

Future Large Surveys with the Westerbork Synthesis Radio Telescope

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ASTRON

WSRT Users' Meeting

Amersfoort

4 June 2008



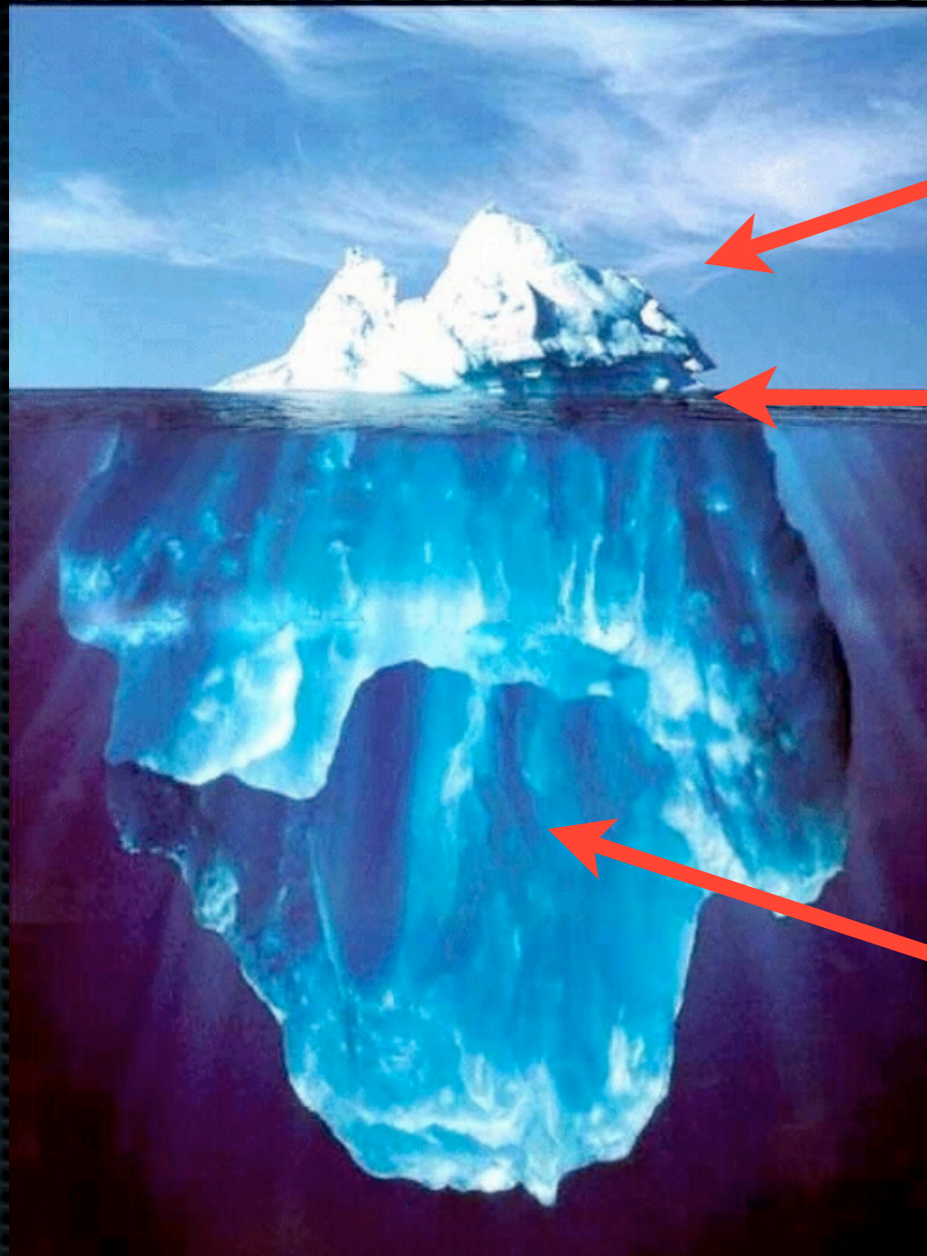
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NWO

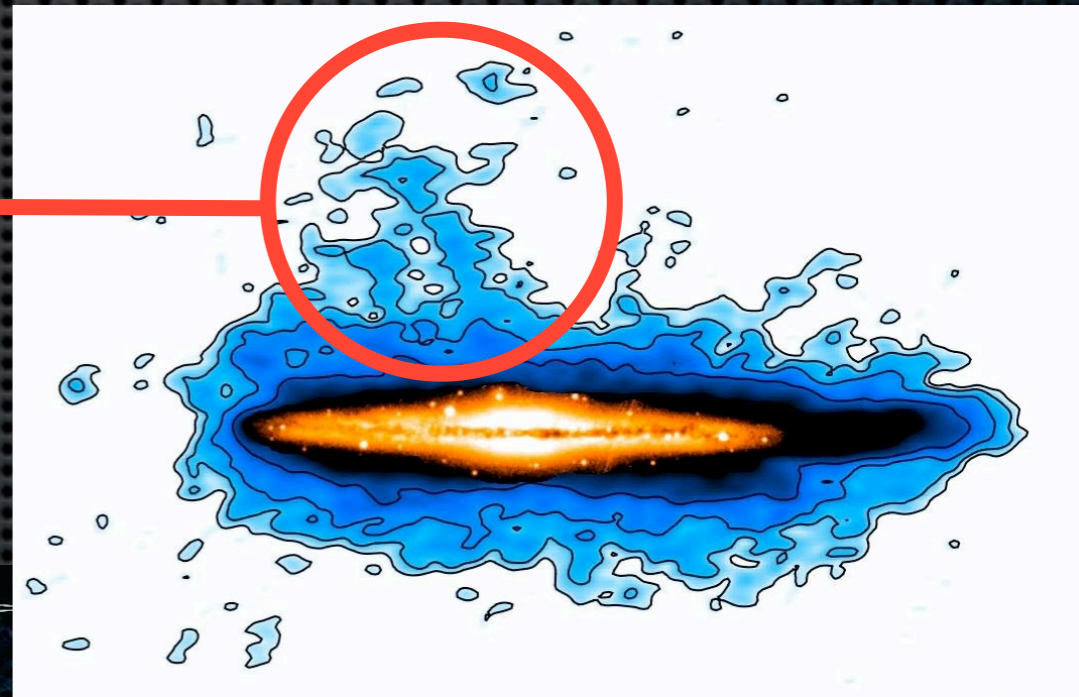
- ✦ As noted in the APERTIF document by Tom & Wim (§5):
 - ✦ APERTIF of course provides new capabilities to WSRT
 - ✦ but some capabilities will be lost (or retained, but with reduced sensitivity)
- ✦ Which capabilities are diminished?
 - ✦ Low frequency work (pulsars, LOFAR prep/support)
 - ✦ VLBI (at frequencies other than L-band)
 - ✦ Hi....

- A strength of WSRT is ability to perform deep HI observations:
 - nearby galaxies (e.g. NGC 891; Oosterloo)
 - distant clusters (e.g. Abell 963/2192: $z \sim 0.2$; Verheijen)
- Still possible with APERTIF, but
 - $\sim 64\%$ increase in noise (APERTIF-12) $\Rightarrow \sim 3$ longer integration
 - e.g. NGC 891: $20 \times 12\text{hr} \Rightarrow 54 \times 12\text{hr}$
- Other radio facilities? (EVLA?)
- Take home message: Deep HI work is best done now before WSRT is upgraded to APERTIF !!

Motivation for a deep HI survey

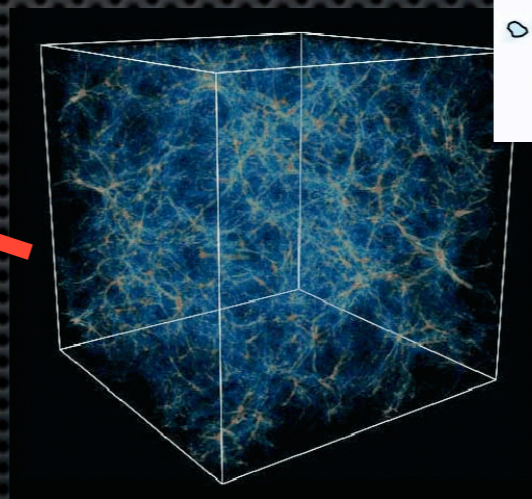


condensed structures
~ 6% of Ω_b (at $z=0$)
(Fukugita 2003)



Oosterloo+

?



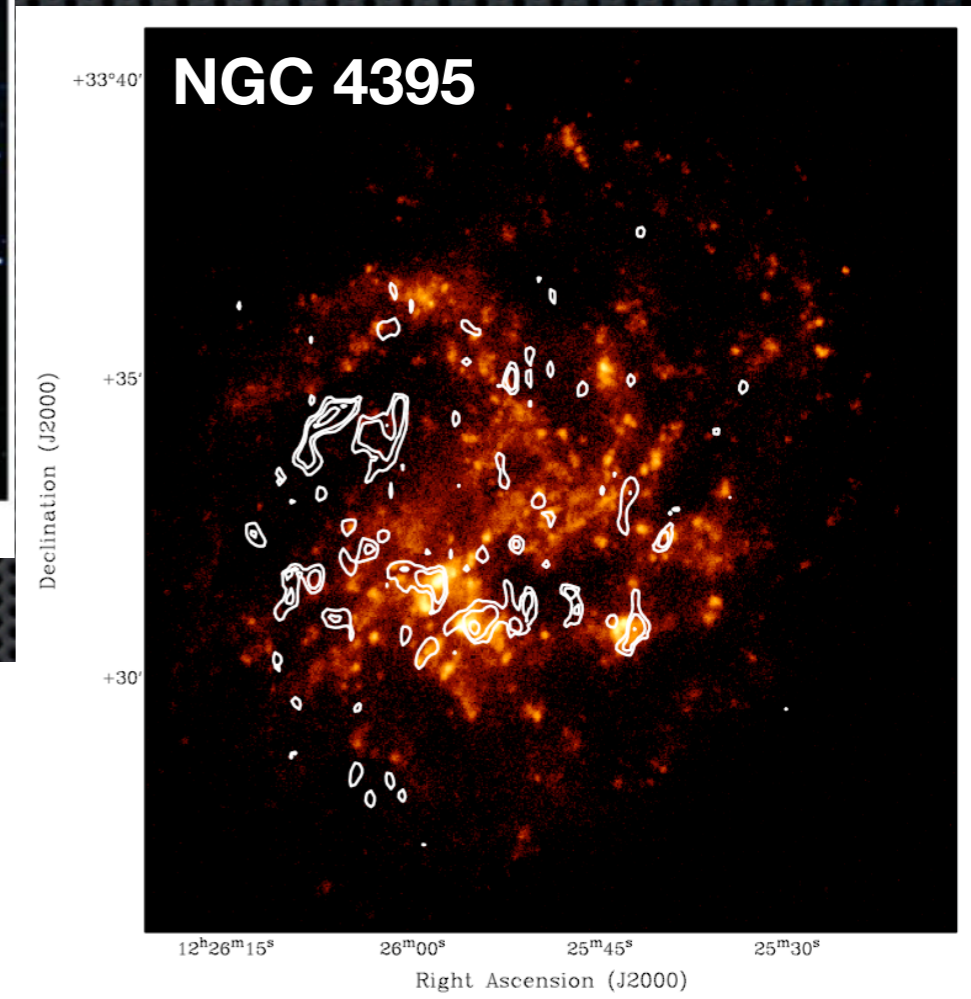
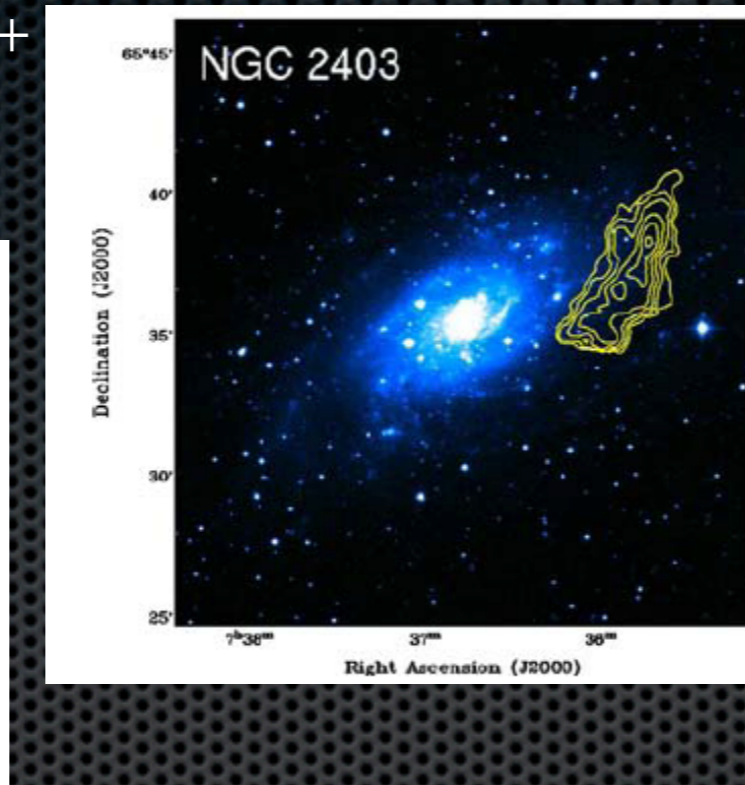
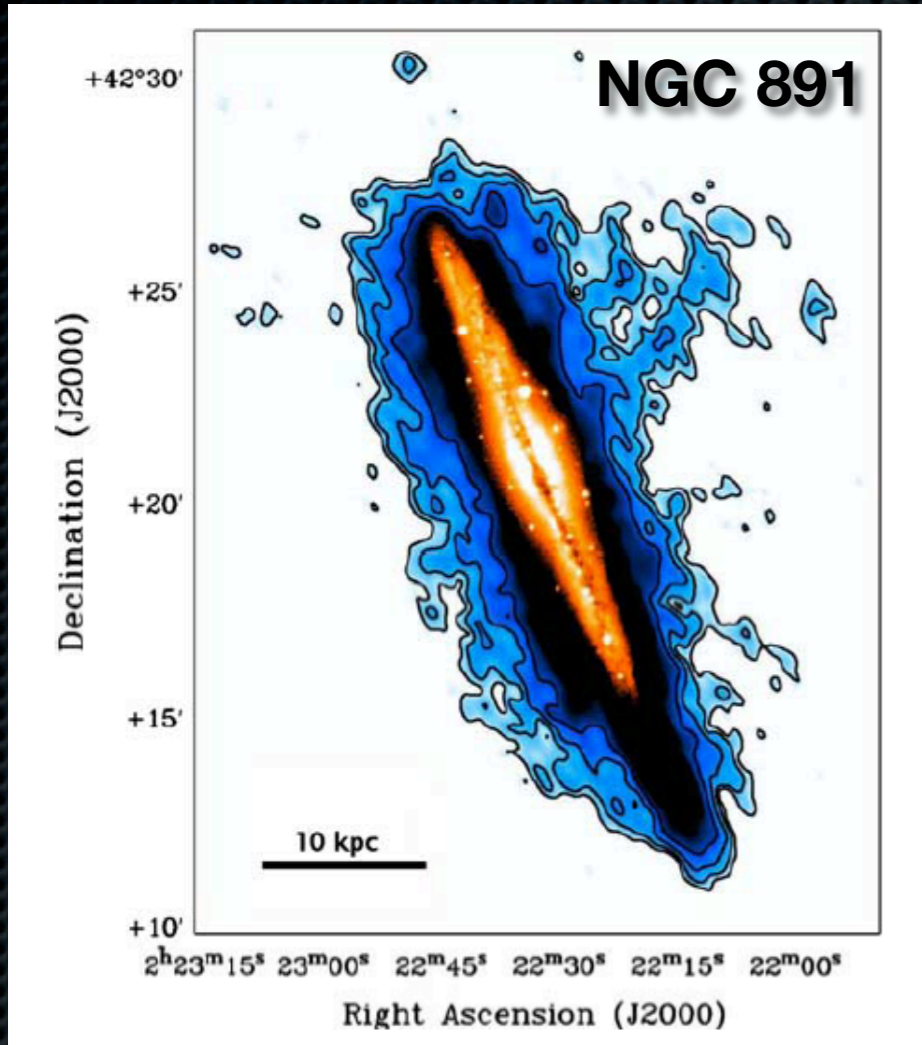
Ly α forest + WHIM
~ 40% of Ω_b (at $z=0$)
(Danforth & Shull 2008)

Motivation for a deep HI survey

- ✦ Gas accretes onto condensed objects along filaments in “cold mode”, from arbitrary directions in “hot mode”
 - ✦ Cold mode is still expected to be dominant for normal starforming galaxies at $z=0$
- ✦ Accretion rate should be $\sim 1 M_{\odot}/\text{yr}$ in order to maintain star formation rate, match chemical abundances (MW: $\sim 1 M_{\odot}/\text{Gyr}$)
- ✦ Connection between galaxies and the IGM still unclear:
 - ✦ Lopsidedness, warps thought to be result of recent accretion
 - ✦ Cold accretion: how ubiquitous? how much?

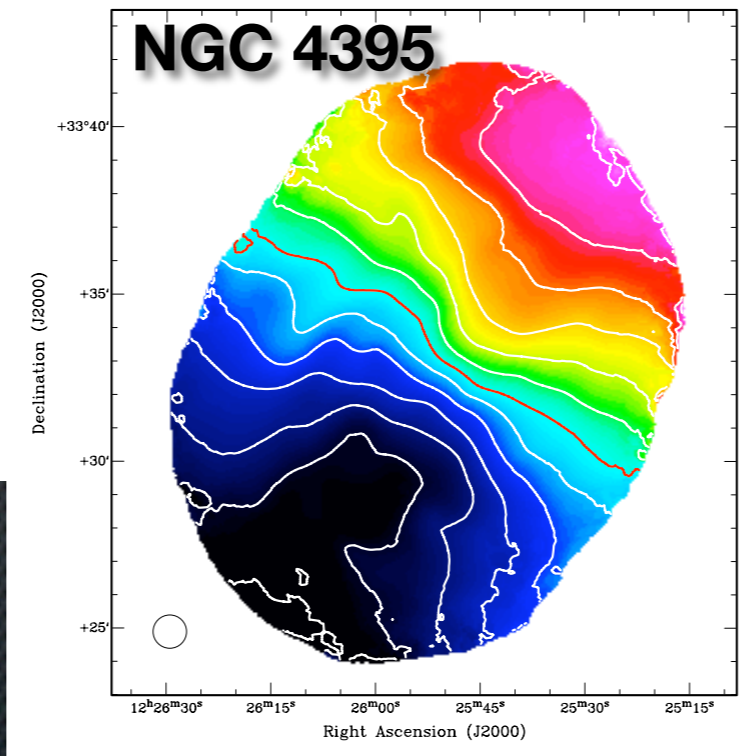
Motivation for a deep HI survey

Fraternali+

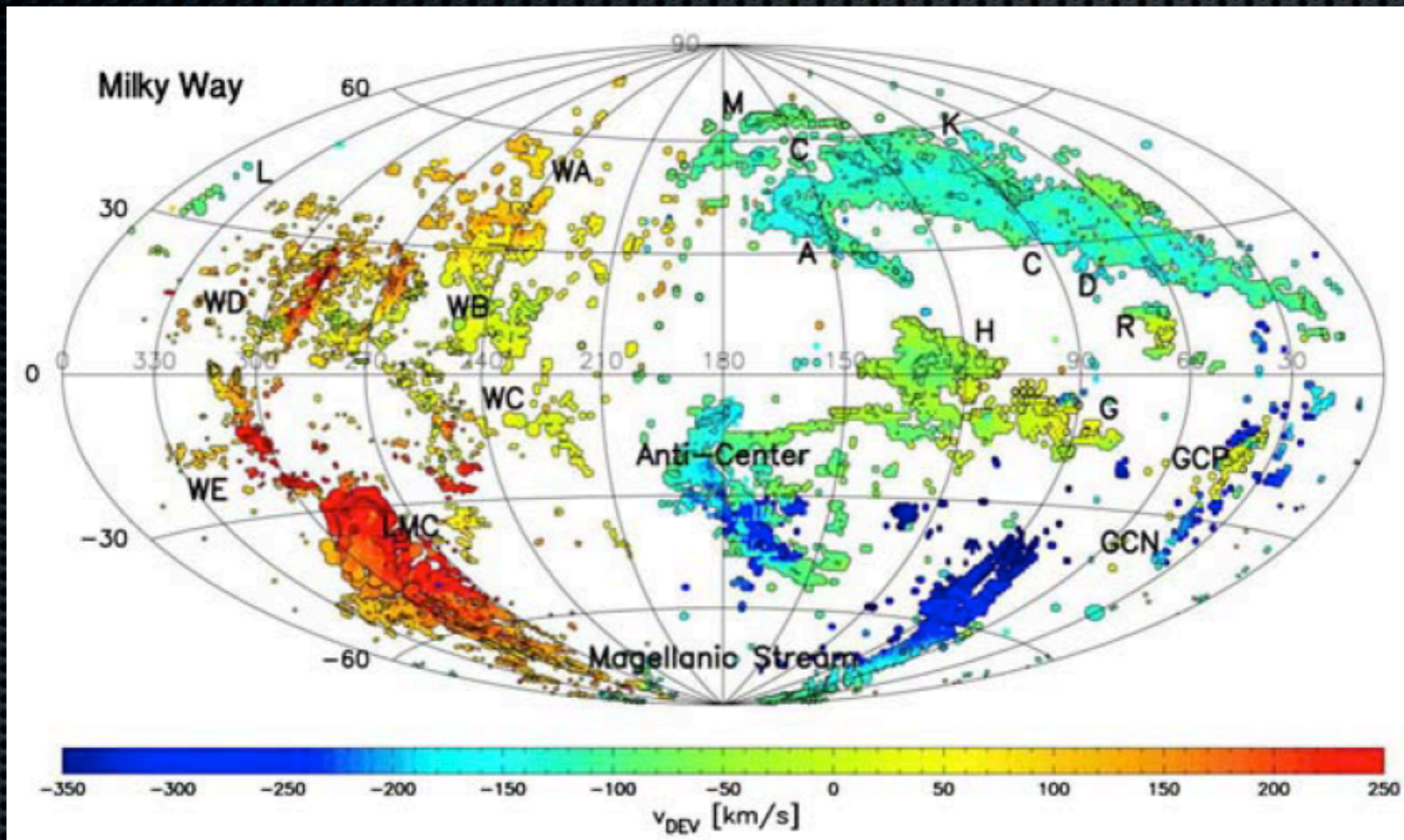


Heald & Oosterloo

Oosterloo+



Motivation for a deep HI survey

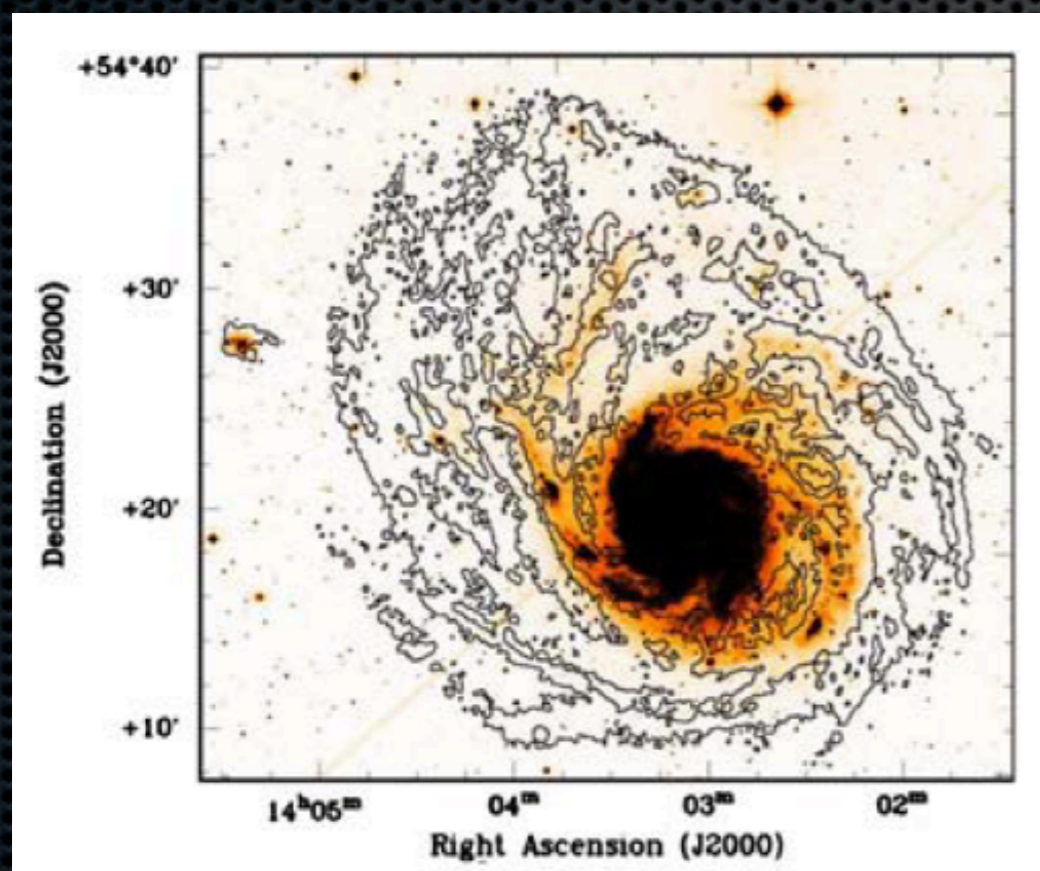


Wakker

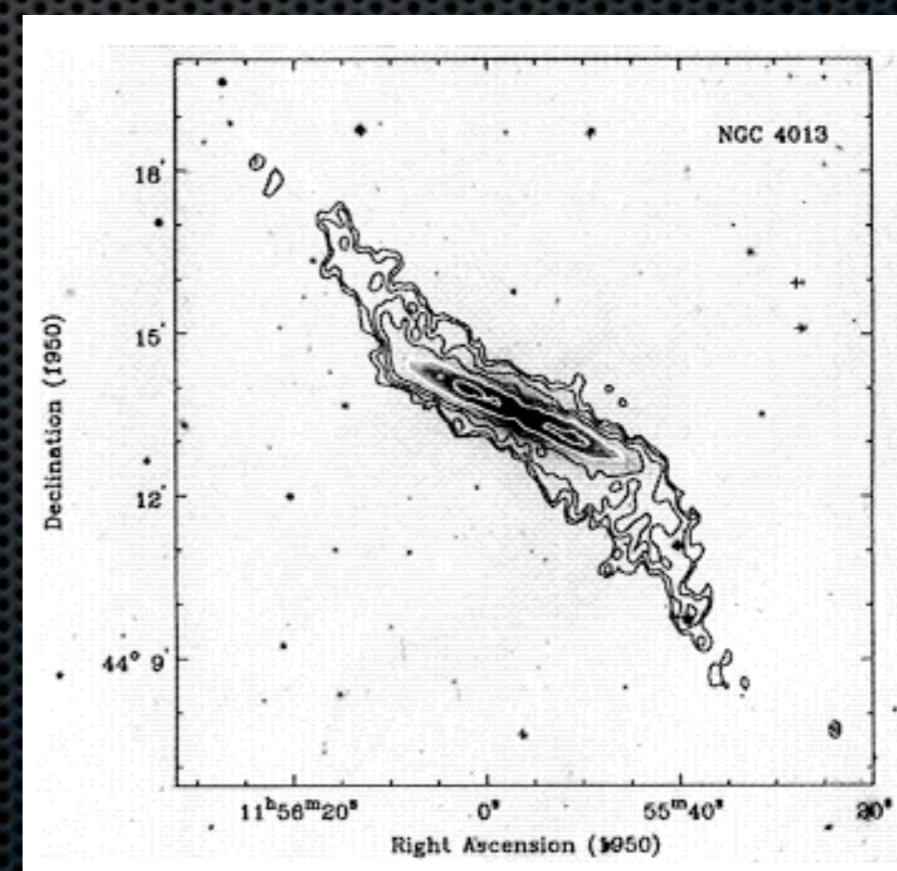
- General conclusions hard to come by, using the hodgepodge of available data

Target selection

- What types of galaxies?
 - Lopsided
 - Warped
 - “Normal”



Sancisi+



Bottema

How deep?

- Observations of NGC 891 and NGC 4395 have shown that the interface between galaxies and the IGM can begin to be revealed with integration times of order $\sim 10\text{-}20 \times 12\text{hr}$.
- In NGC 891, halo clouds (some counter-rotating) detected with $M \gtrsim 10^6 M_{\odot}$
- Assuming $20 \times 12\text{hr}$ and ~ 15 (3x5) galaxies this means $300 \times 12\text{hr}$.
- If split over 6 semesters, $50 \times 12\text{hr}$ per semester.
- **SWANSONG**: Superdeep Westerbork Archival Neutral-hydrogen Survey Of Nearby Galaxies

Final thoughts

- ✦ Coordination with other wavebands
 - ✦ Deep optical, IR, UV imagery will be observed, where the data are not already available
- ✦ If WSRT is upgraded to APERTIF, surveys like this one are particularly timely.
- ✦ Comments and suggestions welcome...