[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-P03]MuSCAT and MuSCAT2: Two Multiband Cameras for Transit Observations Developed Toward the TESS Era

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The all-sky transit survey satellite TESS, which will be launched in early 2018, is expected to drastically increase the number of small transiting planets in the proximity of our Solar system, the type of exoplanets that has not yet been discovered much even by the Kepler satellite. Because their host stars are bright, detailed information on the individual planets, such as the mass and atmospheric features, can be extracted by conducting various follow-up observations from the ground and space. These studies could help to understand the compositions and formation mechanisms of close-in small planets (so-called hot super-Earths and Neptunes), which have been revealed to be common in the Universe but whose nature has not been well understood yet.

On the other hand, there are some limitations in the TESS survey; the survey periods for most fields are only about 27 days, the image resolution of the detector is as large as 21 arcsec/pixel, and there is no filter change mechanism (single-band survey). Because of them, the planetary candidates to be detected by the TESS survey will have a high probability of false positives. Therefore, it will be essential to follow-up them from the ground to identify which are the true planetary systems. In particular, multi-band transit observations with a higher image resolution and good enough photometric precision can play important role on the planetary validation. Multi-band transit observations are also useful for roughly studying the planetary atmospheres.

In this context, we have developed an optical 3-band camera, MuSCAT, for the Okayama 188 cm

telescope, and an optical 4-band camera, MuSCAT2, for the 1.52 m telescope at Teide Observatory in Spain, in preparation for the TESS era. The development of MuSCAT has been completed in 2014, and it has been in operation since 2015. So far it has produced a number of scientific results, highlighting that we validated/characterized several planets/planetary candidates detected by K2, which is the Kepler’s second mission and is considered to be the precursor of TESS. MuSCAT2 had its first light in August 2017, and started science operation in January 2018. MuSCAT2 has various advantages over MuSCAT in the site altitude (2390m), the clear-sky ratio (70%), the number of channels (4), the available telescope times (more than 160 nights), and the field of view (7.4 x 7.4 arcmin), all of which can contribute to produce outstanding scientific results in terms of quality and quantity. On the other hand, we plan to make the 188cm telescope and MuSCAT semi-robotic so that we can use it more for monitoring the activities of planetary host stars.

In this presentation, we will report the status of MuSCAT and MuSCAT2 including the science results obtained with these instruments.