X-RAY EMISSION FROM LINERS OBSERVED WITH ASCA

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Abstract.

We present X-ray observations of LINERs with ASCA. We detected a hard point-like source of X-ray luminosity of $10^{40} - 10^{41}$ erg s^{-1} at the nucleus. Their hard X-ray continuum is well represented by power-law of photon index ~ 1.8. The X-ray to Hα luminosity ratio $L_X/L_{H\alpha}$ is quite similar to Seyfert galaxies and strongly support the presence of low luminosity AGNs.

1. Introduction

Nuclei of nearby bright galaxies have been extensively studied by optical spectroscopic surveys, and low level activity has been recognized as LINERs (Low Ionization Nuclear Emission-line Regions) (e.g. [2]). X-ray observations are one of the most powerful tool to investigate excitation mechanisms of LINERs (weak AGN or shock). X-ray emission above 2 keV from normal galaxies are dominated by discrete X-ray sources such as low mass X-ray binaries and their integrated luminosity is roughly proportional to B-band luminosity ([1], [5]). If a low luminosity AGN is present, we expect a nuclear X-ray source and excess hard X-ray emission compared to normal galaxies.

2. Observations and Results

We compiled LINERs with broad Hα in their optical spectra; NGC 1097, NGC 3031, NGC 3310, NGC 3998, NGC 4450, NGC 4579, NGC 4594,NGC 4636, and NGC 5005. The X-ray spectra are represented by two component

model; a power-law with small intrinsic absorption ($N_{\rm H}<\sim 10^{21}$ cm^{-2}) plus soft thermal component of $kT \sim 0.5-1$ keV. The photon indices of the power-law component are $\Gamma \sim 1.8$ except for NGC 5005, which shows flatter slope ($\Gamma \sim 1.0$). The X-ray images above 2 keV is consistent with a point source except for NGC 4636 (for detailed X-ray results, see [3], [4], [6], [8]). Most objects have much larger $L_{\rm X}/L_{\rm B}$ value than normal galaxies and the presence of the X-ray source in addition to integrated emission from discrete X-ray sources is inferred. If the excitation mechanism in LINERs is photoionization by low luminosity AGNs, the Hα luminosity $L_{\rm H\alpha}$ is expected to be proportional to the X-ray luminosity $L_{\rm X}$ as is observed in Seyfert galaxies (e.g. [10]). Figure 1. shows correlation between $L_{\rm X}$ and $L_{\rm H\alpha}$ for LINERs and Seyfert galaxies. The correlation extends to lower luminosity and strongly support the presence of low luminosity AGNs in our sample of LINERs. Note that the $L_{\rm X}/L_{\rm H\alpha}$ for starburst galaxies are about 2 orders of magnitude smaller than Seyfert galaxies [7] and shock excitation by starburst driven winds is not a dominant excitation mechanism in the present sample.

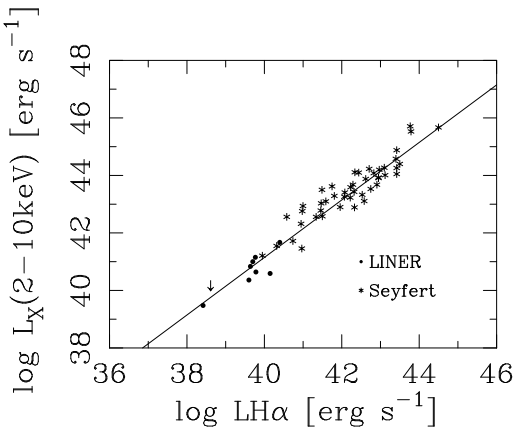

Figure 1. Correlation between X-ray and Hα luminosity. Asterisks represent Seyfert galaxies taken from [10]. Upper limit of the X-ray flux for the nuclear point source in NGC 4636 is shown as an arrow.

References

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