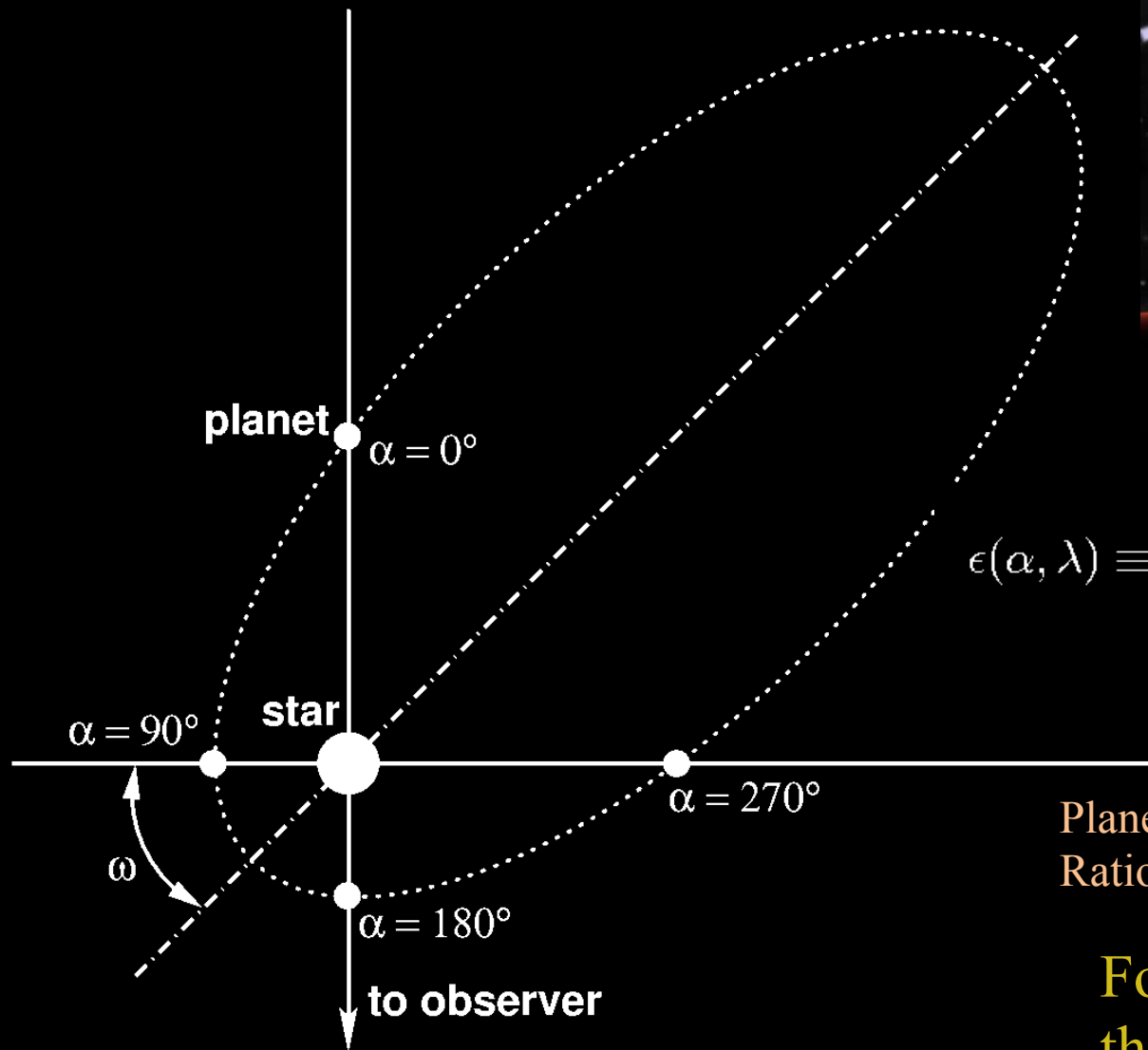


Detecting Exoplanet Phase Variations

Dr. Dawn M. Gelino

NExSci

Exoplanet phase variations



$$\epsilon(\alpha, \lambda) \equiv \frac{f_p(\alpha, \lambda)}{f_\star(\lambda)} = A_g(\lambda)g(\alpha, \lambda)\frac{R_p^2}{r^2}$$

A_g = Geometric Albedo
 g = Phase Function

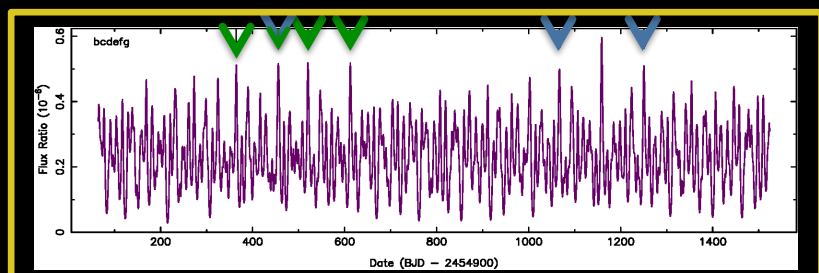
Planet Radius/Star–Planet Separation
 Ratio = inverse-square distance

**For eccentric orbits, all of
 these are time dependent!**

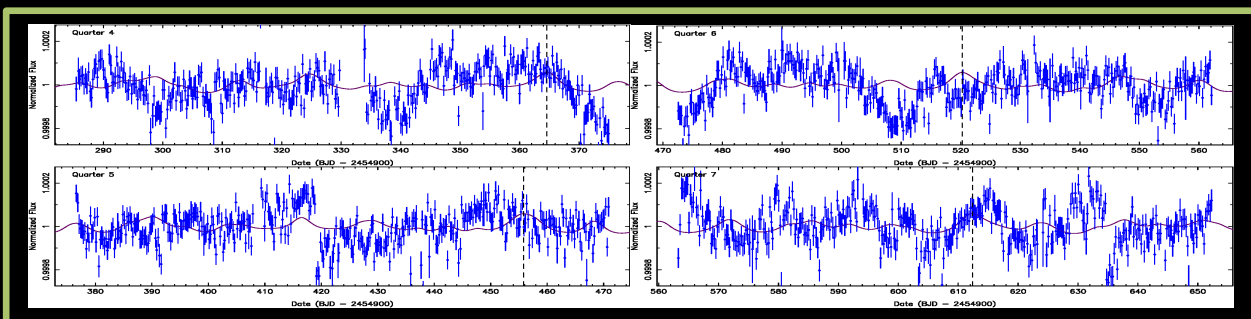
Phase Variation Study: Kepler-11

Multi-planet system

- Discovery: Lissauer et al. 2013, ApJ, 770, 131
- System: Tightly packed system of 6 $e \sim 0$, low-density, transiting planets; 5 with $P < 50$ d
- Host star: $M_{\star} \sim 0.96 M_{\odot}$; $R_{\star} \sim 1.07 R_{\odot}$; $K_p = 13.709$



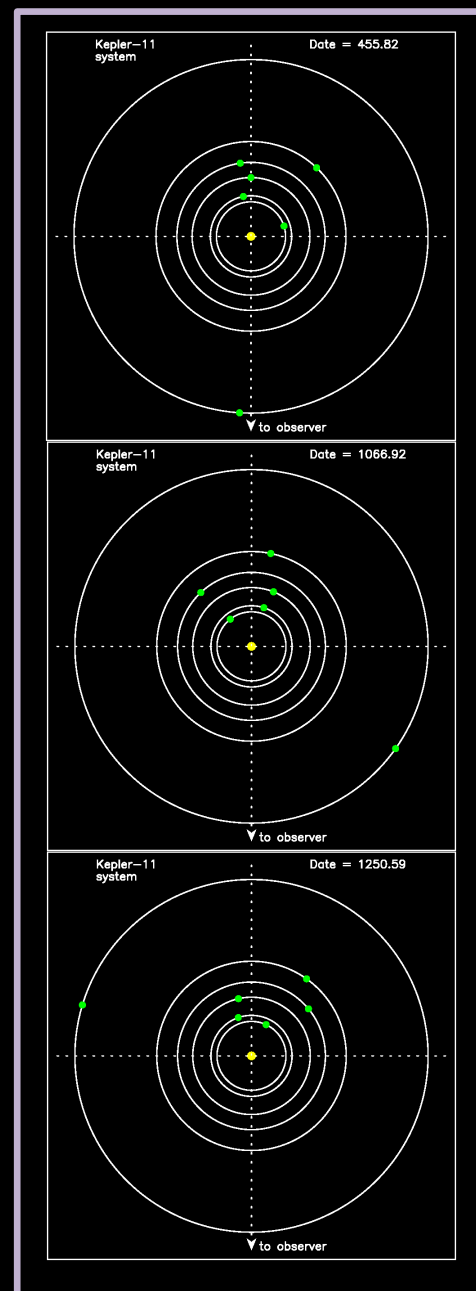
Predicted flux variations computed for Q1 – Q17 Kepler observations.



Kepler data and predicted flux variations. Quarters including maximum phase peaks (green arrows) are better fit (X^2) by a phase model than a constant model, showing this process could detect signatures in higher S/N scenarios.

Phase signatures of multi-planet systems teach us about the reflective and thermal properties of those planets, and can significantly contribute to exoplanet atmosphere models.

Top-down views of the system at the times of peak phase amplitude as shown by the blue arrows. The peak phase amplitude corresponds to when most of the planets are near superior conjunction.



American Astronomical Society (AAS) Involvement: Volunteer Service for the Scientific Community

- AAS Council Member (6/2013 – 6/2016)
 - The Council is the governing body of the 7,000 member Society and is responsible for the management, direction and control of the affairs and the property of the AAS
- AAS Publications Board (6/2016 -)
- AAS eBooks Board (1/2016 -)
- Journals Future Task Force Member (2014)
 - Recommended major changes in the AAS Journals (ApJ, AJ, ApJL, ApJS), including:
 - A single point of entry will be established for publishing in AAS journals, greatly simplifying the submission process for authors.
 - A single office will manage all processing functions to increase the reliability and speed with which manuscripts are handled.
 - All submitted manuscripts will be sorted into broad topical areas — “corridors” — and assigned to the journals based on their new content-based definitions.
 - The editorial hierarchy will be revamped to better match the submitted content.
- AAS Agent (2013 -)
 - Educating your colleagues about the AAS
 - Informing them of benefits and deadlines
 - Recruiting new members
 - Making the Society better and more relevant



Dawn M. Gelino
NASA Exoplanet Science
Institute
(6/2013-6/2016)