ASCA OBSERVATION OF ω CENTAURI

Energy Spectra of Einstein IPC Sources

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1. Introduction

The number of compact stars such as white dwarfs, neutron stars, and black holes in globular clusters gives us information on binary formation rates and dynamical history of the clusters.

In *Einstein* IPC observations of ω Centauri, 5 dim ($L_X \sim 10^{32-33}$ erg/s) X-ray sources were discovered toward the center of the cluster; IPC sources A–E (Hertz & Grindlay 1983). Recently, sources A and D were optically identified as foreground dMe stars (Cool *et al.* 1995). *ROSAT* PSPC observations revealed that there were three point sources near the region of extended source B (Hartwick *et al.* 1982), and that source C within the cluster core was two sources separated by 44" (Johnston *et al.* 1994).

Despite these advanced studies, the nature of sources B and C are still unknown mainly because of the lack of direct information from these sources. *ASCA* (Tanaka *et al.* 1994) observation of ω Centauri provides wide energy range 0.5 – 10 keV images and energy spectra of these sources for the first time. We present their first results obtained with the GIS.

2. Observation and Results

ω Centauri was observed on 1994 August 1–2 by *ASCA*. IPC sources A–D were detected with the GIS (gas scintillation imaging proportional counters) in a soft X-ray band (Fig.1 *left*). Furthermore, several X-ray sources were discovered, for instance, on the NW side of C, and on the west side of B. In a hard X-ray band, C is the brightest source in the FOV (Fig.1 *right*). The NW source of C is not separated from C because of the *ASCA*'s spatial resolution of $\sim 1'$, but its effect is also clearly seen.

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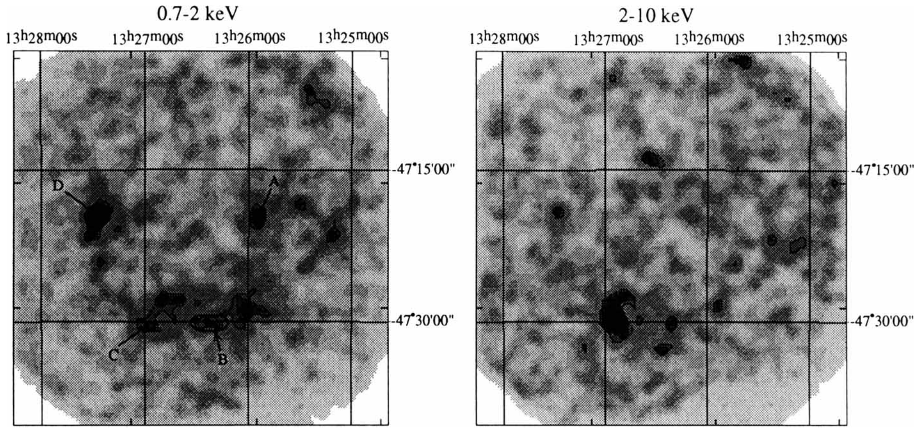

Figure 1. GIS2+3 images of ω Centauri in the energy range of 0.7–2 keV (*left*) and 2–10 keV (*right*). Both the images has been smoothed with a Gaussian of $\sigma = 0.5'$.

These images indicate that C has a very hard spectrum. In fact, its energy spectrum taken with the GIS can be represented by a thermal bremsstrahlung model with $kT > 10$ keV. While, fits to GIS energy spectra of A and D with a Raymond Smith model spectrum with *no* interstellar absorption give $kT \lesssim 1$ keV, which are marginally consistent with (but higher than) typical coronal temperature of dMe stars (Agrawal *et al.* 1986). In the region of B, we found a source with a hard spectrum (probably No. 7 source of Johnston *et al.*). More detailed information of these and the other sources will be reported elsewhere.

3. Discussion

The spectrum of C is compatible with those of Galactic CVs (Ishida 1992; Mukai & Shiokawa 1993), and much harder than those of the other X-ray sources with $L_X \sim 10^{31-33}$ erg/s possible to exist in globular clusters (Verbunt *et al.* 1994). This strongly suggests that source(s) C is CVs. Their relatively high luminosity of $\sim 10^{32}$ erg/s, compared with those of CVs, also suggests that only high luminous CVs in the cluster were detected.

references

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