

## The Evolution History of Binary Cluster Abell 3705

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## ABSTRACT

The nearby (z=0.0895), binary cluster of galaxy Abell 3705 is investigated. The cluster is composed of two main parts; A3705-NW and A3705-SE. We also constructed a wavelet map to study temperature and metal abundances variations over ICM. Temperature and hardness-ratio maps also show the same pattern as SE part of the binary cluster which has slightly higher temperature value. The iso-temperature regions elongates in the same direction with the alignment of the binaries. This temperature structure is interpreted as SE and NW structures do not see each other for the first time. The epoch we observe, should be at least their second passage. The temperature and abundance maps show a subgroup in the SE region. In the optic and radio images there isn't any significant matches with the x-ray image of the cluster. The entropy and the pressure maps don't show any significant difference between the SE and NW regions.

## **DATA & ANALYSIS:**

Figure2: DSS optical image

The XMM-Newton archival data (PI: Zabludoff) is is analyzed in order to study evolutional history of binary cluster A3705 (z=0.0895). The ODF is reduced with the standard procedure. Figure 1 shows raw merged EPIC image. The X-ray and radio (VLA 1.4Ghz) contours (red) are superposed on the DSS optical image in Figure 2. The western radio-jet is at the edge of FOV, which is almost out of our X-ray vision. The cluster is composed of main 2 parts. The brightness contours are elongated in W-E direction which is perpendicular to the binary structure.

In order to trace the temperature variations within ICM, we contracted a hardness-ratio (HR) map, by using background corrected 0.8-2 keV soft and 2-10 keV hard band images. The background images are produced from blank-sky event files. Figure 3 shows the produced HR map with x-ray contours. The ICM seems isothermal at first glance with a slight hot region at the northern part of the main part.





**Pressure and Entrophy:** The Pressure (P) and Entropy (S) can be key parameters to reveal the physical conditions of the ICM (Henry et al. 2004, Briel et al. 2004). In Figure 5 we show both maps by using the definition of  $P^{-}nkT$  and  $S^{-}kTn^{-2/3}$ . For a qualitative analysis, we estimate temperature (kT) from HR map, and electron density square ( $n^{2}$ ) from intensity map. Both maps are featureless. There are small scale low pressure and entropy regions at the north of SW region which can be associated with the recent mergers.



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**Wavelet-Maps:** For the wavelet mapping we used the algorithm package built by Bourdin H. (2004). The constructed the temperature and metal distribution maps. Figure 4 shows the produced maps. We can also see from wavelet maps, SE and NW gas clusters are at about the same temperature. We can also see a high metallicity region at the core of SE region (figure 4-B) which can be interpreted as recent minor merging activities.

## RESULTS

A3705 binary cluster is analyzed with X-ray data to understand evolutional history of the cluster. The X-ray map shows 2 main bodies SE and NW (Figure 1). The ICM gas has a uniform temperature distribution at large scale. There is no shocked hot gas in between SE & NW, which is probably the epoch we observe is not their first encounter. The hot gas (2.7 kev) at SE region is elongated at the N-S direction, perpendicular to the main binary structure. There is a very high metal region of >1 solar. If it is not a chance location at the line of sight, this high metal region can be head of the recent merger sub-group. The elongated gas can the direction of the entrance to the ICM. The pressure and entropy map do not show peculiar features.

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