XVII. Ulusal Astronomi Kongresi VI. Ulusal Öğrenci Astronomi Kongresi
31 Ağustos - 4 Eylül 2010, Adana

Observational Evidences of Gravitational Interactions within Superclusters of Galaxies

Murat Hüdaverdi[1⋆], Mustafa Bozkurt[2], Arzu Mert[2]
Akihiro Furuzawa[3] and Metin Arık[2]

[1] TÜBİTAK Space Technologies Research Institute,
METU Campus, 06531,
Ankara, Turkey
[2] Boğaziçi University, Physics Department,
34342, Istanbul, Turkey
[3] Nagoya University, Division of Particle & Astrophysical Science,
464-8602, Furu-cho, Chikusa, Nagoya, Japan

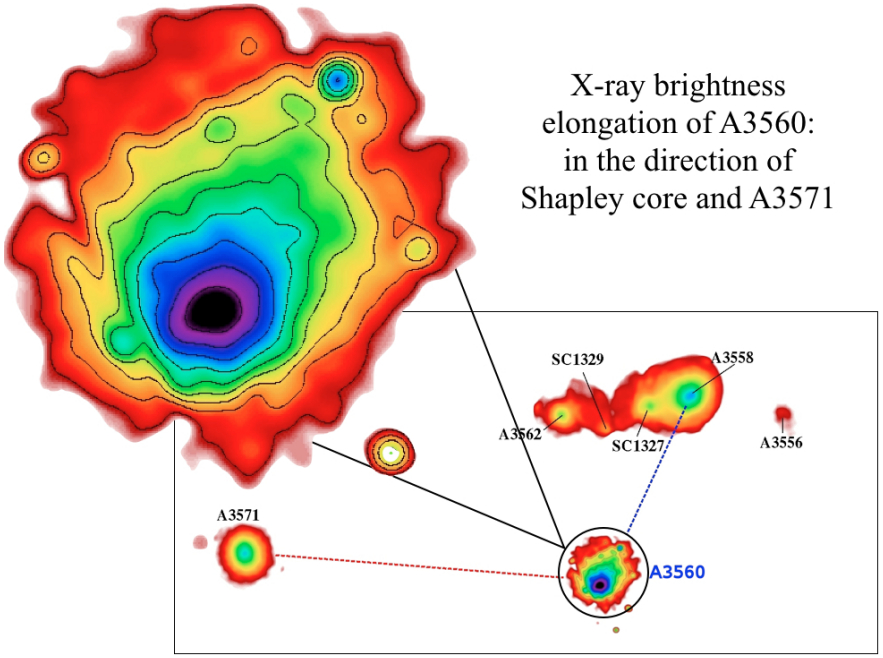
Özet Superclusters are large groups of galaxy clusters and thus the biggest entities of the cosmos. Their existence suggest that the universe is not homogeneous. And yet their dynamical future is still uncertain, but in dark-energy dominated Universe they may evolve to small universes. In this work, we present the observational results of two super cluster regions; Shapley and Aquarius (SCC100). We analyzed X-ray archival data of Chandra, XMM-Newton and ASCA. The imaging analysis results clearly indicates elongated X-ray emission from several clusters. These physical deformations of cluster symmetry is interpreted as mutual gravitational effects of clusters on each other.

1 Introduction

It is a well known fact that, galaxies are not randomly distributed in the Universe. They are distributed like pearls on a necklace, follow a pattern of cosmic web-like filamentary structures. The intersections of these filaments being observed as large scale structures and low-density regions as voids. Shapley and Aquarius Supercluster regions are largest concentration of galaxies in our nearby Universe that forms a gravitationally interacting unit, thereby pulling itself together instead of expanding with the Universe. Shapley Supercluster core hosts an unusual dense structure showing three galaxy clusters –A3562, A3558, A3556– and two galaxy groups –SC1327-312, SC1329-313– connected to each other by a filament of hot gas. Shapley concentration was estimated to have a distance ranging from 30 Mpc to 200 Mpc with a central peaked component at 145 Mpc (De Filippis et al. 2000).

Aquarius Supercluster (Batuski et al. 1985), is first identified in optical observations, is known also as SuperCluster Candidate-100 (SCC100) region. First

⋆ murat.hudaverdi@uzay.tubitak.gov.tr



Şekil 1. The location of A3560 in Shapley region, and 0.5-2 keV XMM-*Newton* image.

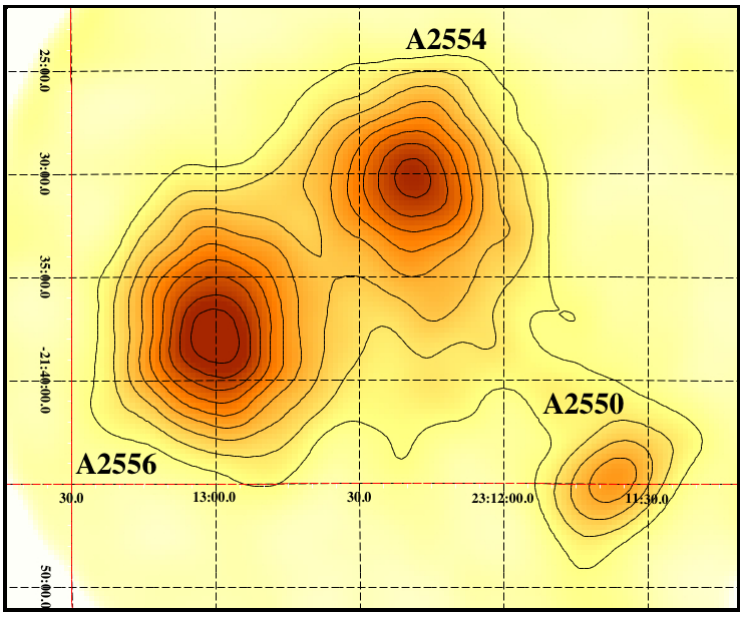
Çizelge 1. The journal of observations

	Source	Ra	Dec	z	Dist.(Mly)	Mission
Shapley						
	A3560	13 31.8	-33 13	0.0477	650	XMM
Aquarius						
	A2554	23 12.3	-21 33	0.1108	1514	ASCA(3),Chandra(3)
	A2555	23 12.7	-22 12	0.1106	1511	ASCA(2)
	A2556	23 13.0	-21 37	0.0871	1190	ASCA(2),Chandra(2),XMM

optical studies are performed by our colleague Dr. Furuzawa, and systematically observed the region by ASCA. In this work, we present spatial analysis results of A3560 of Shapley and A Triad Cluster –A2550, A2554, A2556– from Aquarius region. The observation log is listed in Table-1. Throughout this work we assume a flat universe and all errors are coated 90% at the confidence level and, unless otherwise stated.

2 Elongated X-ray Profile of A3560 at Shapley Core

A3560 is a nearby ($z = 0.489 \sim 650$ Mly) cluster of richness class 3 and Bautz-Morgan class I; the center has coordinates α_{2000}=13h 31m 50.5s, δ_{2000}= -33d 13m 25s. We have analyzed XMM-*Newton* data after routine cleaning of 2.7σ clipping of solar flares. A3560 locates at the southern part of the Shapley core and a close neighbor to A3571, as it is clearly seen in Figure-1. A3560 has an elongated plasma in 0.5-2 keV soft band in the two major directions; NW-South, East-West. Considering the position of Shapley core of rich clusters –A3562, A3558, A3556–, it explains a lot the cause of distorted plasma. It is also worth to note that A3571 locates at ∼6 Mpc east of A3560, which is along the second elongation direction. The case of A3560 is a clear illustration of gravitational awareness of member clusters within the supercluster.



Şekil 2. 0.3-10 keV GIS detector image of –A2550, A2554, A2556– triad cluster.

3 Triad Cluster at Aquarius

Aquarius region is systematically observed by ASCA. Figure-2 shows 0.3-10 keV GIS detector image of –A2550, A2554, A2556– triad cluster. The image reveals a filamentary connection between the clusters. The analysis of point sources from the same field is reported in the presentation ID#111 in this volume by Bozkurt et al. (2010). We need to confirm the redshift values to make sure the distance information for this trio. Our analysis will continue by defining temperature and metal distributions among clusters. Based on these maps, we can understand whether it is their first encounter or second passage and interpret sub-groups if there is any.

This work is supported by TÜBİTAK Scientific Project Contract #109T092.

Kaynaklar

Bardelli S., Zucca E., Zamorani G., et al. 2000, MNRAS,**312**, 540
E. De Filippis, S. Schindler, T. Erben, 2005, A&A, **444**, 387-402
Batuski et al., Astronomical Journal, **vol. 90**, 1985, p. 1413-1424
Bozkurt M, et al. 2010, Presentation ID#111, **UAK-2010** Proceeding Book