STRUCTURE OF GALAXY GROUPS AND CLUSTERS AND MEASUREMENT OF THEIR MASSES

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Clusters of galaxies trace the highest peaks in the matter density feald; their abundance as a function of mass and redshift is therefore extremely sensitive to the growth rate of density perturbations as well as the expansion rate of the Universe. Cluster mass can be estimated using a wide variety techniques, from measurements of the number or velocity dispersion of the cluster number of galaxies, strong and weak gravitational lensing of background sources, and measurements of their X-ray emission or Sunyaev- Zel'dovich signal. We carried out the measurement and comparison of the masses obtained by different methods for a sample of 29 of groups and clusters of galaxies (z<0.1). To measure the dynamic mass from the dispersion of line-of-sight velocities for virialized regions of radii R_{200} and R_e is used archival data SDSS DR7. Our method for determining the sizes of groups or clusters and determination of the effective radii of galaxies systems from the cumulative distribution of the member galaxies depending on the squared clustercentric distance allowed us to estimate masses $M_{1/2}$ (within R_e) which are related to the masses contained within the radius R_{200}: $M_{200} \sim 1.65\, M_{1/2}$. A comparison of the inferred dynamic masses and the hydrostatic masses determined from the radiation of hot gas in galaxy groups and clusters (based on published data) led us to conclude that the inferred masses for the main sample of 21 groups and clusters agree to within 12%. These sample also obey the relation $M_{X,200} \sim 1.65\, M_{1/2}$. For the remaining seven systems, which are mostly located in the region of the Hercules supercluster, the discrepancy between the hydrostatic and the dynamic masses amounts to 2σ. This discrepancy is most likely due to the incompleteness of the formation processes of this clusters via hierarchical merger in the region of the rich Hercules supercluster.

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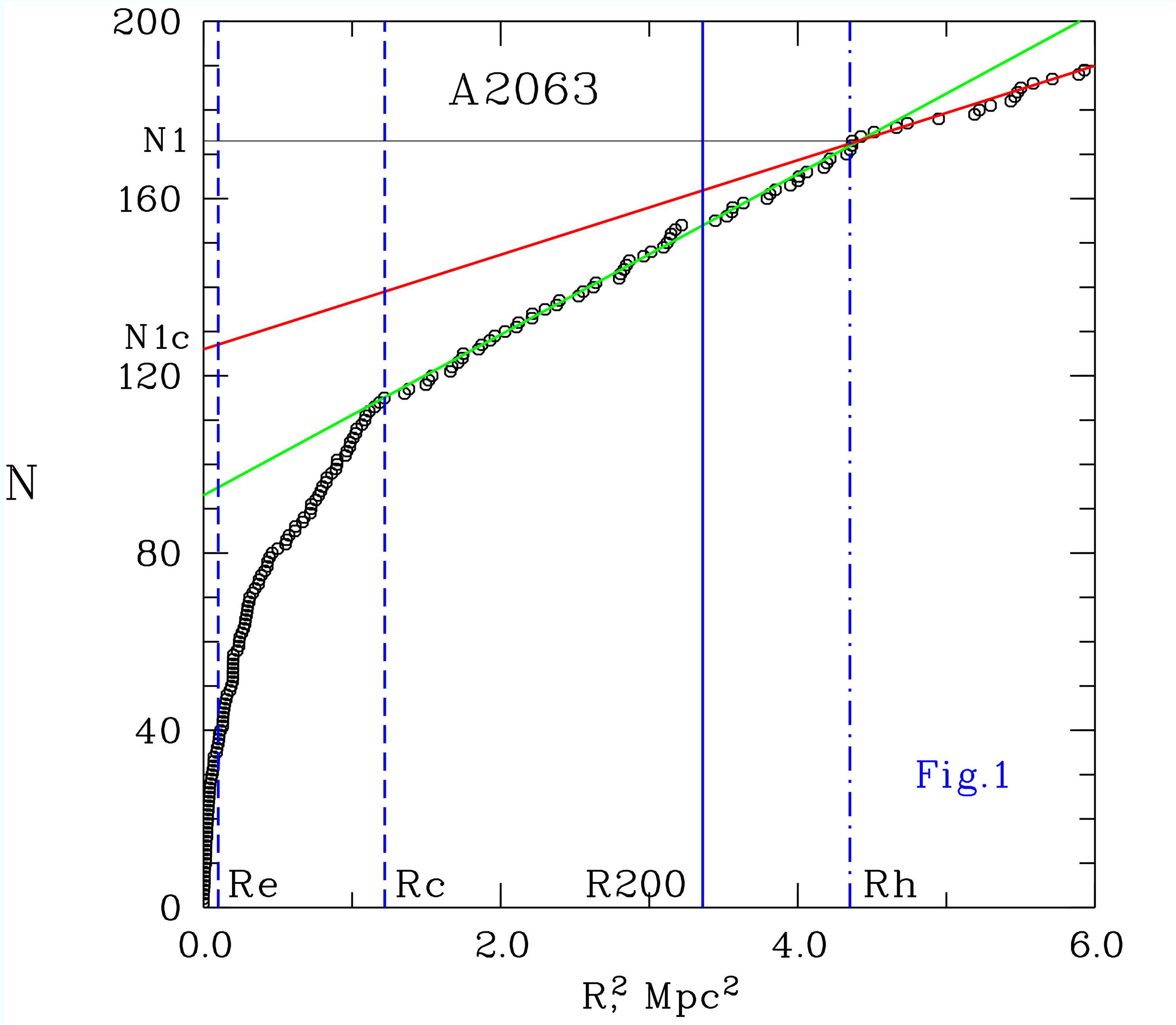

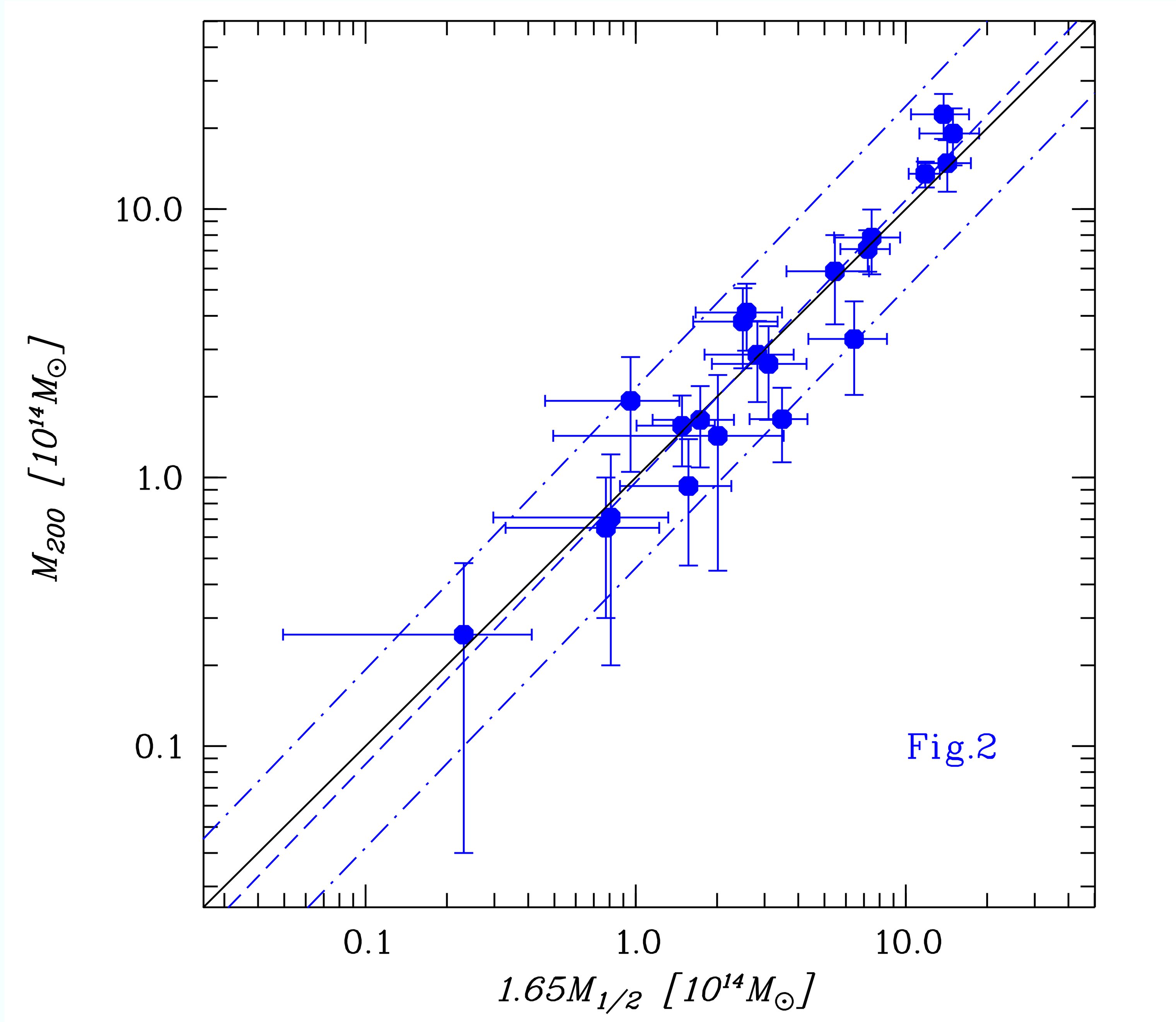

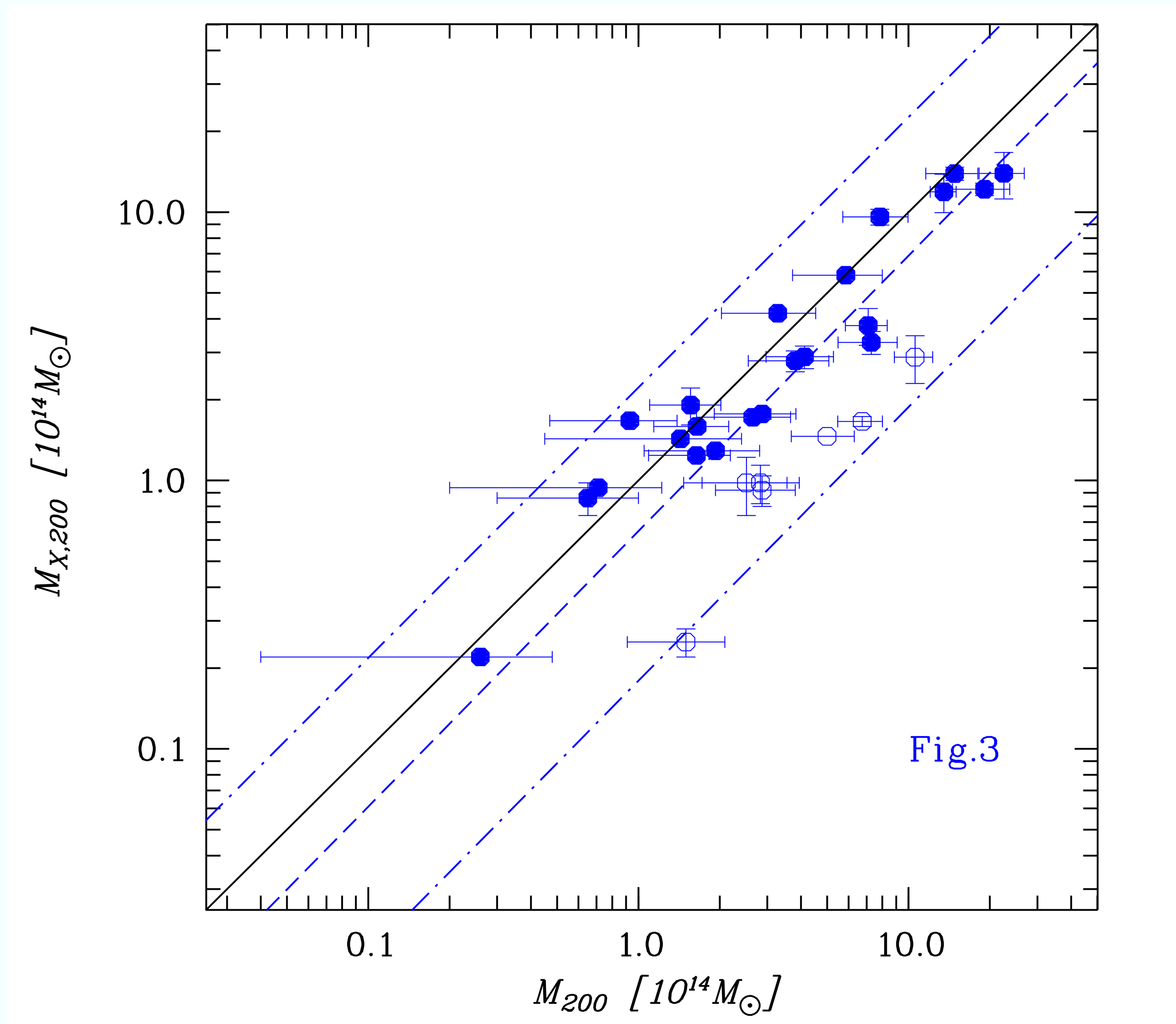

Fig.1

Cumulative distribution of the number of galaxies as a function of the squared clustercentric distance for the A2063. The solid vertical line indicates the R_{200} radius. The dashed-dotted line indicates the R_h radius bounding the cluster core (c) and halo (h); the dashed lines indicate the R_c and R_e radii. Here N_1 and N_{1c} are the numder of galaxies inside R_h before and after background subtraction respectively. The radius R_h corresponds approximately to the virial radius R_{vir}. The green solid line shows the constant surface density distribution of galaxies located in the halo of clusters, and the red solid line shows the distribution of outer field galaxies.

Fig.2

Comparison of the masses of galaxy groups and clusters contained inside R_{200} and inside the effective radius R_e. The solid line corresponds to the linear relation. The dashed line shows the regression relation $M_{200} \propto (1.65\, M_{1/2})^{1.05\pm0.01}$. The dash-dotted lines show the 2σ deviations. The errors of masses correspond to the errors of measured line-of-sight velocity dispersions of galaxy systems.

Fig.3

Dependence of the mass of galaxy groups and clusters $M_{X,200}$ measured from X-ray gas emission on the mass M_{200} measured from the dispersion of line-of-sight velocities. The dashed line shows the regression relation $M_{X,200} \propto M_{200}^{1.01\pm0.02}$. The dashed-dotted lines show the 2σ deviations. Empty circles correspond AWM5, NGC5098, A2147, A2151, NGC6338, RXCJ1022, Virgo.