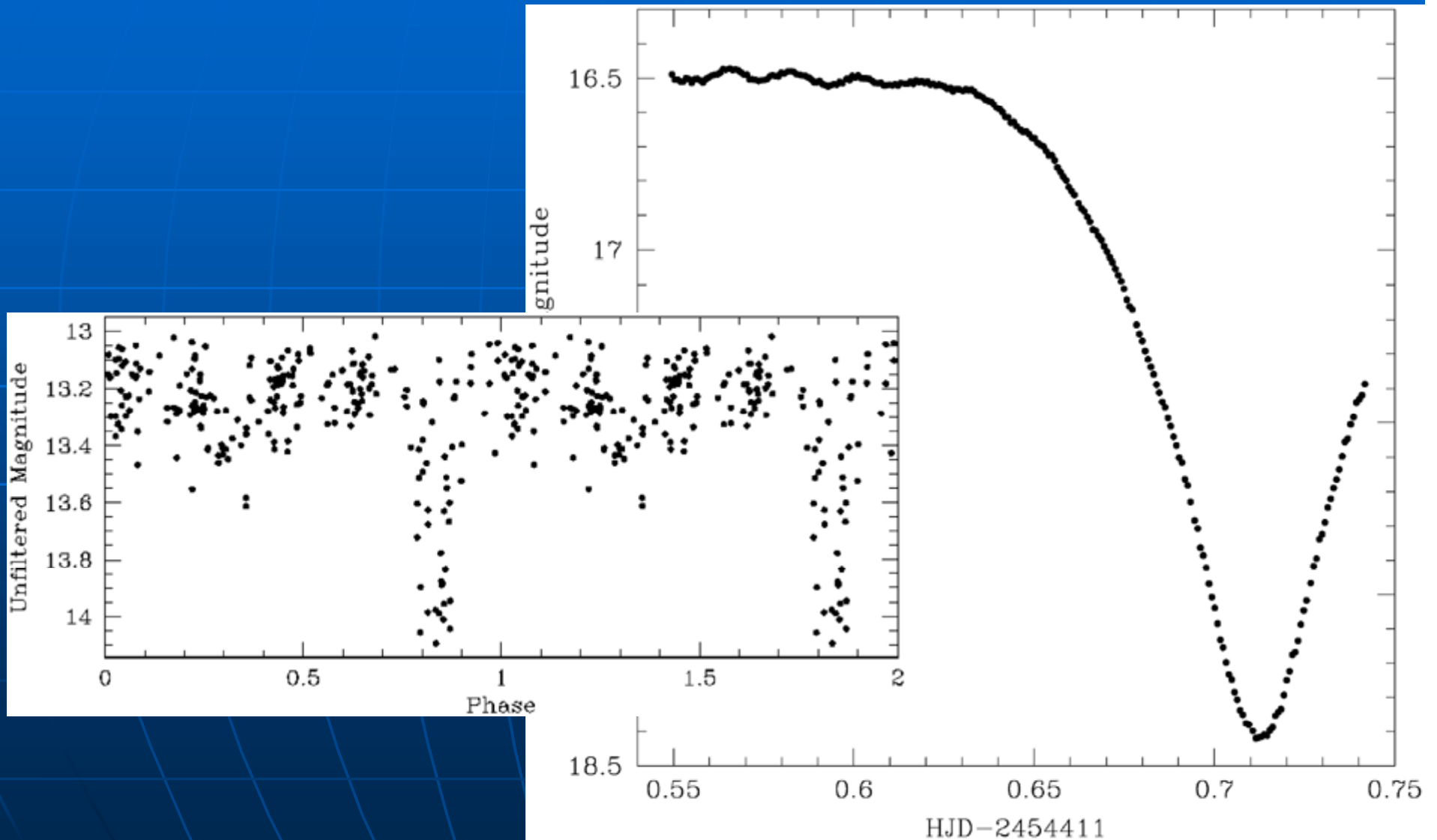
$$M(\phi) \approx \sum_{n=0}^4 a_n \cos(n\pi(\phi - \phi_{\text{offset}}))$$







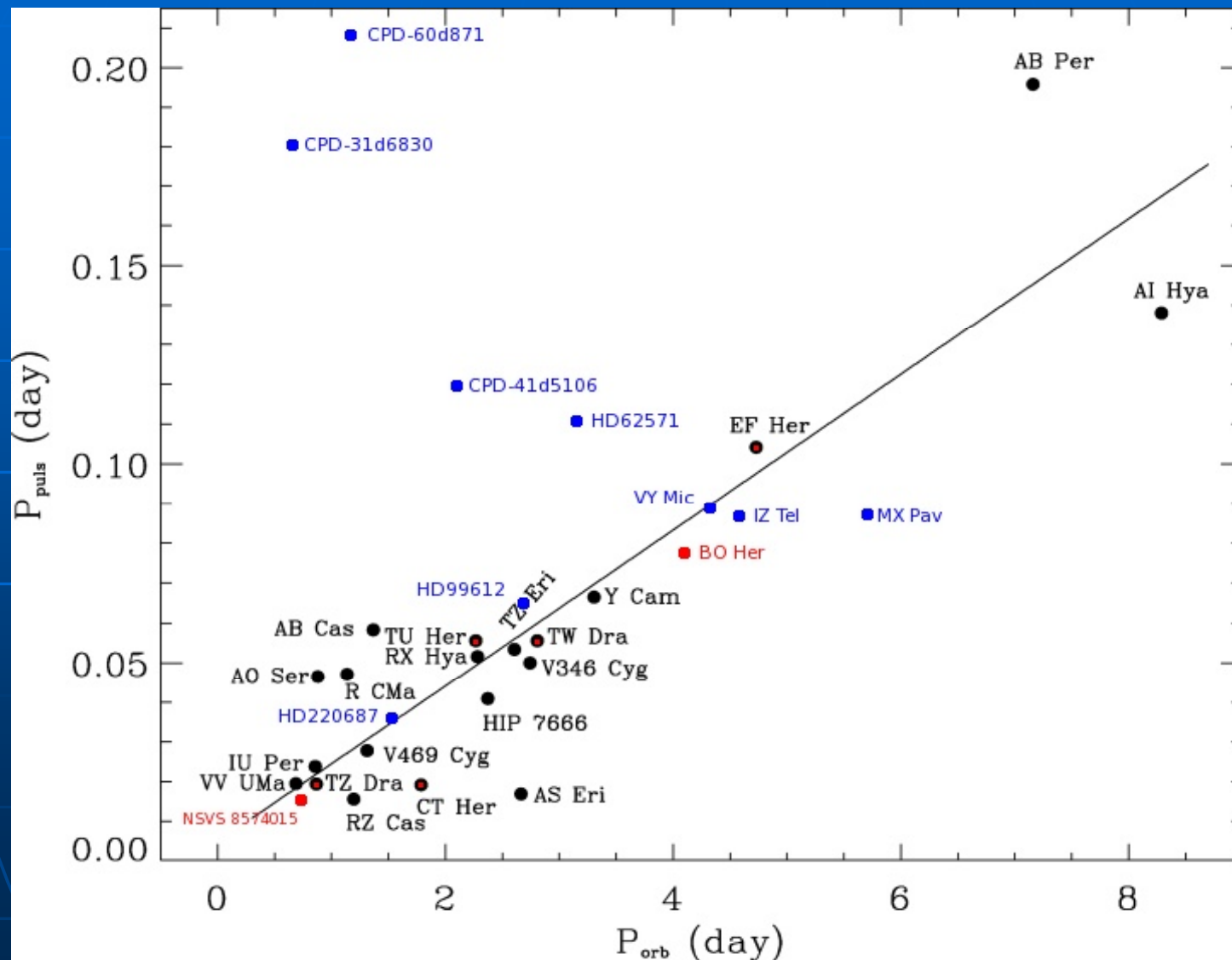
Eclipsing Pulsator NSVS 8574015



Eclipsing Pulsator Motivation

- Only ~30 eclipsing pulsator systems known
- Only 4 have had pulsational vs. orbital masses compared and only 2 were consistent
- Under what conditions and what effect does binarity have on the pulsational modes/frequencies?

Orbital vs. Pulsational Period

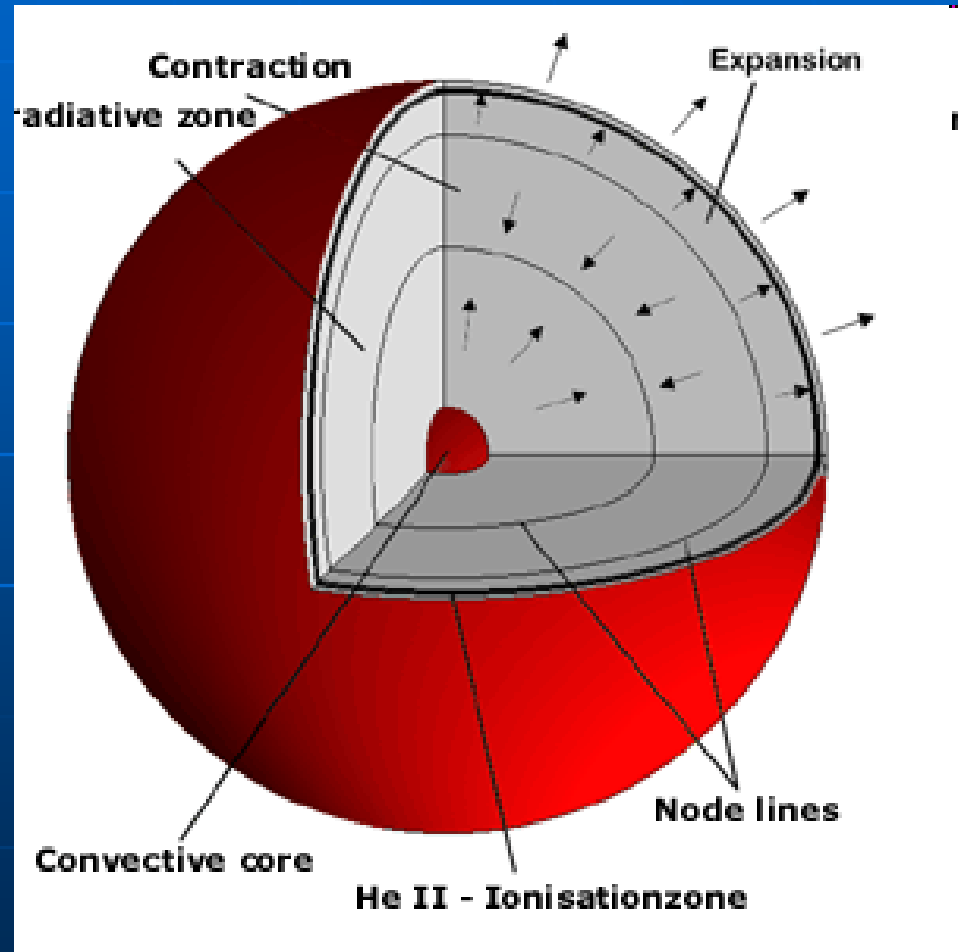
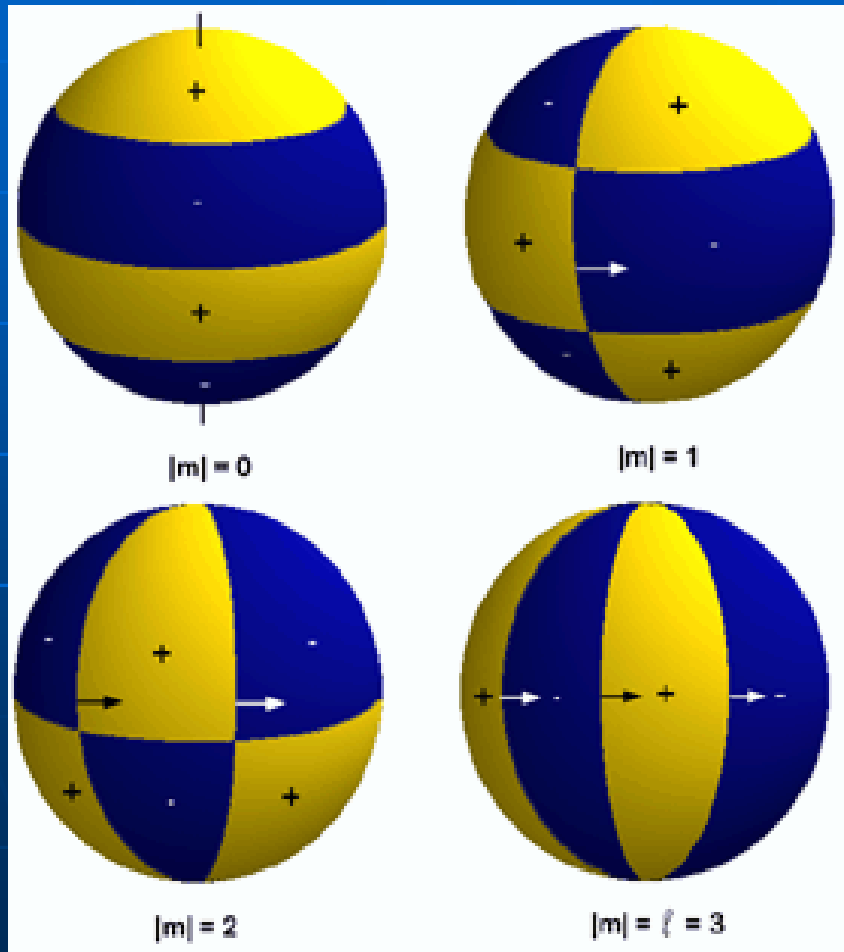


Soydugan et al, 2006

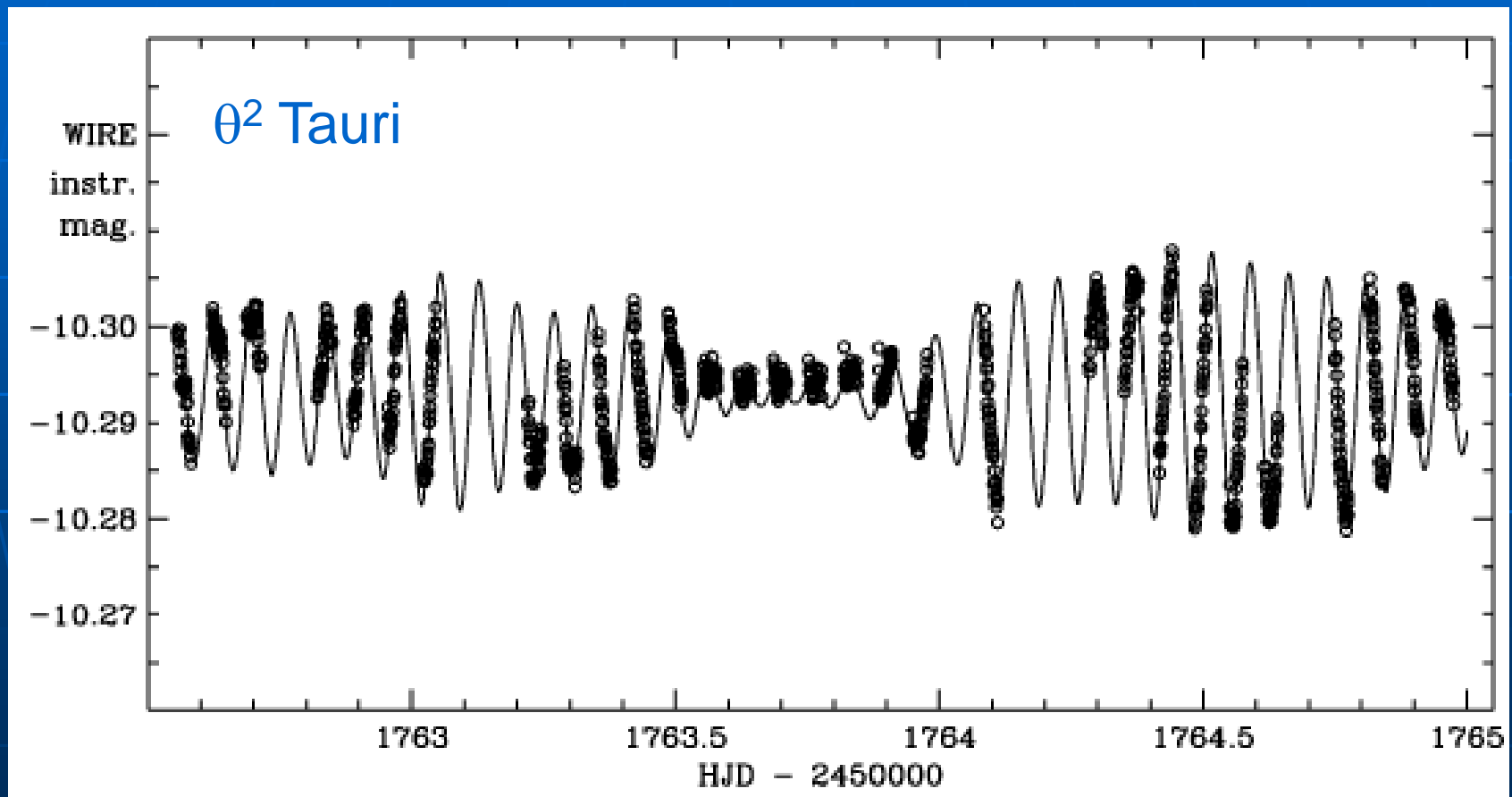
Conclusions and Future Work

- Finish Fourier coefficient classification and publish paper
- Reduce recent APO data to obtain mass ratios on the remainder of systems
- Use 1m BVI data to obtain inclination
- Use 1m B-band LCs to extract ~ 4 pulsational frequencies
- Compare frequencies to models provided by O. Creevey
- Compute pulsational masses

Pulsation Modes



Multi-Mode Lightcurves



Poretti et al, 2002

Frequency Modeling

- The more modes, the more observations needed for modeling
- 6-12 hours of observations typically yield ~ 4 frequencies

