Glossary

The following is a glossary of some of the terms used in this book. For additional definitions, we recommend the use of https://wikipedia.org, particularly their astronomy glossary page at https://en.wikipedia.org/wiki/Glossary_of_astronomy.

Apastron The point in the orbit of an extrasolar planet when it is the furthest away from its parent star.

Asteroseismology Study of stellar interiors and astrophysical parameters based on oscillations on their surfaces. See Sect. 2.1.

Baseline The distance between two telescopes in an interferometric array, sometimes measured in units of the operational wavelength. See Sect. 2.1.

Bolometric Flux The amount of energy received per second from a star, integrated across the full range of wavelengths. We determine this quantity by means of SED fitting. See Sect. 2.2.

CHARA CHARA stands for Center for High Angular Resolution Astronomy and refers to the interferometric array on Mount Wilson in CA, owned and operated by Georgia State University, with which the majority of the work described in this book was performed.

Coherent, Coherence Electromagnetic radiation is said to be coherent if the waves maintain a constant phase relationship. This enables measuring the phase difference of a wavefront at two or more different locations on the ground, which constitutes the basic data required for interferometry. See Sect. 2.1.

Convective Mixing Length Parameter The convective mixing length parameter, α_{MLT}, refers to the distance that a parcel or blob of gas of a certain temperature would travel before it dissipates its thermal energy and adjusts its temperature to its surroundings. Thus, it gives a sense of how quickly a stellar atmosphere is mixed by convection. See Sect. 3.2.11.

K. von Braun, T. Boyajian, *Extrasolar Planets and Their Host Stars*,
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Effective Temperature Stellar effective temperature, T_{eff}, is defined as the surface temperature of a black body that emits as much energy per second as the star to which the effective temperature pertains. Thus, it provides a uniform measure of stellar temperature. See Sect. 2.2.

Extrasolar Planet, Exoplanet Defined here as a planet that orbits a star or multiple stars other than the sun, though the term could also include free-floating planets, i.e., planets that do not orbit any stars.

Habitable Planet Defined here as a planet on which life can exist. Based on this definition, this currently only includes Earth. See Sect. 2.4.

Habitable Zone, HZ The range of distances from its parent star(s) at which an exoplanet with a surface may harbor liquid water. Additional assumptions, such as the amount of greenhouse gases in the planetary atmosphere, go into the calculations of HZs. See Sect. 2.4.

Interferometric Fringe The technique of interferometry is based on the detection of interference of coherent light to measure the brightness distribution of an object on the sky. Interference is visualized in interferometric fringes. See Sect. 2.1 and Fig. 2.5.

Interferometer, Interferometric Array The system that performs the technique of interferometry. See detailed description in Sect. 2.1.

Interferometry The method of using multiple telescopes to achieve very high angular resolution. This technique is described in detail in Sect. 2.1.

Limb Darkening Limb darkening refers to the effect where a stellar disk appears brighter at the center than at the limb. The reason for this effect is that one sees deeper and thus hotter layers of the stellar atmosphere at the center of the disk than at the limb. See Sect. 2.1 and Fig. 2.10.

Luminosity Stellar luminosity refers to the amount of energy a star emits per unit time.

Optical Delay Lines These are elements of an interferometer to detect interferometric fringes. See Sect. 2.1 for much more detail. See Figs. 2.3 and 2.4 for what optical delay lines look like, and see Fig. 2.2 for the function of optical delay lines in an interferometric array.

Optical Path, Optical Path Length The optical path is the path a photon takes from the star through all of the elements of the optical system to the detector. One of the principal engineering challenges involved in the operation of an interferometric array is the adjustment of the optical path lengths for all operating telescopes to exactly the same value via the use of optical delay lines. See Sect. 2.1 and Fig. 2.2.

Periastron The point in the orbit of an extrasolar planet when it is the closest to its parent star.

Spectral Energy Distribution, SED, SED Fitting The distribution of energy emitted by a star as a function of wavelength. The integral over wavelength of a stellar SED corresponds to the bolometric flux. To determine the zeropoint of the SED, we typically use literature broadband photometry, a process referred to as SED fitting. See Sect. 2.2 for much more details on SEDs and SED fitting, and see Figs. 2.7 and 2.8 for examples.

Spectrophotometry In astronomy, spectrophotometry essentially refers to flux-calibrated spectroscopy. That is, the energy received at every wavelength is normalized such that relative energy levels are preserved—in contrast to broad-band photometry where the energy received over a range of wavelengths is integrated across the filter bandwidth. As such, spectrophotometry provides a much less coarse approach to determining stellar energy distribution. See Sect. 2.2 and Fig. 2.7.

Stellar Angular Diameter Angular diameter refers to the apparent size of a star on the sky, as opposed to physical diameter, which is expressed in units of length. CHARA routinely measures stellar angular diameters of fractions of a milliarcsecond with 1–3% precision. The size of a soccer ball as seen on the surface of the moon approximately corresponds to one milliarcsecond. See Sect. 2.1.

Transiting Planet, Transiting Exoplanet A planet is said to transit its parent star(s) if it partially occults the stellar surface as seen from an observer. Venus and Mercury periodically transit the surface of the sun as shown in Fig. 2.10. Transiting exoplanets block minute amounts of the light received from their parent stars. This flux decrement determines the relative sizes of planet and parent star and provides fundamental insights in exoplanet studies.

van Cittert-Zernike Theorem The van Cittert-Zernike Theorem represents the basis on which astronomical interferometry is founded. It essentially states that interferometric visibility is related to the brightness distribution of an object on the sky. See Sect. 2.1.

Visibility, Visibility Function Interferometric visibility represents the degree of coherence of light received at two or more telescopes in an interferometric array. It corresponds to the interferometric data produced when studying angular sizes. It is a function of the angular size of the object, the operational wavelength, and the projected length of the distance between the telescopes. The visibility function corresponds to the dependence of the visibility upon baseline. Its shape depends on the topology, i.e., brightness distribution, of the object on the sky. For uniform disk profiles, the visibility function looks like what is shown in Fig. 2.6. See Sect. 2.1 for much more detail.

Index

K. von Braun, T. Boyajian, *Extrasolar Planets and Their Host Stars*,
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