ASCA OBSERVATIONS OF THE ABELL 496 CLUSTER OF GALAXIES

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1. Introduction

The metal in the intracluster medium (ICM) has been ejected or stripped from galaxies. Thus measurements of the metal distribution and the relative abundance of elements, in particular Si/Fe, are important to study the evolution of galaxies, as well as to study the chemical evolution of the ICM. We present the results from ASCA observations of Abell 496 cluster of galaxies. A496 is a nearby rich cluster with a central cD galaxy. At the redshift z=0.0327 of A496, 1 arcmin is 53kpc, where we assumed $H_0 = 50kms^{-1}Mpc^{-1}$, $q_0 = 0.5$. A496 is known as a cooling flow cluster. Edge and Stewart (1991) obtained the mass flow rate of $\sim 100M_{\odot}yr^{-1}$ and the cooling radius of 177 ± 52kpc.

2. Analysis and results

We made the GIS and SIS spectra accumulated for the ring-cut regions centered on the emission peak. The plasma temperature, the iron abundance, and the silicon abundance were obtained using Mewe–Kaastra model in XSPEC 9.00 (Mewe et al. 1985). The best fit parameters and the 90% confidence errors are shown in Figure 1. Abundances were presented by the ratio to solar values ($n(Si)/n(H) = 3.55 \times 10^{-5}$ and $n(Fe)/n(H) = 4.68 \times 10^{-5}$) given by Anders and Grevesse (1989). Temperature decrease and the abundance increase were seen in central region ($r < 200$kpc) whose size is nearly equal to the cooling radius.

3. Discussion

The relative abundance of silicon to iron is the key parameter to study the origin of the metal, because Type I SNe produce mainly iron, while

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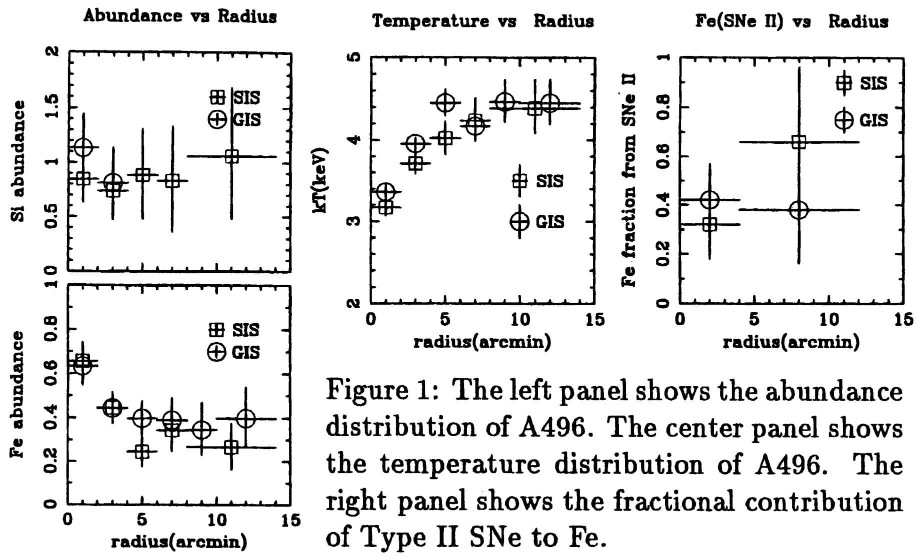

Figure 1: The left panel shows the abundance distribution of A496. The center panel shows the temperature distribution of A496. The right panel shows the fractional contribution of Type II SNe to Fe.

type II SNe produce mainly α–process elements. Observed number ratio of silicon to iron $(\frac{Si}{Fe})_{obs}$ is given by

$$(\frac{Si}{Fe})_{obs} = \frac{Fe_{SNI} \cdot (\frac{Si}{Fe})_{SNI} + Fe_{SNII} \cdot (\frac{Si}{Fe})_{SNII}}{Fe_{SNI} + Fe_{SNII}} \quad (1)$$

where Fe_{SNI} and Fe_{SNII} are the number of iron atoms produced by Type I and Type II SNe, respectively, and $(\frac{Si}{Fe})_{SNI}$ and $(\frac{Si}{Fe})_{SNII}$ are the number ratio of silicon to iron of Type I and Type II SNe, respectively. Using theoretical values of $(\frac{Si}{Fe})_{SNI}$, $(\frac{Si}{Fe})_{SNII}$ (Tsujimoto et al. 1995) and $(\frac{Si}{Fe})_{obs}$, we can estimate the contribution of Type II SNe to the iron. The results are shown in Figure 1. About 40% of the iron is the product of Type II SNe.

The origin of the central metal excess is related to the presence of cD galaxies, because non-cD clusters do not show metal concentration. If the central metal is ejected from cD galaxies, $(\frac{Si}{Fe})_{obs}$ is expected to decrease toward the cD galaxy. However, the observed $(\frac{Si}{Fe})_{obs}$ is constant. Additional process is required to explain the metal concentration in the ICM.

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