ASCA STUDY OF SHAPLAY SUPERCLUSTER

H.HANAMI
Physics Section, Iwate University
Morioka, 020 JAPAN

1. Introduction

We observed five clusters of galaxies in Shapley supercluster with ASCA; A3562, SC13290-313, SC1327-312, A3558 and A3556, which are candidates for interacting clusters since their separation and relative velocities are only 1Mpc and 700-1000km/s (e.g. Raychaudhury et al. '91, Breen et al. '94, Scaramella et al. '89). Main purpose of mapping observations is to make clear the formation and evolution process of the clusters of galaxies in a supercluster. ASCA gives essential informations of ICM like the temperature distribution related to the dynamics; the interactions due to the infalling and merging events. They are important tests for observational cosmology (e.g. Hanami '93).

2. ASCA Observations

We will present ASCA X-Ray observations of the Shapley Concentration in the following table.

objects	$L_X/10^{44}$ ergs s^{-1}	z_X	k_BT keV	$E.M./10^{-16}$ cm^{-5}	Abandance (solar)	$N_H/10^{20}$ cm^{-2}
A3562	1.91	$0.033^{+0.011}_{-0.007}$	$4.55^{+0.06}_{-0.33}$	$2.01^{+0.11}_{-0.09}$	$0.39^{+0.12}_{-0.1}$	$8.93^{+3.49}_{-3.69}$
$SC1329_{in}$	0.268	< 0.0132	$3.64^{+0.44}_{-0.4}$	$4.70^{+0.46}_{-0.38}$	$0.30^{+0.11}_{-0.18}$	< 13.2
$SC1329_{out}$	0.382	< 0.0160	$6.45^{+3.95}_{-0.21}$	$4.30^{+3.90}_{-0.28}$	$0.21^{+0.2}_{-0.21}$	< 6.8
SC1327	0.762	$0.036^{+0.013}_{-0.026}$	$3.58^{+0.17}_{-0.31}$	$1.08^{+0.08}_{-0.05}$	$0.27^{+0.11}_{-0.1}$	< 5.67
A3558	5.99	$0.045^{+0.008}_{-0.006}$	$5.84^{+0.31}_{-0.26}$	$6.26^{+0.17}_{-0.17}$	$0.316^{+0.05}_{-0.05}$	$3.6^{+1.7}_{-1.8}$
A3556	0.199	$0.031^{+0.025}_{-0.031}$	$3.24^{+0.84}_{-0.62}$	$2.92^{+0.53}_{-0.54}$	$0.740^{+0.78}_{-0.43}$	$23.8^{+6.1}_{-15.7}$

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The values of the rich ones (A3562 and A3558) are higher than that from ROSAT (Bardelli et al. '94). Our estimation, however, is consistent with GINGA (Day et al. '91) and the velocity dispersion (e.g. Breen et al '94).

We can see that the poor cluster SC1329-313 is very peculiar; the outer part is hotter than the inner part. The temperature of the inner compornent is consistent with that in hydrostatic equiribium like typical poor clusters. On the other hand, the hot envelope cannot be confined with its higher internal energy than the potential energy. In soft-photon (0.2-2keV) and hard-photon (>2keV) maps, we have also found the elongated cold core structure and the hot halo structure, which extends in the open angle $a \simeq 10$ min; $r_{hot} = 438kpc(H_0/100kms^{-1}Mpc^{-1})(a/10min)(z/0.05)$.

As shown in numerical simulations, the observed complex structure can be formed in a large merger event. A strong circular shock around a cluster originates with the merger at the center and moves outwards at speed of $v_s \simeq 300km/s$, which is comparable to the sound velocity of the hot gas. This feature may be somewhat tentative. Because the hot envelop can be formed by the expanding shock with the age of $\simeq r_{hot}/v_s = 1.4 \times 10^6 yrs$ which is much smaller than the Hubble time. Then, SC1329-313 may be dynamically interacting or just merged. It is also supported from the fact that the x-ray redshift z_X determined with Raymond model < 0.016 is lower than 0.05 obtained from optical observations. It is suggests that the plasma is not in thermal equilibrium state in this region.

From the hard-photon map, we can see also a faint ridge strucutre between SC1327 and SC1329. This strucutre seems to be the filament-like or pancake-like shock which is formed with the interaction of the infalling plasma onto the supercluster plane from A3562 to A3556 in the Shapley concenration. This feature can be related to the existence of the supercluster structure.

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