[JJ] Evening Poster | P (Space and Planetary Sciences) | P-AE Astronomy & Extrasolar Bodies

[P-AE20]Exoplanet

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Exoplanetary science, which began with the discovery of a hot Jupiter in 1995, has reached a major turning point by the discovery of countless super-Earths by the Kepler mission. More recently, planets that are similar in size to the Earth and also receive similar amounts of stellar radiation (namely, located in the so-called habitable zone) have been discovered around nearby stars such as Proxima Centauri and TRAPPIST-1. As a result, not only theoretical, but also observational studies on the atmospheres and surface environments of Earth-like exoplanets have been started. Moreover, the number of planets discovered around early-type and late-type stars has become large enough that the occurrence rate and orbital distribution of planets around a wide variety of host stars have become clear. Thus, new observational insights, which become the basis of pan-planet formation theory, are now gathering. While exoplanets have been mainly targeted for astronomy until recently, it can be said that earth planetary science is finally becoming a research field to make a central contribution. In this session, we aim to share cutting-edge research results in exoplanetary science which is in such a transition period.

[PAE20-P04]Multi-band Simultaneous Transit Observations of Low Density Hot Jupiters

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Observations of transiting exoplanets provide an invaluable window into the nature of exoplanet atmospheres. Characterizing an exoplanet atmosphere, especially from the ground using meter-class telescopes, however remains difficult. A promising method to detect broad atmospheric features is to search for Rayleigh scattering signature using multi-band photometry at optical wavelengths. For this study, we used OAO/MuSCAT to conduct simultaneous multi-band observations of several transiting low-density hot Jupiters, including HAT-P-12b, HAT-P-14b, and WASP-21b. Our goals are (1) to improve the transit parameters of these systems, and (2) to search for broad spectral features such as Rayleigh scattering signature in the optical wavelengths. Our homogeneous analysis of transit light curves uses a Bayesian approach to model the transit and systematics simultaneously.

The derived transit parameters are in good agreement with previous results. Careful analysis of transit depth variation in each band shows a marginal increase in the planetary radius from the red toward the blue ends of the visible wavelength range. In addition, to compare the observed data with a theoretical atmospheric model, we calculate a model spectrum for each planet considering two cases: (case 1) 1x Solar and (case 2) 100x Solar metallicity clear atmospheres, assuming thermochemical equilibrium compositions and isothermal structures. Comparing the measured transit depths with the spectrum model for each planet, we found that our achieved photometric precision is not enough to robustly distinguish between the two atmospheric models. To test the significance of (non-)detection of Rayleigh scattering, a Monte Carlo fitting routine was performed using the posterior samples from MCMC of transit depth for each band. We find a marginal Rayleigh slope for HAT-P-12b at 1.0σ and HAT-

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P-44b at 1.2σ. On the other hand, we find a positive slope for WASP-21b within 2.8σ which cannot be explained by either atmospheric models. Instead, such trend can be explained by unocculted spots on the surface of WASP-21. Motivated by our results, we consider future multi-epoch observations of these systems as well as search for new targets feasible for detecting broad atmospheric features using MuSCAT and MuSCAT2.

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