

Toward Detections and Characterization of Habitable Transiting Exoplanets. Norio Narita¹, ¹National Astronomical Observatory of Japan (2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan).

The *Kepler* mission [1] led by NASA has discovered dozens of possible habitable exoplanets by the transit survey method. The transit survey method monitors brightness of hundreds of thousands of stars to detect a periodic slight dimming which is caused by a transit of a planet in front of a host star. The *Kepler* has demonstrated that habitable exoplanets indeed exist around other stars than the Sun.

A big problem for *Kepler*'s candidates of habitable transiting exoplanets is their host stars are far away, say over 1000 light years. It is difficult to characterize such distant exoplanets with the current telescopes or even with next generation extremely large telescopes (ELTs). Thus the next step for astronomical studies of habitable exoplanets is to detect such planets around the Solar neighborhood, say within 100 light years from the Sun.

The next breakthrough for detections of habitable transiting exoplanets will come from the Transiting Exoplanet Survey Satellite (TESS) mission [2] led by MIT/NASA, which is expected to be launched in 2017. The TESS will search for nearby transiting exoplanets in almost the whole sky for 2 years.

Thus a time for observations to characterize habitable transiting exoplanets will come in 2020s. For transiting exoplanets, it is known that one can observe their atmospheres by transmission spectroscopy.

Transmission spectroscopy can be done using some observing methods, including multi-color photometry, multi-object spectroscopy, and high dispersion spectroscopy. The multi-color photometry and multi-object spectroscopy methods can characterize wavelength dependence of transit depths for transiting exoplanets, and can reveal whether the planetary atmosphere is dominated by primitive compositions (hydrogen dominated) or not, and possible presence of clouds or haze. While the high dispersion spectroscopy method may be able to detect alkali metal lines (e.g., Na and K) and molecular lines (e.g., H₂O, CH₄, CO, CO₂, O₂). Those observations will reveal characteristics of habitable transiting exoplanets in the future.

In this talk, I will present such prospects of future detections and characterization of habitable transiting exoplanets.

References:

- [1] Borucki. W. J. et al. (2010) *Science*, 327, 977-980.
- [2] Ricker. G. R. et al. (2010) *Bulletin of the American Astronomical Society*, 42, 459