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HI Observations of Nearby Dwarf Galaxies

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Abstract. We present HI detections towards several Local Group dSphs and dIrr/dSphs. The possibility that the detected emission can be due to High Velocity Clouds (HVC) is ruled out although it appears that most of our targets are in HVC rich regions.

1. Introduction

In the Local Group (LG), two categories of dwarf galaxies are identified: the dwarf spheroidals (dSph), known to have a mainly old stellar population; and dwarf Irregulars (dIrr), which have a mixed age stellar population. The dSphs seem to have no neutral hydrogen (HI) within their stellar boundaries (with the exception of Sculptor dSph, Carignan et al. 1998, Bouchard et al. 2003). Since HI could fuel star formation, its presence or absence could be the cause of some of the major differences between these objects. Stellar population analysis now seem to indicate that many LG dSphs may have undergone recent star formation (e.g. Fornax). HI detections near those systems may be of high significance.

2. Observations and Analysis

Following the work by Blitz & Robishaw (2000), we present data for several LG dwarf galaxies acquired with the Parkes 64-m telescope using a multibeam receiver. The initial dataset is from the HI Parkes All Sky Survey (HIPASS, resolutions of $15.5'$ by 18 km s^{-1}), and followup observations were obtained with a narrowband backend (resolutions of $15.5'$ by 0.8 km s^{-1}).

Since the recent publications of a HVC catalog by Putman et al. (2002), it appears that almost all LG dwarfs, with the notable exception of Antlia, are in regions were the High Velocity Cloud density is higher than average — $\langle\rho_{\rm hvc}\rangle = 10^{-4}/(\text{deg}^2 \text{ km s}^{-1})$, see Table 1.

Because HI clouds seem to be offsetted from the spatial and kinematical centers of some dwarfs (mainly the case for dSphs), an association probability (P_A, also listed in Table 1) has been calculated for every cloud found near a dwarf in order to avoid confusion with random HVCs. That probability depends on the angular distance of the cloud to the center of the galaxy (R_1), on the velocity

Table 1. HI detections

Object	M_{HI} ($\times 10^5$ $M_\odot$)	$V_\odot^{HI}$ (km s^{-1})	P_A %	ρ_{hvc} (deg^2 km s^{-1})$^{-1}$
Antlia	6.2±0.3	362±1	100	0.00005
Aquarius	18±2	−144±3	100	0.0018
Carina	14.9±0.9	270±15	25.5	0.0030
Cetus	43.9±1	−293±9	$69.3^\dagger$	0.0018
Fornax	1.46±0.04	29±1	$87.7^\dagger$	0.0015
LGS3	1.6±0.1	−340±5	93.6	...
Pegasus	54±2	−186±2	100	...
Phoenix	1.9±0.1	−23±1	100	0.0004
Sculptor	2.34±0.05	104.2±1	99.7	0.0022
Tucana	18±1	132±5	$98.7^\dagger$	0.0009

offset between the cloud and the galaxy (Δ V_1) and the number of clouds in the vicinity of that particular galaxy (N). N is calculated by counting every HVC — from the catalog by Putman et al. (2002) — inside a 10 deg radius (R_0) of the galaxy and with its velocity within ± 100 km s^{-1} (Δ V_0) of the galaxy. Where velocity information was not available for a galaxy, all clouds within 10° are counted and the velocity ratio is considered to be unity (these values are noted with a dagger (†)).

$$P_A = \left[1 - \left(\frac{R_1}{R_0}\right)^2 \frac{2\,\Delta V_1}{\Delta V_0}\right]^N$$

Sculptor, Cetus, LGS 3 and Carina were all found to have more than one cloud which could be associated with them. In these cases, the values listed in Table 1 are weighted averages (with respect to their HI masses) of the different clouds.

3. Conclusion

HI clouds were detected around many LG dwarfs, including some dSphs (Cetus, Sculptor, Fornax, Carina, and Tucana). Two galaxies, LeoI and Sextans, were not detected in HI. Even if the HVC density around those objects can be up to 30 times above average, we are confident, based on statistical grounds, that the detected clouds are genuinely associated with the dwarfs.

References

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