Name: Rory Barnes
Email: rory@astro.washington.edu
Institution: University of Washington
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A planet's capacity to support surface life is the result of a complex interplay between the planet’s characteristics, its host star, and the other bodies in the system. Traditionally, the first order attempt to assess planetary habitability involves using mass and/or radius measurements to determine the likelihood that the planet is terrestrial, and comparing its orbital semi-major axis to estimates of the habitable zone for the host star. However, there are many more observations of the planet’s environment and planetary system that could enhance our understanding of a planet's ability to support life, but many, such as planetary spectroscopy, are currently unavailable for the majority of Kepler’s distant planets. In this presentation, we will review all factors affecting habitability. Planets can be very complicated systems, and accurately modeling all the relevant physics is currently intractable. Nonetheless, in many cases we can leverage other information, such as the presence of additional planetary companions, to constrain planetary properties and, hence, habitability.

As Kepler preferentially finds potentially habitable transiting planets near the inner edge of the habitable zone, we will focus on phenomena that are most relevant for these orbits. Classically the inner edge is defined as the orbital radius at which the absorbed radiation initiates a runaway greenhouse, an atmospheric condition that precludes surface water in all circumstances. Increasing planetary albedo lowers the absorbed radiation, but increasing eccentricity raises it. Unfortunately Kepler cannot measure either of these properties directly. Lack of information on planetary albedo and orbital eccentricity leads to an "eccentricity-albedo" degeneracy for estimations of absorbed radiation. If the stellar properties are well known, then a lower bound on the eccentricity can be calculated and provide crucial information for habitability assessments.

Close-in planets are also more susceptible to a star's gravitational effect on habitability. For example, Kepler-22 b, if old and on an eccentric orbit, could be tidally locked. However, recent progress has shown that tidal-locking does not necessarily sterilize a planet, and could even lead to positive feedbacks that extend the habitable zone inward. Tidal heating on planets can also be significant relative to other heat sources, potentially altering the internal structure and evolution of terrestrial exoplanets. In extreme cases, tidal heating could trigger a runaway greenhouse on planets in the habitable zones of stars smaller than about one-quarter of a solar mass, and hence is an important consideration for planets discovered by TESS. In summary, although Kepler cannot directly measure exoplanet surface properties, we can still use its wealth of data to better characterize terrestrial planets in the habitable zone.