Chandra Observations of the Massive Cluster MS2137.3-2353

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Abstract

We report on a Chandra observation of the massive, medium redshift ($z = 0.313$) cooling flow cluster MS2137.3-2353. MS2137.3-2353 was observed by Chandra using the ACIS-S for 43.6 ksec in order to search for evidence of accumulated cooled material from the purportedly large ($\dot{M}_X \sim 1400$ $M_\odot$ yr^{-1}) cooling flow. We confirm the presence of a steep temperature gradient in the central 240 kpc of the cluster. The temperature drops from an ambient value of ~ 7.0 keV at the cooling radius to a central value of ~ 3.5 keV. The ACIS spectra are best fit by a cooling flow model *only* in the cluster core with a total mass accretion rate of $\dot{M}_X \sim 300$ $M_\odot$ yr^{-1}. This value is a factor of ~ 7 below the value of 1400 $M_\odot$ yr^{-1} reported by previous ASCA and ROSAT analyses. At larger radii, a single temperature thermal model provides an excellent fit. The spatially resolved spectra show some evidence for increased absorption relative to the Galactic value as a function of decreasing projected radius in the cluster. The measured level of $\Delta N_{\rm H}(r)$ is, however, less than implied by the measured $\dot{M}_X(r)$. We find no reliable evidence for an absorption edge in the ACIS PHA spectrum consistent with redshifted O K associated with accumulated cooled material. 2-D maps of the temperature, abundance, and absorbing columns are presented. In addition, MS2137.3-2353 has been studied extensively with HST due to the presence of strong radial arcs presumably produced by gravitational lensing. Such radial arcs are consistent with very small core radii ($r_c \lesssim 50$ h_{50}^{-1} kpc) in the underlying dark matter distribution and suggest that MS2137.3-2353 is likely a relaxed cluster. Comparisons between the X–ray derived mass from Chandra and previous estimates based on gravitational lensing show good agreement.

CATEGORY: CLUSTERS OF GALAXIES