A search for intervening HI absorption in nearby galaxies

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A Search for Intervening HI Absorption in Nearby Galaxies

- Conducting a targeted search for intervening HI absorption in nearby galaxies
- Sample: I6 nearby, gas-rich galaxies (selected from the HIPASS Bright Galaxy Catalogue; Koribalski et al. 2004)
- By targeting nearby galaxies we can directly relate gas distribution to the absorptionline detection rate

• Questions:

- What is the expected detection rate of intervening absorption-lines?
- How does detection rate vary with distance from the centre of the galaxy?
- What is the typical spin temperature of the gas in disks of spiral galaxies?



Galaxy Sample



Red contours: SUMSS continuum image (843 MHz) **Greyscale:** optical image (SuperCOSMOS)



ATCA Observations

- I2 hr observations with ATCA 750m arrays
- Obtain simultaneous emission- and absorption-line data (by varying the weighting scheme used in reduction)
- Achieve rms noise of ~1.5-2.5 mJy per channel (comparable to FLASH)
- Spatial and spectral resolution also well-matched to FLASH









Blue contours: ATCA HI distribution (natural weighting, excluding CA06) **Red contours:** ATCA continuum image (uniform weighting) **Greyscale:** optical image (SuperCOSMOS)

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HI Absorption Results

- 7/15 sight-lines intersect the HI disk of the foreground galaxy
- One intervening absorption-line detection (7% detection rate)

- Low detection rate is largely due to the structure of the background sources
- This provides important information about the expected detection rate of future absorption-line surveys





Comparison to Previous Surveys



Gupta et al. (2010):

- Detection rate of 50% for integrated optical depths
 0.1 km s⁻¹ and impact parameters < 20 kpc
- Background sources all QSOs

Our sample:

- 7% detection rate
- 15 radio sources
- I confirmed QSO



Detection in NGC5156



- Impact parameter: 20.6 kpc
- Absorption-line: optical depth $\tau_{\text{peak}} \sim$ 0.06, line-width ~13 km s⁻¹ (2 channels)
- HI column density: $N_{HI} \sim 1.1 \times 10^{21} \text{ cm}^{-2}$ (for $T_S/f = 100 \text{ K}$)
- Spin temperature: estimate $T_s/f \sim 160 \text{ K}$

- Follow-up observations:
 - 12 hours with 6km array
 - High spectral resolution mode



Outlook for FLASH

• General comments:

- Need to consider the effect of background source structure on absorption-line detection rate
- Can still expect to detect hundreds of intervening absorption-lines





- FLASH-Wallaby piggyback:
 - Confusion from emission at low redshift will be an issue (need uniform weighting)
 - Wallaby piggyback survey offers the opportunity to repeat this analysis with a much larger sample



Conclusions

- Have conducted a targeted search for intervening HI absorption in 16 nearby, gas-rich galaxies
- Using ATCA observations we obtain both emission and absorption-line data
- 7 of the 15 sight-lines intersect the disk of the galaxy, and we have detected one absorption-line at an impact parameter of ~20 kpc
- Detection in NGC5156: combined emission- and absorption-line data allows us to estimate the spin temperature: $T_{\rm S}/f \sim 160~{\rm K}$
- Outlook for future surveys is very positive but need to be aware of the effect of background source structure on expect detection rate

