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AKARI near-infrared spectroscopy of brown dwarfs

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1. Introduction

Brown dwarfs (hereafter BDs) are of particular interest because of their extremely low-temperature atmospheres for comparison with atmospheres of giant planets. Aiming to obtain clues to understand the formation and disappearance of dust clouds and molecular abundances in BD photospheres, we conducted an observation programme of space-borne near-infrared spectroscopy of bright BDs with the Infrared Camera (IRC) on-board AKARI.

2. NIR spectra of BDs

Eleven BDs were observed during the cold phase of the AKARI mission (May 2006–Aug. 2007). The spectra cover the wavelength range 2.5 to 5.0 μm with a resolving power of roughly 100. Spectral types of the observed targets range from L5 to T9.

Seven targets have good quality spectra. We detect CO_2 for the first time in spectra of late-L and T-type dwarfs. We also confirm CO bands in a T9 dwarf spectrum, supporting the idea of non-equilibrium chemistry in the photosphere of late-T dwarfs.

3. Model analysis and discussion

All spectra are reasonably well fitted by the Unified Cloudy Model (UCM; Tsuji 2002, 2005). Observed CO and CO_2 bands in late-L to T dwarf spectra are much stronger than that expected from the UCM assuming thermal equilibrium chemistry. We can reproduce the depth of CO bands in T9 dwarf spectra by introducing vertical mixing effects into the model. However, the same mechanism does not work for mid-T and late-L dwarfs, since CO is rather abundant in the upper photosphere from the beginning under LTE. Alternative mechanisms need to be considered, which is a subject of future investigations.

We continue the AKARI observations in its warm phase.

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References

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