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NEARBY CLUSTERS OF GALAXIES HIDDEN BY THE SOUTHERN MILKY WAY

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It is generally accepted that clusters of galaxies mark the peaks of the mass density field. However, the mapping of nearby clusters, and their associated large-scale structures, is incomplete due to the obscuration of the Milky Way. Because of the preponderance of E/SO galaxies in clusters, optical searches have proved more successful than HI/IRAS surveys in detecting clusters in the "Zone of Avoidance". We report here on a number of clusters we have located in our survey of the southern Milky Way. They include ACO 3627 and other clusters believed to mark peaks in the"Great Attractor" region, the most influential of the nearby large-scale structures.

1 Introduction

Figure 1 shows how the "Zone of Avoidance" (ZOA) of the southern Milky Way has been narrowed to a width of only some six degrees. This has been made possible by optical searches for galaxies with D $\geq$ 0.2 arcmin carried out by our collaboration (Kraan-Korteweg, Woudt, Salem, Fairall). The searches have also revealed a number of low-latitude candidate clusters, which have been explored in the various campaigns of follow-up spectroscopy (Kraan-Korteweg, Woudt, Fairall, Balkowski, Cayatte, Henning).

This southern segment of the ZOA has been considered particularly important since it passes close to the dipole in the Cosmic Microwave Background and therefore may be obscuring major nearby large-scale structures that have the greatest gravitational contribution to local peculiar

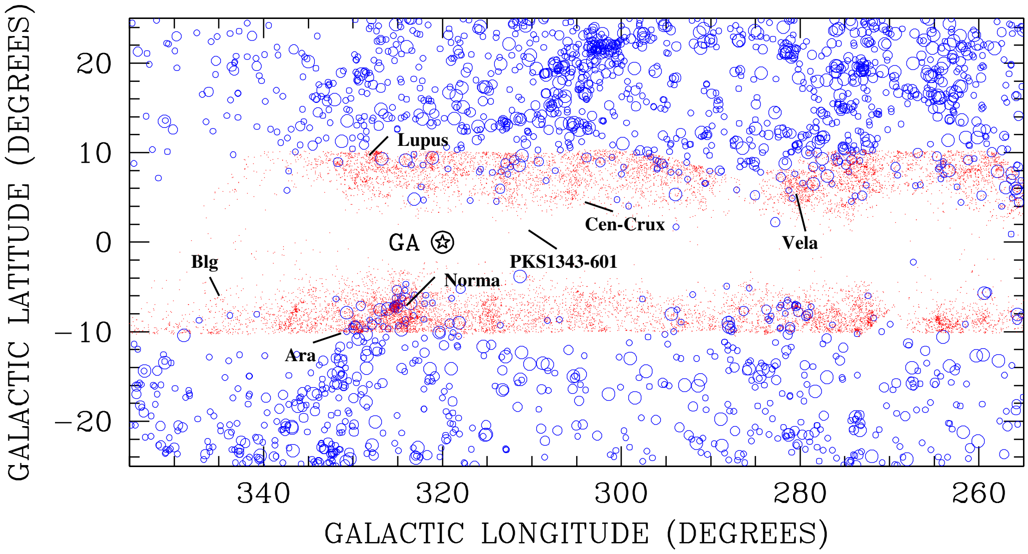

Figure 1: The Zone of Avoidance of the Southern Milky Way, in which various clusters, described in the text below, have been identified. The main clusters are identified and labelled in this graph. The open circles show the galaxies that were known before our deep optical galaxy search (Kraan-Korteweg 2000, Woudt 1998). These galaxies are diameter-coded. Galaxies with $1.3' \leq$ D $\leq 2'$ are shown as small circles, galaxies with $2' \leq$ D $\leq 3'$ as medium-sized circles and galaxies with D $\geq 3'$ are shown as large circles. The small dots correspond to the galaxies found in our deep optical galaxy search.

motions (see Dekel, this conference).

Alternative avenues to map large-scale structures in the ZOA have involved blind H I searches and IRAS galaxies. Such surveys (eg. Staveley-Smith et al. 2000, Saunders et al. 2000) have detected more extended overdensities, but have not directly detected any of the clusters reported in this paper, presumably because of their bias away from elliptical and S0 galaxies. Consequently, our approach both serves a useful purpose and for the time being, offers one of the best ways to locate clusters behind the Milky Way.

2 Clusters found in the Zone of Avoidance

We review below the various nearby (cz $<$ 15000 km/s) clusters so far revealed by our survey. Each of these clusters are marked and labelled in Figure 1.

2.1 Clusters in the Great Attractor region

ACO 3627 (The Norma cluster) at l = 325°, b = -7°

Clearly the most significant find (cz = 4844 km/s, σ = 848 km/s), we have shown that this cluster is comparable in population and mass to the Coma cluster (Kraan-Korteweg et al. 1996, Woudt 1998). Furthermore it lies close to the predicted centre of the "Great Attractor" (Kolatt et al. 1995), probably marking the peak of this extended over-density. We are currently engaged in producing a photometric catalogue of its member galaxies, and establishing its fundamental plane, so to be able to explore its peculiar motion. Early indications in this regard suggest that the cluster has only a small peculiar velocity, if any, relative to the local frame of reference (from the Cosmic Microwave Background), and therefore likely marks the bottom of the potential well of the Great Attractor.

One cannot exclude the possibility that other rich clusters in the Great Attractor region remain hidden behind the remaining Zone of Avoidance ($A_B \geq 3^m$). It could be that bottom of the potential well of the Great Attractor is rather broad and deep, and a large part of the Great Attractor might still be hidden by the remaining optical Zone of Avoidance at $A_B \geq 3^m$ (cf. Stavelely-Smith et al. 2000). A particularly interesting object in this respect is PKS1343-601.

PKS1343-601 at l = 310°, b = +2°

Hidden behind 12 magnitudes of extinction in the B-band (Schlegel et al. 1998) – and hence invisible in the B-band – PKS1343-601 is the second strongest extragalactic radio source (McAdam 1991) in the southern sky, and is associated with a giant elliptical galaxy at $(\ell, b, v) \sim$ (309.7°, +1.7°, 3872 km/s) (West and Tarenghi 1989). This galaxy is located in the central Great Attractor region, and there is evidence that this galaxy might be embedded in a cluster of galaxies; evidence from the radio continuum morphology of PKS1343-601 (McAdam 1991), from the ASCA X-ray data (Tashiro et al. 1998), and from the redshift distribution of known galaxies in this region (see also Kraan-Korteweg and Woudt 1999). We are currently investigating this region using deep optical I-band images taken with the Wide Field Imager at ESO.

The Centaurus-Crux cluster at l = 306°, b = +6°

The Centaurus-Crux cluster, together with the Norma cluster and the Vela cluster, is part of the Norma supercluster that forms part of the general Great Attractor overdensity. This cluster is a low-mass cluster (σ = 472 km/s) at a redshift of cz = 6214 km/s (Woudt 1998, Fairall et al. 1998). At a Galactic latitude of $b = +5.5°$, the Galactic foreground extinction is fairly high ($< A_B > = 2.4^m$).

The Vela cluster at l = 280°, b = +6°

The Vela cluster (Kraan-Korteweg and Woudt 1993) is a fairly round overdensity of galaxies and part of the general Great Attractor overdensity. This cluster is located on the far side of the Great Attractor at a redshift of cz $\approx$ 6000 km/s.

2.2 Other clusters in the Zone of Avoidance

A cluster seen through the Galactic Bulge at l = 344°, b = -5°

Three galaxies within 15 arcmin in position and 200 km/s in redshift form the core of a probable extended cluster at cz = 5700 km/s. The galaxies observed obviously have the highest central surface brightnesses. Though they appear as ellipticals, one is an AGN, another a narrow emission line IRAS galaxy, so they could equally well prove to be the central bulges of spirals.

A cluster in Lupus at l = 328°, b = +9°

A medium-rich cluster at cz = 11200 km/s marks a peak in an enhanced galaxy density that probably reflects a supercluster at this redshift. The location of this cluster corresponds roughly with a peak in the reconstructed "PSCz + BTP" density field (Saunders et al. 2000).

The Ara cluster at l = 329°, b = -9°

This massive cluster (σ = 1182 km/s) at a redshift of cz = 14722 km/s was detected by Woudt (1998) and has now been identified in X-ray as well (Böhringer et al. 2000, Ebeling et al. 2000). This cluster is located near the X-ray bright Triangulum-Australis cluster at $(\ell, b, v) \sim$ (324°, -12°, 15300 km/s) and together they might be part of a larger structure, i.e., a supercluster.

3 References

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