Galactic Extinction in the Anti-Center Region

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Astro 7620
February 17, 2010
The Problem

- Low-HI mass galaxies in very small dark matter halos may be visible in other groups like the Local Group, but will only be visible very nearby (ask Betsey!)
- EGG is considering a deep HI survey of nearby groups to look for these halos.
- We investigated dust in the anti-center region $1h < \text{R.A.} < 5h$, $3 < \text{Dec} < +33$.
  - Along with the galaxies with known redshift in that region
  - And background structures for ancillary science that could be done with an HI line survey of this type.

Leo T: [Discovery paper](#) and [HI measurement](#) at the GMRT
Total HI mass: $2.8 \times 10^5 \ M_{\text{Sun}}$
$M_{\text{Dyn}}$: $3.3 \times 10^6 M_{\text{Sun}}$
M-to-L ratio: $>50$
How do you determine Galactic extinction?

- **Burstein and Heiles** (’78–’82) assumed correlation between HI and dust; map at lower resolution than filamentary structures. DIRBE on COBE: the *Diffuse Infra-Red Background Experiment* @ 100 and 240 micron, + IRAS maps (which were poorly calibrated)
  - Two bands give you the temperature, which allows you to convert the 100um map to a dust column.
  - Extinction level is calibrated by a magnesium line strength/color relationship in elliptical galaxies.
- **1998 Paper, Schlegel et al.** (fun fact: when you read a paper this old, sometimes they will tell you that they obtained the data “on CD-ROM”.)
How to use the DIRBE Map

- Dust maps and IDL code are available at Berkeley and Princeton (mirror sites)
- Or, in EGG, you can check out /home/dor3/galaxy/eggidl/dirbe
- (their) dust_getval.pro obtains the E(B-V) magnitude correction for a given l,b
  - Other options include accessing the Burstein-Heiles extinction, the dust temperature map, etc.
- (our) dirbe_bandpass.pro can convert that extinction to many other bandpasses, including UBVRI and the SDSS ugriz.
  - Extinction In Other Passbands, Appendix B of the Schlegel et al. dust map paper
Dust – DIRBE view
Region between $1h < R.A. < 5h$, $3 < Dec < +33$
What do we expect to see!

• Anti-center: In principle, looking away from the bright city lights of our Milky Way
• Very less obstruction – No ZoA
• Molecular Clouds, Galaxy Clusters – over a modest (z) distance range
• How modest: $\sim 200\text{Mpc} \ (\text{around } z \sim 0.05)$
What did we see
Structures Appear!!
A rough but general sense
Where could we see

\[ \lambda_{obs} = \lambda_{src} \sqrt{\frac{1 - \beta}{1 + \beta}}, \quad \beta = \frac{\nu}{c}, \quad z = \frac{\Delta \lambda}{\lambda_{src}} \]

**ALFALFA**

- H-I line at 1421 MHz at a Redshift of \( z = 0.06 \), is observed at 1340.56 MHz, \( \sim 80 \)MHz shift

- \( \nu = 17448.8 \)km/sec, away | \( D = 242.5 \)Mpc
- \( D = 250 \)Mpc \( \Rightarrow z = 0.06196 \Rightarrow \nu = 18000 \)km/sec
Groups in the Foreground

- NGC 784 & 672 Groups
  - Saintonge et al. 2008 covered part of this region

NGC672 grp: open
NGC784 grp: filled
Groups in the Foreground

- NGC 784 & 672 Groups
  - [Saintonge et al. (2008)](#) covered part of this region
  - [Sohn and Davidge (1990)](#) measured a distance to NGC672 of 7.9 Mpc (method of brightest stars): **open circles**
  - [Drozdovsky & Karachentsev (2000)](#) measured a distance to NGC784 of 5.0 Mpc (same): **filled circles**

NGC672 grp: open
NGC784 grp: filled
Groups in the Foreground

- NGC 784 & 672 Groups
  - *Saintonge et al. (2008)* covered part of this region
  - Sizes of the symbols are “proportional to the logarithm of the ratio between the masses of the galaxies and the least massive galaxy of the sample.”

\[
\log M_{HI} : 8.49 \quad \sim 6.5
\]

NGC672 grp: open
NGC784 grp: filled

\[
\log M_{HI} \sim 9.1 \rightarrow \sim 7
\]
E(B-V) extinction in this region is less than 0.1 mags
Ancillary Science: LSS in the Background

- Abell 150/152
- Dec +13 to +14
- Abell 160
- +15 dec

Dec 3–18
Anti-Center
N = 5860
Ancillary Science: LSS in the Background

- Portions of the Pisces-Perseus supercluster
- Hunt for galaxies in the Taurus void and compare their properties

UGC2627 with companion UGC2629 in the Taurus Void
Recommendations

- Optical followup potential in the NGC 784/672 groups:
  - Small extinction, ranging from 0.04 to 0.11 magnitudes

- Ancillary science:
  - Lots of background groups and clusters
  - Intermediate-mass (log $M_{\text{HI}}$ 8.5-9) detectable in Pis-Per and the Taurus Void with ALFALFA.