AXES-2MRS: A new all-sky catalogue of extended X-ray galaxy groups

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Understanding the baryonic physics on the galaxy group level is a prerequisite for cosmological studies of large-scale structure. While the majority of baryons in galaxy groups are located in their intragroup medium (IGrM), one poorly understood aspect of galaxy groups is their hot intragroup X-ray emission. In this thesis, A new all-sky catalogue of X-ray detected groups (AXES-2MRS) is presented, based on the identification of large X-ray sources discovered in the ROSAT All-Sky Survey (RASS) with the 2MRS Bayesian Group Catalogue. In addition to X-ray luminosity coming from the shallow survey data of RASS, detailed X-ray properties of the groups have been obtained by matching the catalogue to archival X-ray observations conducted by XMM-Newton. The relationship between X-ray and optical properties of AXES-2MRS is explored through scaling relations, namely $\sigma_v - L_X$, $\sigma_v - kT$, $\sigma_v - M$, and $kT - L_X$ which denote (velocity dispersion vs. X-ray luminosity), (velocity dispersion vs. X-ray temperature), (velocity dispersion vs. hydrostatic mass), (X-ray temperature vs. X-ray luminosity), respectively. The scaling relations reveal similarities between our low-redshift catalogue and high-redshift studies implying that our knowledge about galaxy groups is redshift-invariant. This study enhances the representation of the underexplored low-z, low-luminosity galaxy groups, particularly in low-mass systems ($< 10^{14} M_{\odot}$). This enhances the completeness of galaxy group catalogs, addressing the persistent issue of missing faint, low-mass systems. Moreover, previous catalogues, based on detecting the peak of the X-ray emission preferentially sample the high dark matter halo-concentration groups, while AXES-2MRS includes many low DM halo-concentration groups.