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X-ray Spectroscopy of the Cluster of Galaxies PKS 0745-191 with *XMM-Newton*

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Abstract. We present the X-ray spectroscopy of cluster PKS 0745-191 with XMM-Newton in this paper.

1. Introduction

PKS 0745-191 is an X-ray luminous cluster of galaxies at redshift $z = 0.1028$. Previous *ROSAT* data show that the cluster is elliptical and smooth, which implies that it is well relaxed (Allen et al. 1996, hereafter A96). In addition, *BeppoSAX* showed the metal abundance decreased towards the outer region (De Grandi 1999).

In the optical energy band, PKS 0745 is also known to have strong lensing arcs (A96). The lensing mass is reported to be agreement with X-ray results, when a multiphase analysis is adopted.

Two observations of PKS 0745 were performed with *XMM-Newton* in October 2000, one is pointing at the center of the cluster, the other has an offset (Fig. 1a).

2. Spectral Analysis and Morphology

We divide the image into 10 annular regions centered on the emission peak and use the offset observational data from the same detector regions to determine the background. The radial temperature profile (Fig. 1b) shows a drop in the center of the cluster, indicating that the gas in the central region is cooling. The metal abundance is found to decrease with the radius from 0.5 solar unit at the center to about 0.2 at a radius of 350 kpc, which is consistent with the result from *BeppoSAX* (De Grandi 1999). Some similarity between the X-ray morphology (Fig. 2a) in the central region and the radio structure (Fig. 2b) is observed.

3. Mass Determination

We deproject the radial brightness distribution assuming spherical symmetry and determine the electron number density distribution profile. Using this

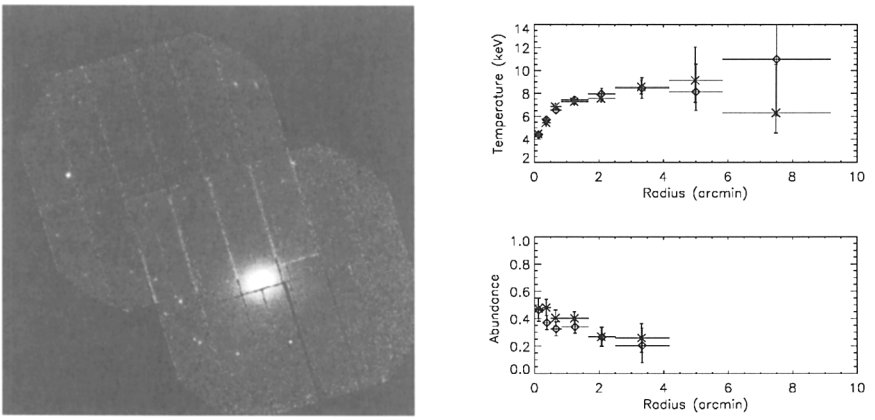

Figure 1. (a) EPN image of PKS0745-191 (left). (b) Temperature and abundance profile. Diamonds represent data from EPN and crosses are from EMOS (right).

method, we got about only $1.2(\pm 0.1) \times 10^{13} M_{\odot}$, however, which is a factor ~2 lower than that from optical lensing.

If there is lots of energy in relativistic protons in the central region of the cluster as suggested by Baum & O'Dea (1991), the protons can provide some additional pressure and occupy some volume. This may enhance the X-ray emission in the central region and may also explain the discrepancy of the obtained gravitational mass between X-ray and optical lens.

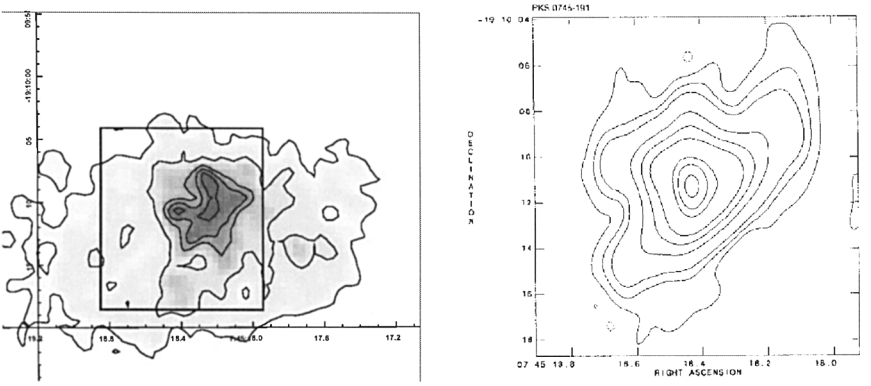

Figure 2. (a) Chandra image with pixel size 0".5 × 0".5. (b) 20-cm VLA A array map (Baum & O'Dea 1991).

References

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