Fundamental Parameters and Habitable Zones of Exoplanet Host Stars

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OVERVIEW

We use infrared and optical interferometry, coupled with spectral energy distribution fitting and trigonometric parallax, to get estimates of stellar parameters that are as model-independent as possible. The main purpose of this research is to produce empirical constraints to stellar models and to characterize the exoplanets in orbits around their hosts. **You only understand the exoplanet as well as you understand its parent star.**

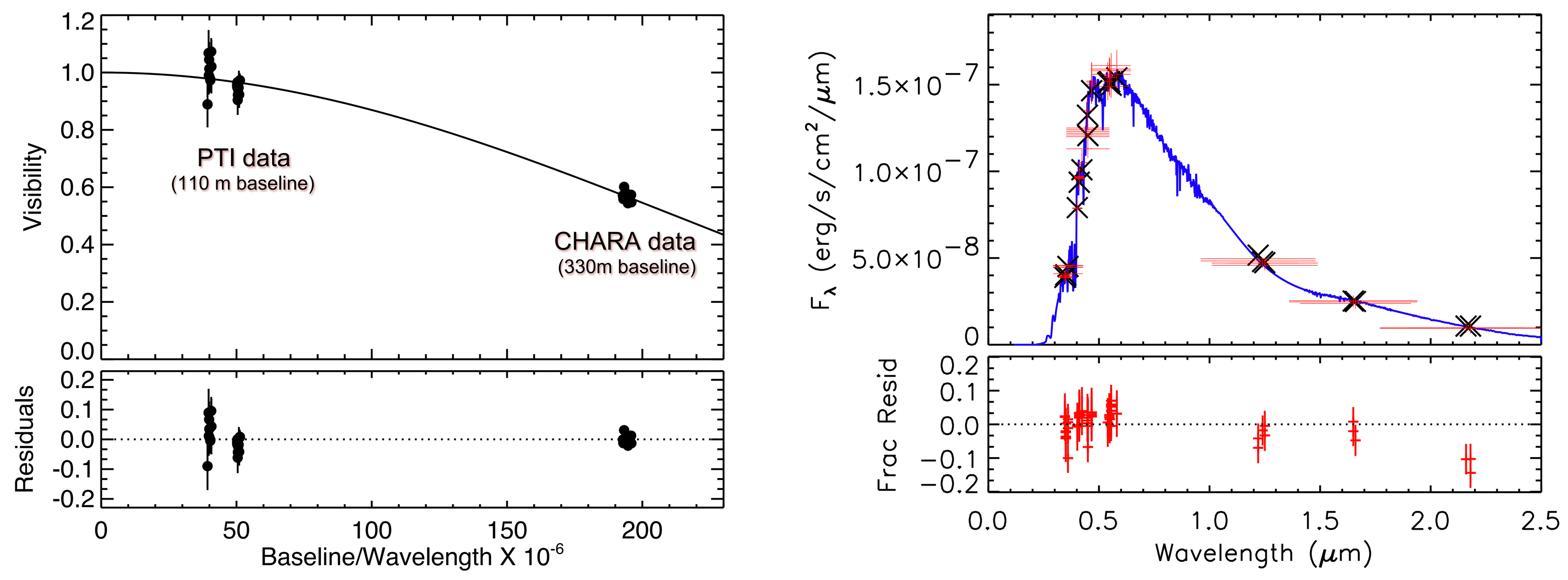

Fig 1 shows examples of our interferometric data (left panel) and SED fitting (right panel) for the exoplanet host star 55 Cancri. Combining these data with trigonometric parallax values allows for empirical determination of stellar radius, temperature, and luminosity.

Fundamental Stellar Parameters

The directly determined values for stellar radii and temperatures enable us to create empirical Hertzsprung-Russell Diagrams. Exoplanet host stars from the literature and currently under investigation are identified in blue and red, respectively. Stars not currently known to host a planet are shown in grey. Particularly for KM dwarfs, these directly determined values provide constraints for models, which tend to underestimate stellar radii and overestimate stellar surface temperatures for late type dwarfs.

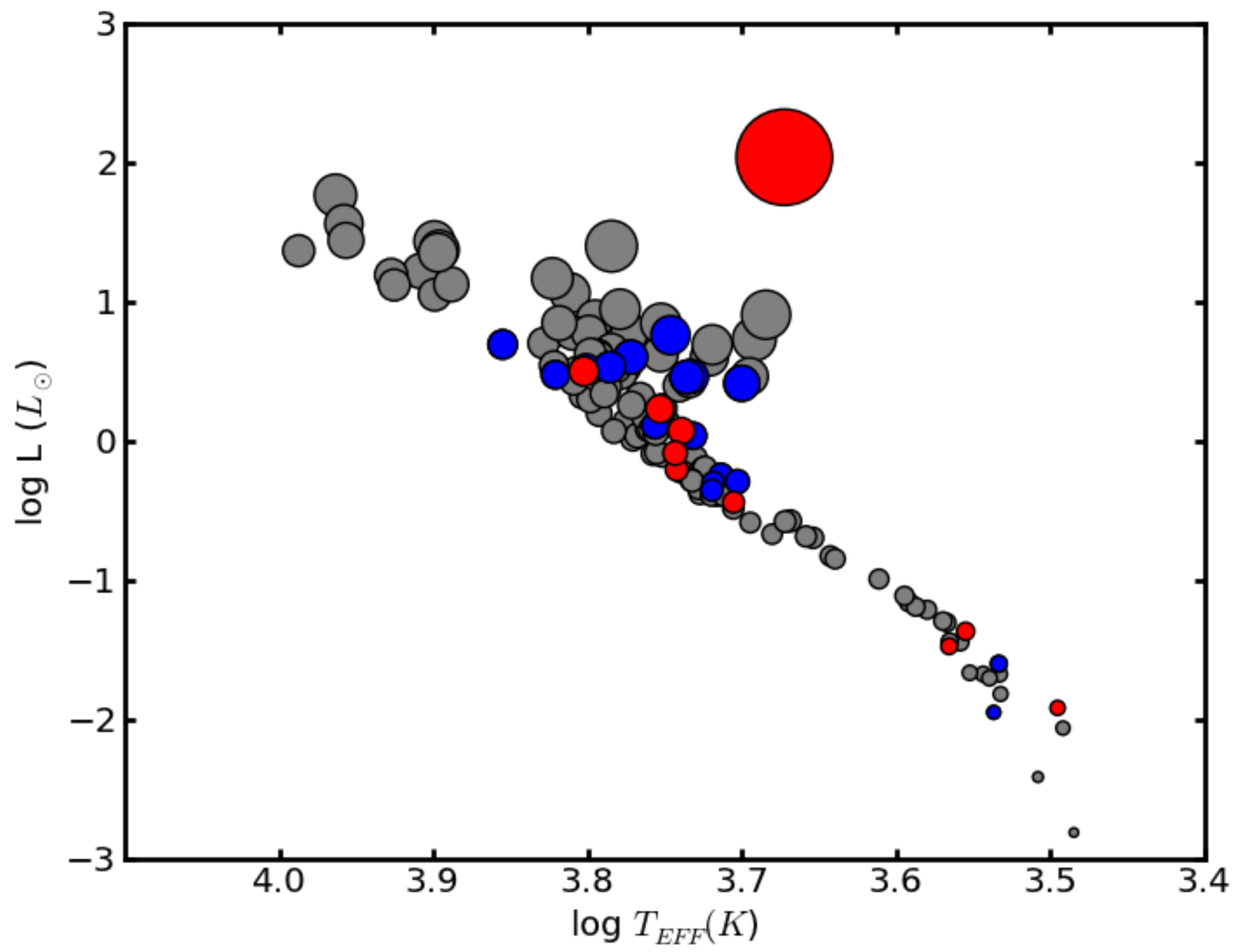

Fig. 2 Empirical H-R Diagram for (Exoplanet Host) Stars
Shown here is the empirical H-R Diagram for all main-sequence stars with interferometrically determined radii whose random uncertainties are smaller than 5% (Boyajian et al. 2012, 2013, and references therein). The diameter of each data point is representative of the respective stellar radius. Error bars in effective temperature and luminosity are smaller than the size of the data points. Exoplanet host stars are identified in **blue** (from Baines et al. 2008, 2009; Boyajian et al. 2013; Henry et al. 2013; Kervella et al. 2003; van Belle & von Braun 2009; von Braun et al. 2011, 2012a, 2012b). The exoplanet host stars that are presented here are shown in **red** (von Braun et al. in prep). Stars that are not currently known to host any planets are shown in **grey**.

The Habitable Zone (HZ)

We define the circumstellar HZ as the annulus around a star in which a planet with a sufficiently dense atmosphere can sustain liquid water on a solid surface. The location and extent of this HZ is (mostly) dependent on stellar luminosity, i.e., stellar radius and effective temperature.

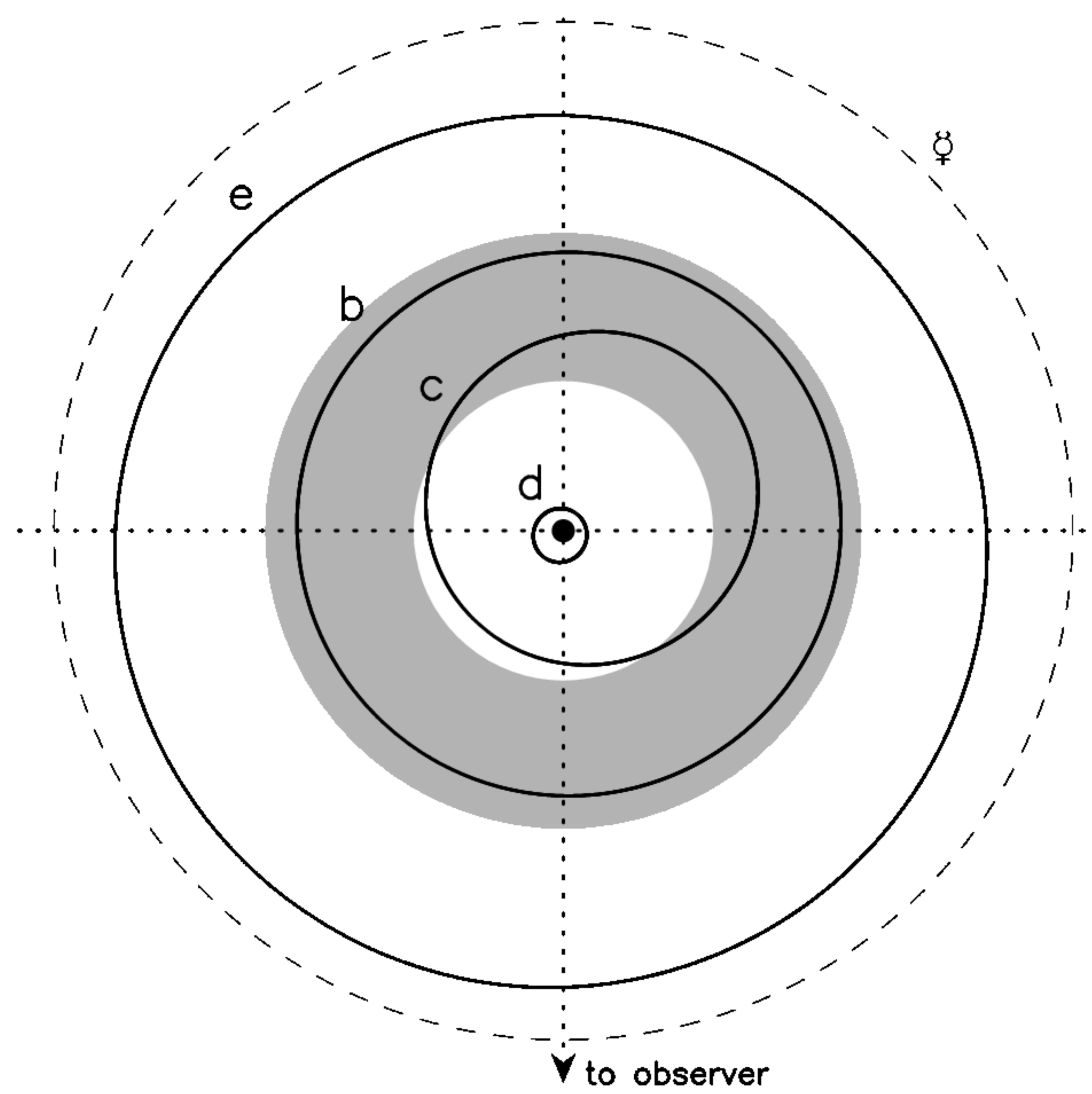

Fig. 3 Habitable Zone in the GJ 876 System The HZ, shaded in grey, of the GJ 876 system, a multiplanet, main-sequence, exoplanet host of spectral type M4. Planets b and c spend all or large parts of their orbital periods in the circumstellar HZ. Mercury's orbital distance (0.39 AU) is shown as a circular orbit for reference. Orbital parameters for the GJ 876 system are from Rivera et al. (2010); HZ location and extent are calculated using the formalism described in Jones & Sleep (2010). See also hzgallery.org for HZ diagrams.

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