Low-resolution transmission spectrum of a Sub-Neptune around a young K-dwarf K2-136 c

*Mayuko Mori[1,2], John Livingston[1,2], Akihiko Fukui[3], Norio Narita[3]

1. Astrobiology Center, NINS, 2. National Astronomical Observatory of Japan, 3. The University of Tokyo

Among the various exoplanetary systems, planets in young (<1Gyr) systems are the interesting targets for detailed atmosphere investigation. By examining the extent and composition of the atmosphere, we can determine whether the planet is still undergoing atmospheric mass loss and infer the atmosphere's formation and evolution history of the planet.

The K2-136 system is known to have three transiting planets around a young late-K dwarf in the Hyades cluster (650 ±70Myr). The system offers a promising opportunity for comprehensive characterization due to its well-determined age and proximity to the Solar system. Especially, the largest planet, K2-136c, is the most well-characterized in the system through radius and mass measurements ($R\tilde{}3R_{\oplus}$, $M\tilde{}18M_{\oplus}$). However, the atmosphere composition of the planet has not yet been investigated.

To probe potential atmospheric signals on K2-136c, we obtained the spectrophotometric data of the transit of K2-136c to produce a low-resolution transmission spectrum. Our dataset includes optical light curves from Kepler, TESS, and the multi-band photometry instrument MuSCAT2, complemented by infrared light curves from Spitzer. Additionally, we investigated its stellar brightness modulation caused by spots by the multi-band monitoring observations using TESS and Sinistro. This allowed us to mitigate the influence of spots on the observed transmission spectrum.

We will present our results and scrutinize the atmospheric nature of K2-136c by comparing a range of atmosphere models with the observed spectrum.

Keywords: Sub-Neptune, Planetary Atmosphere, Transit

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