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Gas Temperature Profile of the Medium-Distant Galaxy Cluster Abell 1835 Observed with XMM-Newton

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Abstract. Abell 1835 ($z = 0.252$) is the most distant galaxy cluster observed by XMM-Newton during the performance verification phase. The intracluster gas temperature profile of this massive cluster as observed with the EPIC-pn camera is presented. A clear temperature drop towards the center is detected. The temperature profile in the outer cluster parts is consistent with being flat.

1. Introduction

XMM-Newton with its large effective area and good simultaneous spatial and spectral resolution is the ideal instrument to resolve discrepancies concerning intracluster gas temperature gradients as observed with previous satellites (e.g., Markevitch et al. 1998; Irwin, Bregman, & Evrard 1999; White 2000; Irwin & Bregman 2000). Here results of an analysis of EPIC-pn data of the medium-distant galaxy cluster A1835 are presented. $H_0 = 50\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$ is assumed.

2. Data Reduction and Analysis

In order to increase the signal to noise ratio times of very high background, caused by 'soft protons', have been cut out. Obvious point sources as well as hot pixels and columns have been excluded. A correction has been applied to account for events counted during read out (out of time events). The remaining background has been subtracted using a ring outside the cluster emission. The background spectrum has not been corrected for vignetting since the not vignetted particle induced background dominates. The nominal energy (E) range used for spectral fits to a single temperature model has been set to 0.3–10 keV. Events with $7.9 \leq E \leq 8.1\,\mathrm{keV}$ have been excluded due to spatial variations of an 8 keV instrumental line.

3. Results

The intracluster gas in the central region is significantly cooler than in the outer part of A1835. The gas in the outer part is consistent with being isothermal but also a decrease with increasing radius cannot be excluded at present. No indications for gas temperatures below $\sim 2\,\mathrm{keV}$ have been found. The cluster temperature within $250 \leq R \leq 1\,500\,\mathrm{kpc}$ has been determined as $kT_\mathrm{X} =$

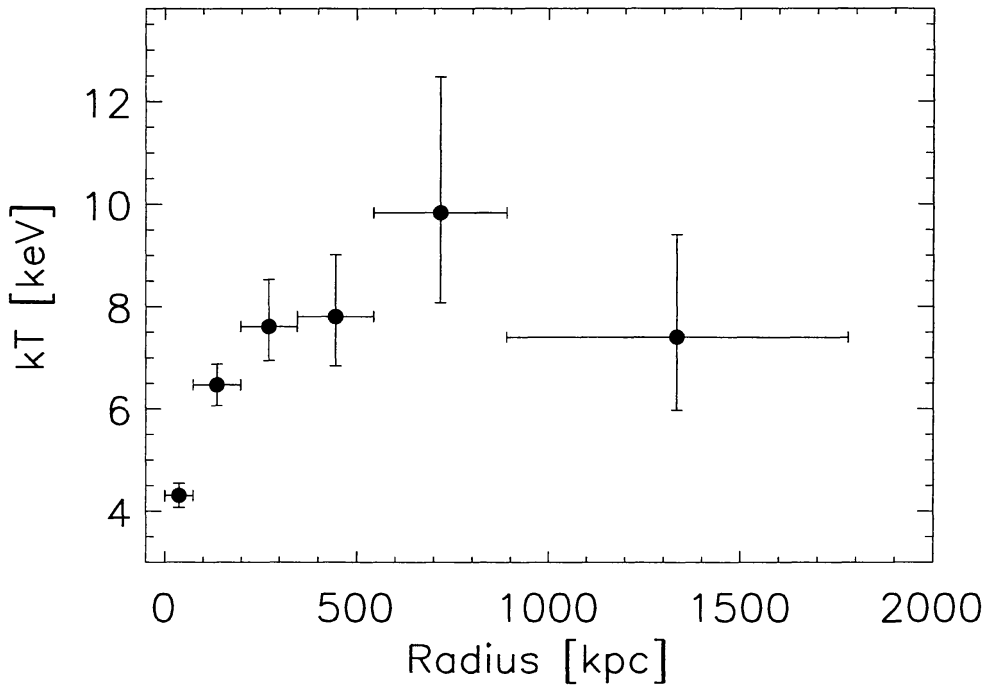

Figure 1. Radial temperature profile with 90 % c.l. statistical errors.

8.7 ± 0.6 keV. This significantly reduced error on the overall cluster temperature may allow to put tight constraints on H_0 in combination with the SZ effect. Assuming the cluster temperature to stay isothermal beyond 1 500 kpc an estimate of the total gravitational mass has been obtained utilizing the gas density profile determined from a ROSAT PSPC pointed observation. Under the assumption of hydrostatic equilibrium it is found that $M_{\rm tot} = (1.3 \pm 0.2) \times 10^{15}\, M_\odot$ within $R_{500} = 2.1$ Mpc. More results and a more detailed discussion of the complication of the temperature determination in the outer low surface brightness regions by various types of background, energy dependent vignetting, and out of time events can be found in Reiprich (2001), available at: http://www.xray.mpe.mpg.de/~reiprich/act/publi.html

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