EPSC Abstracts
Vol. 6, EPSC-DPS2011-1622, 2011
EPSC-DPS Joint Meeting 2011

Interferometric Studies of Exoplanet Hosting Stars

K. von Braun (1,3), T. S. Boyajian (3), S. R. Kane (1,3), D. R. Ciardi (1,3), G. T. van Belle (5), T. A. ten Brummelaar (4), M. Lopez-Morales (6), H. McAlister (3), G. Schaefer (4), T. J. Henry (3), S. T. Ridgway (7), R. White (3), L. Sturmann (4), J. Sturmann (4), N. H. Turner (4), C. Farrington (4), P. J. Goldfinger (4)
(1) NASA Exoplanet Science Institute; (2) California Institute of Technology; (3) Georgia State University; (4) CHARA Array; (5) Lowell Observatory; (6) CSIC-IEEC; (7) NOAO

Abstract

Planetary characterization is playing an increasingly important role in exoplanet research. A frequently overlooked aspect in the calculation of physical quantities of these planets is that they are actually functions of astrophysical parameters of the host stars, such as stellar luminosity or diameter. The value of "understanding the parent stars" cannot be overstated in the realm of assessing the radii of transiting planets, the potential of harboring liquid water on exoplanets (habitable zone), the planetary equilibrium temperatures, etc. We use long-baseline interferometry to provide directly determined stellar astrophysical parameters of exoplanet host stars with the aim of characterizing their planet population. In this presentation, we show the results of our studies of the multiplanet systems GJ 581, GJ 876, and 55 Cancri with planets in or near the respective habitable zones, and of GJ 436 with a transiting hot Neptune.

1. Introduction

The formation, evolution, and environment of extrasolar planets are heavily dependent on the astrophysical properties of their respective parent stars. In particular, the location and extent of the system's habitable zone (HZ) are direct functions of the parent star's size and surface temperature, both of which are frequently determined by stellar modeling. Furthermore, the calculation of exoplanetary radii based on the photometric flux decrement during transit relies on the stellar radius, which is often based on stellar models. The direct determination of these astrophysical quantities not only provides a model-independent characterization of the exoplanets and/or their environments, but it can serve to calibrate indirect values for systems for which direct measurements are not feasible.

The advent of long-baseline interferometry at near-infrared or optical wavelengths has made it possible to directly measure stellar diameters and effective temperatures. We use the Georgia State University CHARA Array with its 330m baseline in the *H* band to characterize exoplanet host stars. Combined with stellar distance from trigonometric parallax values and spectral energy distribution (SED) fitting to literature photometry, measurements of the angular diameter provide direct values of stellar linear diameter (Fig. 1) and effective surface temperature (Fig. 2).

2. Targets

In our presentation, we present our results on the following exoplanet hosting stars:

- GJ 581: M dwarf host of a multiplanet system with at least one planet in the HZ (Fig. 3).
- GJ 436: M dwarf host of a transiting hot Neptune.
- 55 Cancri: multiplanet system with a transiting super-Earth and one planet in the HZ.
- GJ 876: M dwarf host of a multiplanet system.

3. Figures

Below are three examples of our data and results.

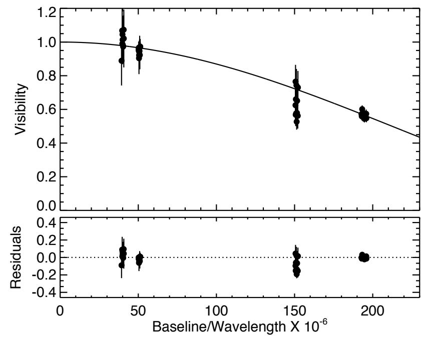

Figure 1: Interferometric visibilities of 55 Cancri taken with the Palomar Testbed Interferometer (PTI) and CHARA, along with our best fit for the limb darkening corrected angular diameter [1].

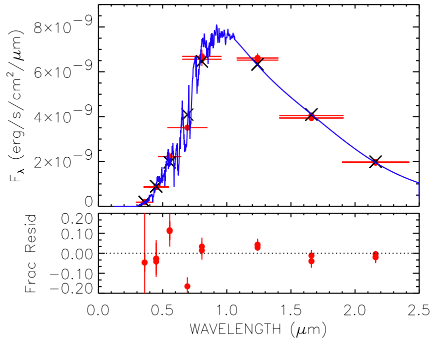

Figure 2: Spectral energy distribution fitting of literature photometry of GJ 581 to an M dwarf spectral template [2,3].

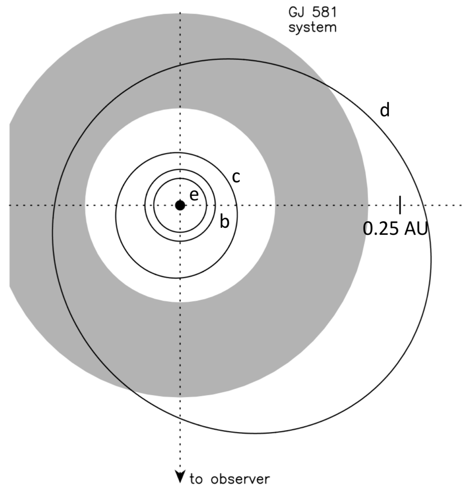

Figure 3: Orbital configuration of the planets in the GJ 581 system, along with the grey-shaded location of the system's HZ. Planet d spends the majority of its "year" in the temperature range that allows for water to exist in liquid form [2,4].

References

[1] von Braun, K. et al. 2011, in prep.

[2] von Braun, K. et al. 2011, ApJ, 729, L26

[3] Pickles, A. J. 1998, PASP, 110, 863

[4] Mayor, M., et al. 2009, A&A, 507, 487