EXPLORING THE URSA MAJOR REGION

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To shed light on the effect of environment on the evolution of nearby gas-rich spiral galaxies, we investigate the Ursa Major region using data from the HI Jodrell All-Sky Survey (HIJASS; Lang et al. 2003). Ursa Major lies just north of the Virgo cluster, which was studied as part of the HI Parkes All-Sky Survey (HIPASS; Barnes et al. 2001; Wong et al. 2006).

The 480 deg^2 region is an ideal target to study the first signs of interactions and transformation in spiral galaxies as it is nearby and most of the known member galaxies are late-type galaxies that are rich in neutral hydrogen (HI). The region includes the Ursa Major cluster (17.1 Mpc; Tully et al. 2008), the Canes Venatici groups (4.1 Mpc; Karachentsev et al. 2003) and the less dense filamentary structure that connects Ursa Major and the Virgo cluster (16.7 Mpc; Kent et al. 2007).
We compiled a peak-flux limited catalogue of the region containing 162 HI sources; 20 of which are newly detected in HI including 8 candidate galaxies/HI clouds (Wolfinger et al. 2012).

Here, we present an overview of the region: we show examples of first time detections in HI (Fig. 1), intriguing objects such as HIJASS detections with HI extensions/plumes (Fig. 2) and candidate regions for galaxy-galaxy interactions (Fig. 3) – the majority of which lie within the Ursa Major cluster as defined by Tully et al. (1996).
Furthermore we show preliminary results from our study regarding substructures in the region and their dynamics (Fig. 4). In a upcoming paper we will probe the hypothesis that Ursa Major is a *newly forming cluster* (Zwaan et al. 1999) and we will investigate the nature of the Ursa Major cluster by comparing galaxy optical (SDSS; York et al. 2000) and HI properties.

Fig. 1: First time detections in HI

Multi-color SDSS images with overlaid HIJASS spectra.

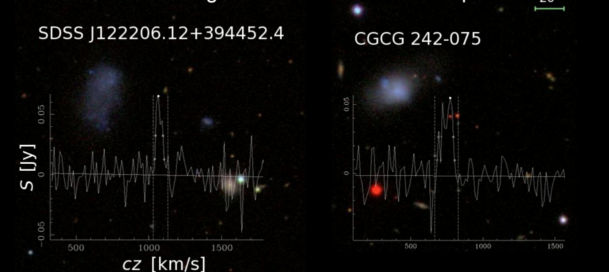
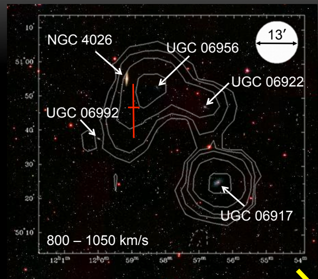


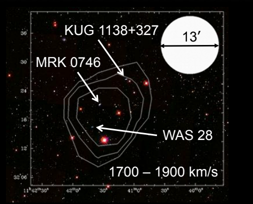
Fig. 2: HIJASS detection with extended HI content



SDSS image with overlaid integrated flux levels (contours) at ±1, 2, 4, 8, 16 Jy beam^{-1} km s^{-1}. Negative contour levels are indicated with dashed lines. The HIJASS beam is shown in the top right corner.
The HI contour lines include multiple catalogued galaxies as labeled in the figure. High resolution observations of this system conducted with the VLA reveal an HI filament of 97 kpc in size (cross) which is likely to be tidally stripped of NGC 4026 (Verheijen & Zwaan 2001).

Fig. 3: Candidate for interactions

This region encompasses multiple galaxies and high resolution follow up observations are required to study the HI distribution, kinematics and possible interaction of these galaxies.



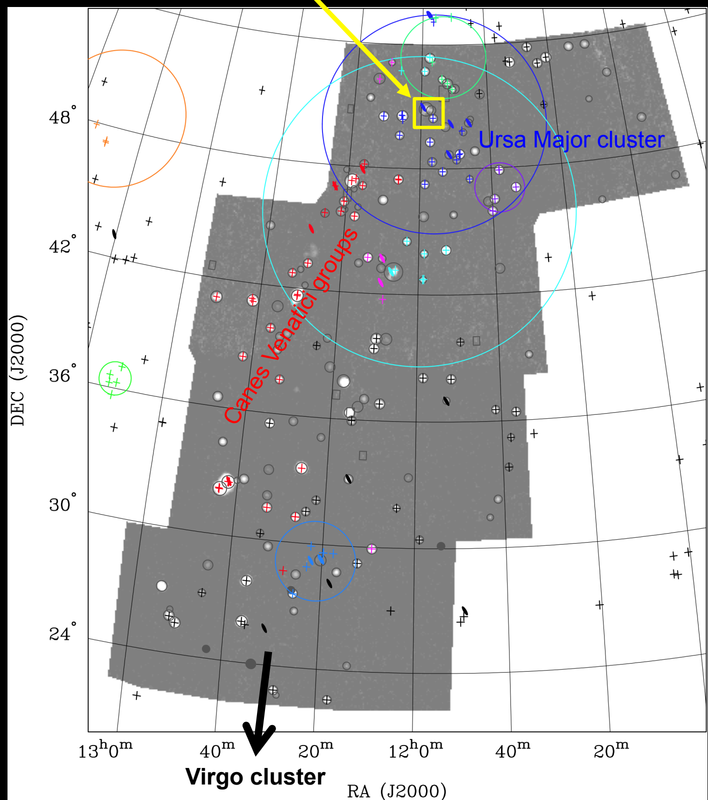


Fig. 4: Integrated HI distribution of the Ursa Major region over the velocity range from 300 to 1900 km s^{-1} as obtained from the HIJASS data (greyscale).

Overlaid are symbols to indicate the projected positions of HI detections (in grey):

- o 150 HI sources with an associate optical counterpart
- • 4 HI detections to which we assign optical counter-parts without previous redshift measurements
- □ 8 candidate galaxies / HI clouds

We show preliminary results derived using a friends-of-friends (FOF) algorithm (Huchra & Geller 1982) on a magnitude-limited sample from HyperLEDA (B ≤ 14 mag).

The spatial distribution of the catalogued galaxies is indicated by crosses and filled ellipses – the latter mark the few early-type galaxies in the region. Using the FOF algorithm we find the groups indicated by colored circles (luminosity-weighted centroid and maximum radial extent). The group members are marked with the same colors. We use the biweight location and scale estimators (Beers et al. 1990) to determine the central velocity and velocity dispersion of the groups:

v_c=359 km/s σ_v= 89 km/s	v_c=898 km/s σ_v=124 km/s
v_c=524 km/s σ_v=202 km/s	v_c=914 km/s σ_v=150 km/s
v_c=746 km/s σ_v= 75 km/s	v_c=954 km/s σ_v= 98 km/s
v_c=777 km/s σ_v=280 km/s	v_c=990 km/s σ_v= 57 km/s
v_c=792 km/s σ_v=131 km/s	

Note that we do not show the maximum radial extent of the red and magenta groups as they are ~ 13 deg.

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Kathrin Wolfinger: I am a PhD student working on the evolution of gas-rich spiral galaxies in different environments.
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