SPICA による近傍銀河の星間氷の観測　　Poster ID: S2

Observations of Interstellar Ices in Nearby Galaxies with SPICA

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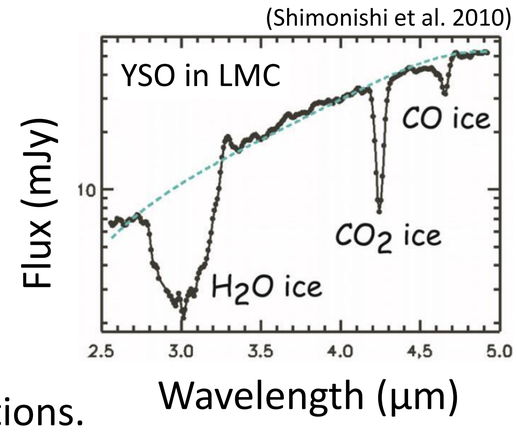
We present the near-infrared (2.5–5.0 μm) spectra of the edge-on starburst galaxies NGC 253, NGC 3079, and M82 obtained with AKARI. We detect the absorption features of the H_2O and CO_2 ices from all the galaxies, revealing that the ices are widely distributed near the central regions. Based on these results, we propose spectral mapping observations of ices in the mid-infrared (e.g. H_2O: 6,13 μm, CO_2: 15μm) with SPICA to obtain the detailed distributions of the ices in nearby galaxies.

■ Introduction ----------

NIR (2.5-5.0μm) includes the absorption features of the ices, important to trace interstellar environment.
However, it is difficult to observe the NIR band due to the atmospheric absorption.
→ We can derive continuous and sensitive spectra by space observations.

Example of NIR spectrum
(Shimonishi et al. 2010)

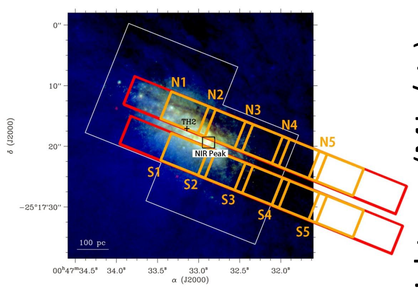


Only a few observations have been performed for ices in nearby galaxies. We observe the edge-on galaxies to perform systematic studies on the ices in nearby galaxies.

■ Observations & Results ----------

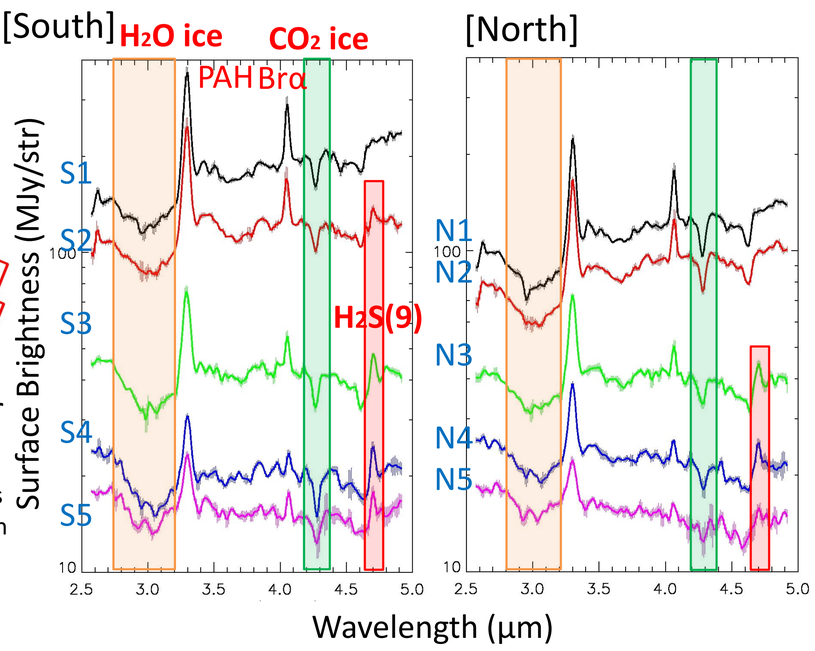
Obs. date : AKARI Post-Helium phase (phase 3) 2008-2009
Instrument : IRC 2.5-5.0 μm (R=120, slit size : 5”x48”, 3”x60”)
Targets : NGC253 (x 2 pointing), NGC3079, M82

NGC253

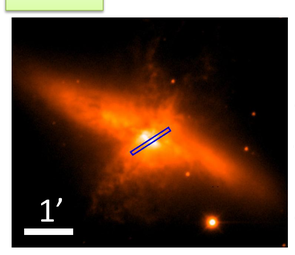


HST NIR(IHK) 3 band color
(Kornei& McCrady2009)

Each sub-aperture(N1-5, S1-5) has a size of 5'' x7.5'' with a separation of 6'' between each, from which we created the spectra.

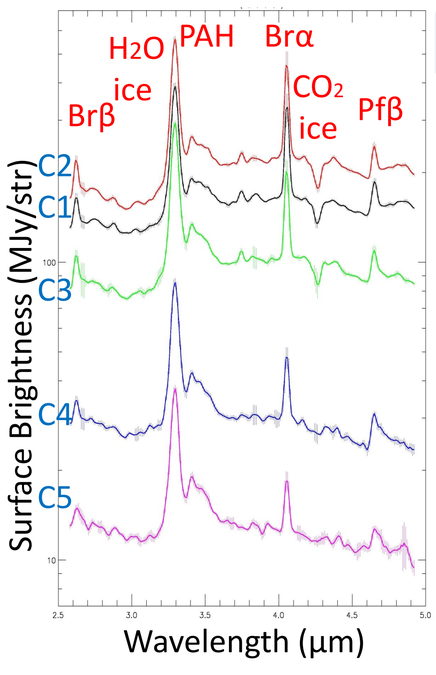


M82



↑ MLO 1.0m Hα
+ slit positons

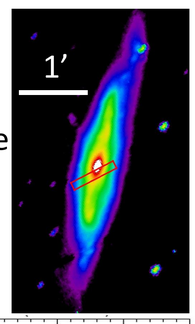
Each sub-aperture (C1-5) has a size of 3'' x7.5'' with a separation of 6'' between each. The C2 region is the core of M82.

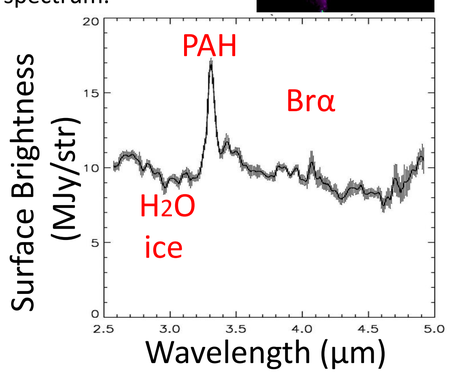


NGC3079

AKARI 3μm image
+ slit position →

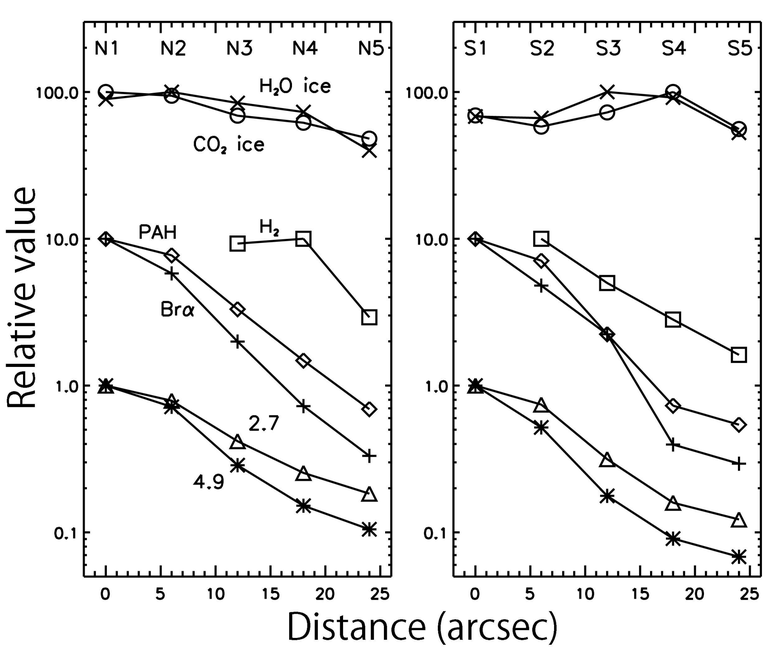
From the aperture of 5”x16”, we created the spectrum.





■ Discussion ----------

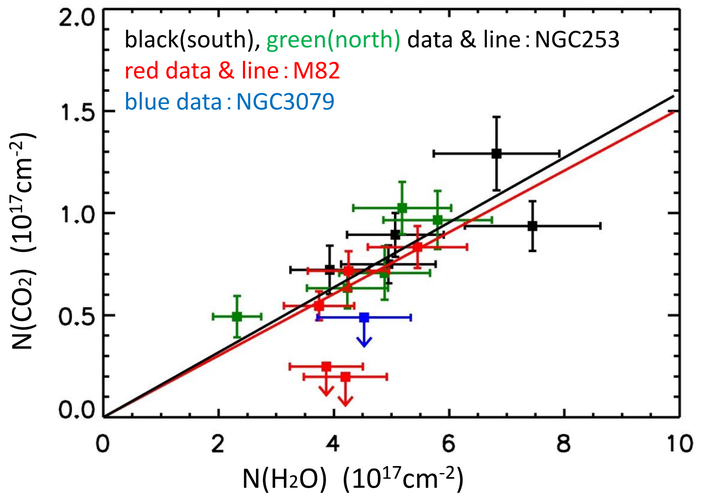
◆ Profiles of the ices, PAH, and gas in NGC253



Plotted against the distance from the center.
Distributions of the ices differ from those of the PAH and gas.
The ices are distributed more widely.

Column densities of the H_2O and CO_2 ice, integrated intensities of the PAH 3.3 μm, Brα, $H_2S(9)$, and the surface brightness at 2.7 and 4.9 μm. Each profile is normalized by its peak value.

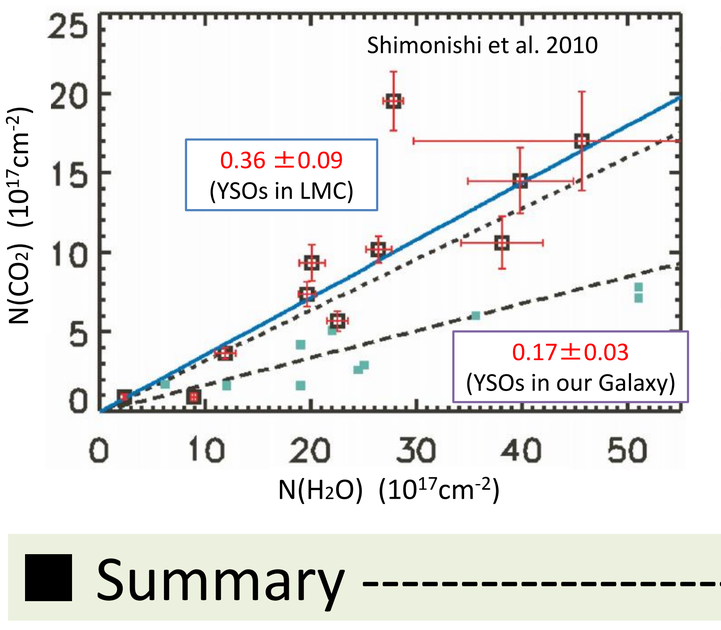
◆ N(CO_2)/N(H_2O) ratio



$$N = \int \tau d\nu \Big/ A$$

v [/cm] : wave number(=1/λ)
A [cm/mol.] : Gerakines et al. 1995

N(CO_2)/N(H_2O) =
0.17±0.05 (NGC253)
0.16±0.03 (M82)



The N(CO_2)/N(H_2O) ratios are similar to those obtained from the Galactic massive YSOs although much stronger interstellar radiation field and higher dust temperature are expected for NGC253 and M82.

■ Summary ----------

- With AKARI, we have performed the NIR spectroscopic observations of NGC253, NGC3079, and M82, and detect the absorption features of the H_2O and CO_2 ices.
- In NGC253, the distributions of the ices differ from those of the PAH and gas.
- The N(CO_2)/N(H_2O) ratios in NGC253 and M82 are similar to those obtained from the Galactic massive YSOs.

■ Problems to be addressed by SPICA ----------

- Spatial distributions of the ices (e.g. H_2O: 6,13 μm, CO_2: 15μm)
- Change of the N(CO_2)/N(H_2O) ratio, the properties of dust, and infrared dust emissivity with the ices
- Evolution from ice mantle to ice dust