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Near-infrared spectroscopy of Galactic PDRs with AKARI

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The near-infrared region (2–5 μm) contains a number of interesting features from gas and solid species in PDRs. The Infrared Camera (IRC) onboard the infrared satellite $AKARI$ provides a unique capability to study this spectral region with high sensitivity even in the warm mission phase with the grism (R ∼100) and the prism ($R \sim$ 20–40) (Onaka et al. 2012). The IRC made observations of a number of PDR-HII region complexes on the Galactic plane. Most spectra show the aromatic and aliphatic emission features at 3.3–3.5 μm together with hydrogen recombination lines. Spectra taken with the prism cover up to 5.5 μm and detect the 5.25 μm band clearly in a number of PDRs for the first time, which shows a good correlation with the 3.3 μm band (Mori et al. 2014). A large fraction of the spectra also show absorption bands of H_2O ice at 3.0 μm and CO_2 ice at 4.27 μm. The absorption of H_2O ice affects the continuum in the 3 μm region, which could produce a jump-like structure across the 3.3 μm band emission.

In this report, we present recent analysis of IRC near-infrared spectra of about 100 Galactic PDR-HII regions. The intensities of the emission bands at 3.3–3.5 μm are estimated by taking account of the H_2O ice absorption. Part of the results are reported in Mori et al. (2014), which shows a weak trend that the ratio of the aliphatic 3.4–3.5 μm to the aromatic 3.3 μm bands decreases with the continuum at 3.7 μm to the 3.3 μm band intensity. The latter ratio is thought to indicate the ionization fraction of the band carriers, suggesting the destruction of aliphatic structures near the boundary between the PDR and ionized region. Here we also report the results of the ice features. The CO_2 and the H_2O ice column densities show a linear correlation as seen in massive YSOs, supporting that a major part of the structure seen across the 3.3 μm band is due to the H_2O ice absorption. Our results also suggest that the formation of ice may start at the region of $A_v \sim 5$ in general PDRs.

REFERENCES

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