# MAPPING THE TOTAL GRAVITATING MASS IN THREE GROUPS OF GALAXIES

THIERING I.[1], DAHLEM M.[2]
[1] *Landessternwarte, Heidelberg, Germany*
[2] *STSCI, Baltimore, U.S.A.*

We report on the detection and analysis of hot ionized gas in three groups of galaxies (MKW 4s, AWM 5, NGC 6329 group) at distances above 100 Mpc (recession velocities above 8000 km $s^{-1}$). In all three cases their emission is centered on the dominant member of the group (NGC 4104, NGC 6269, NGC 6329, respectively). The central electron densities of the gas $n_{e,0}$ are about 0.02 $cm^{-3}$, decreasing to the outside as: $n_e = n_{e,0}\ [1 + \ (r/r_c)^2]^{-3\beta/2}$, with an exponent $\beta$=0.40 .. 0.77, (see Tab. 1). In each case, the spectra are well-represented by thermal Raymond-Smith spectra with k$T$ $\simeq$ 1.0 to 1.3 keV in the center and a weak increase by ca. 0.5 keV to the outside, indicating a slight cooling flow. The fits suggest that none of the central galaxies hosts an AGN that contributes significantly to the emission in the ROSAT band (0.1 to 2.4 keV). Using the radial temperature and density distributions, the total gravitating mass within a radius $r$ can be derived. This value is 1.7±0.4 $10^{13}$ $M_\odot$ within 300 kpc for all three cases, as opposed to to $10^{14..15}$ $M_\odot$ for rich clusters.

TABLE 1. Results of the imaging and the spectral fits

| group: | MKW4s | AWM5 | NGC 6329 gr. |
|---|---|---|---|
| cent.surf.br. $\Sigma_0$ $[\frac{cts}{\square'' s}]$ | 0.072±0.005 | 0.047±0.007 | 0.068±0.005 |
| core radius $r_c$ [kpc] | 11.0 ± 1.1 | 9.4±1.4 | 18.7 ± 2.2 |
| exponent $\beta$ | 0.47±0.002 | 0.40±0.002 | 0.77±0.09 |
| $L_{x,tot}$ [$10^{42}$ erg/s] | 4.72 | 7.85 | 1.90 |
| spectral fit: $\chi^2/\nu$ | 0.85 | 1.00 | 1.16 |
| $N^{\#}_{Hgal}$ [$10^{20}$cm$^{-2}$] | 1.81 | 5.32 | 1.24 |
| $z_{inner}/z_\odot$ | 0.78±0.34 | 0.58±0.43 | 1.49±0.55 |
| $z_{outer}/z_\odot$ | 0.05±0.06 | (0.26±0.31) | 0.06±0.02 |
| k$T_{center}$ [keV] | 1.28±0.12 | 1.19±0.14 | 1.02±0.07 |
| k$T_{outer}$ [keV] | 1.80±0.48 | 1.6±0.3 | 1.25±0.20 |
| $n_{e,0}$[cm$^{-3}$] | 0.020 | 0.013 | 0.022 |
| cooling time $t_{br}$ [$10^9$yr] | 1.4 | 2.1 | 1.1 |
| cooling radius $r_{cool}$ [kpc] | 51 | 42 | 59 |
| accreting mass $\dot{M}$[$M_\odot$/yr] | 6.1 | 6.5 | 5.4 |
| $M_{grav}$(<r=300kpc) [$M_\odot$] | 2 $10^{13}$ | 1.5 $10^{13}$ | 2 $10^{13}$ |

# values from Hartmann & Burton, 1995, Cambridge Univ. press

https://doi.org/10.1017/S0074180900233706 Published online by Cambridge University Press