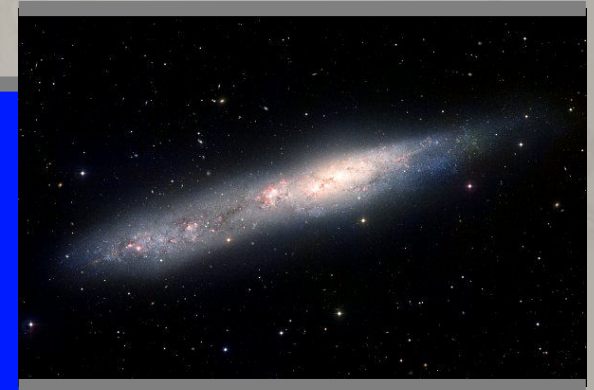
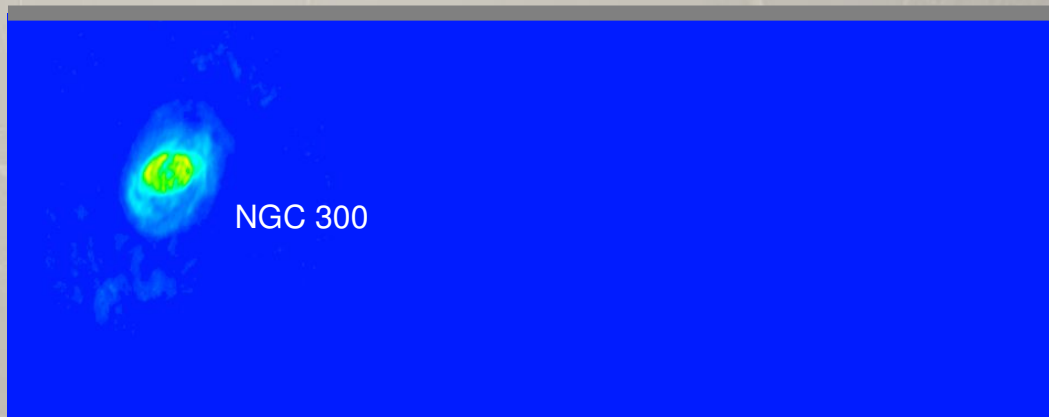


Gas and Dark Matter in Galaxy Groups

Tobias Westmeier, *Australia Telescope National Facility*



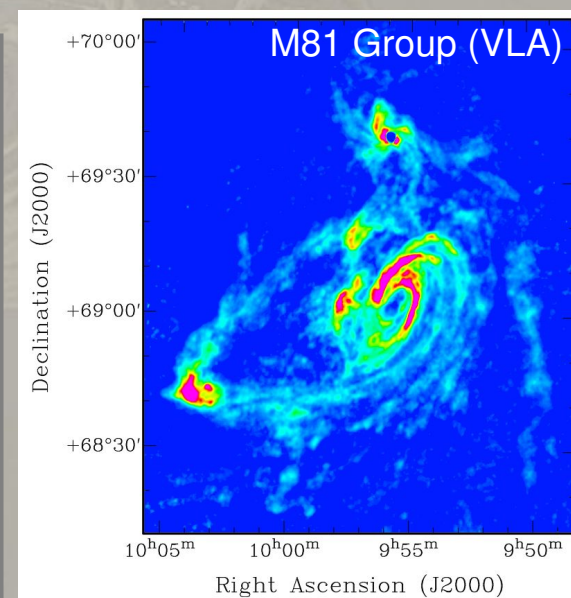
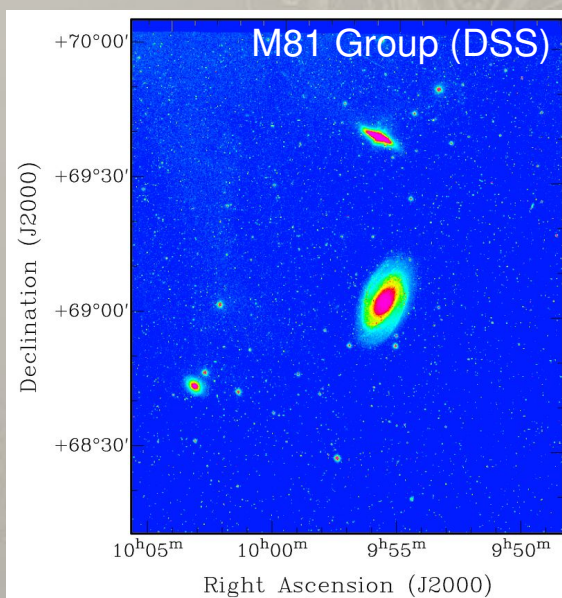
Prospects of the New SKA Prototypes

The new generation of radio telescopes (ASKAP, MeerKAT, WSRT/Apertif) will have:

- moderate to large **field of view**
 - moderate to high **sensitivity**
 - excellent **uv coverage**
- } **High survey speed**

These are ideal parameters for large-scale, sensitive H I studies of **nearby galaxies** and entire **galaxy groups**.

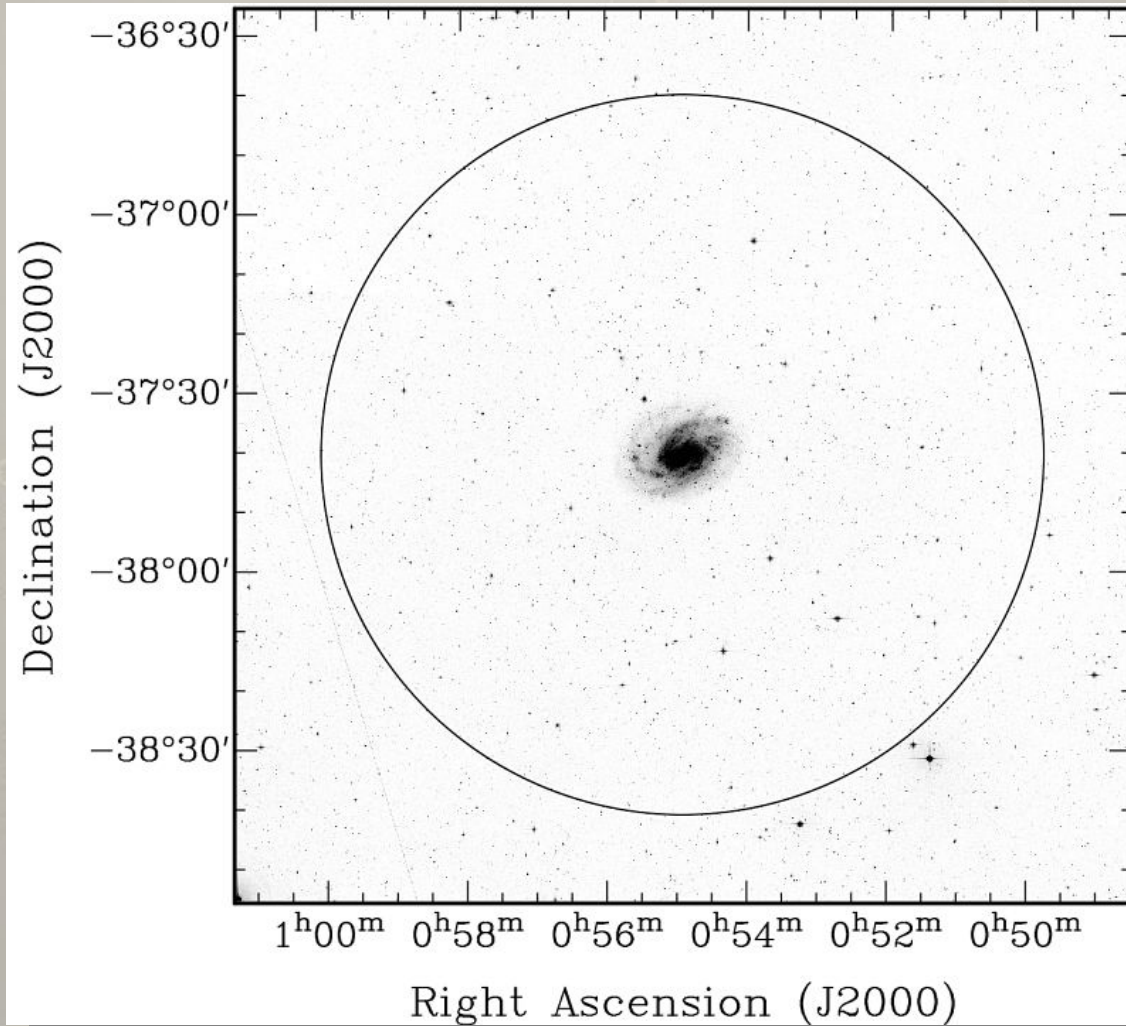
This presentation will showcase some of the expected science outcomes of **deep, wide-field** H I observations of nearby galaxies and groups.



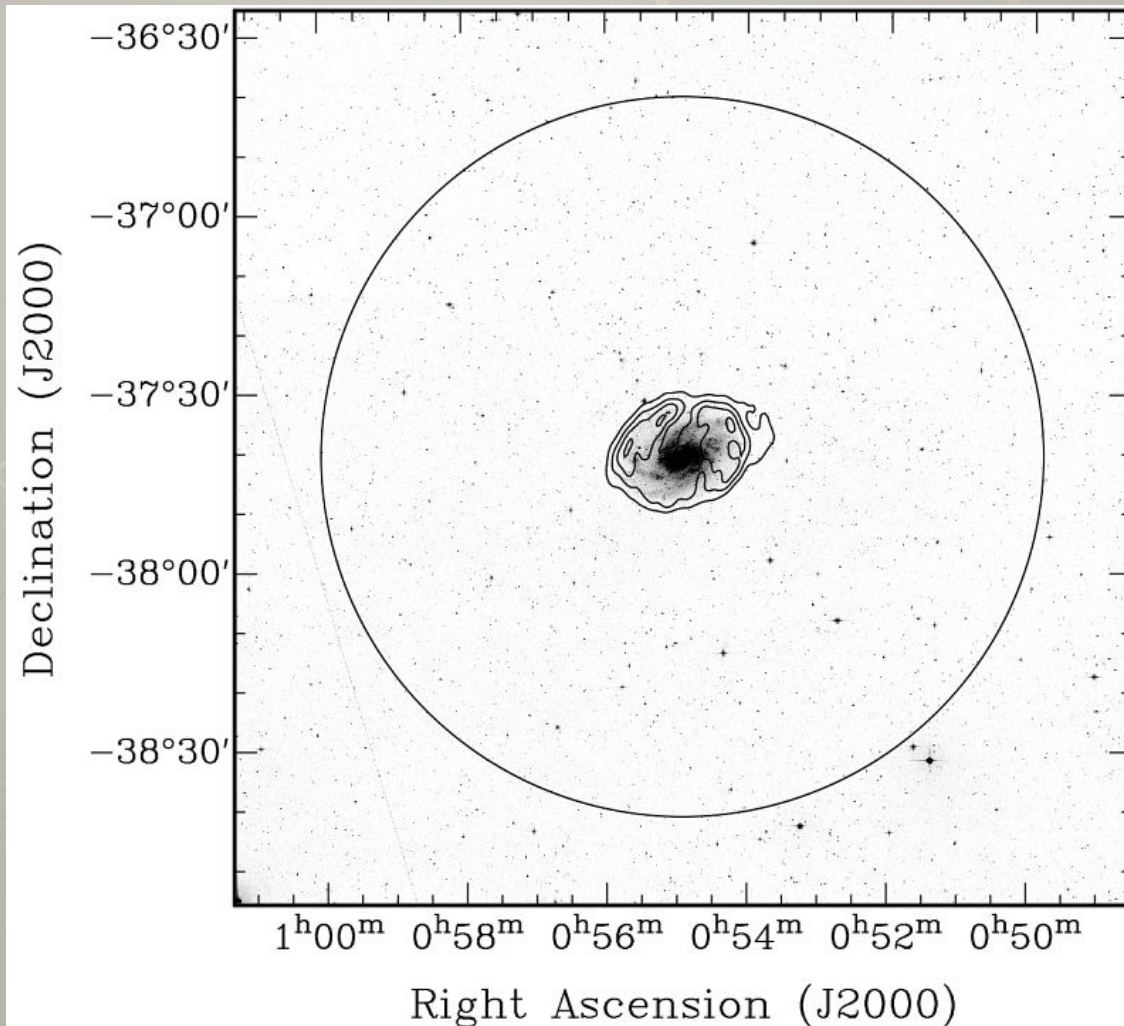
ATCA Survey of NGC 55 and NGC 300

- Frequency: 1420 MHz (H I), 1384 MHz (continuum)
- Array configurations: EW352, EW367
- Number of pointings: 32
- Covered area: $2^\circ \times 2^\circ$ ($65 \times 65 \text{ kpc}^2$)
- Total integration time: 96 h (3 h per pointing)
- Angular resolution: $90'' \times 150''$ ($0.8 \times 1.4 \text{ kpc}^2$)
- Velocity resolution: 4 km/s
- Sensitivity in H I: 10^{19} cm^{-2} ($10^5 M_\odot$)



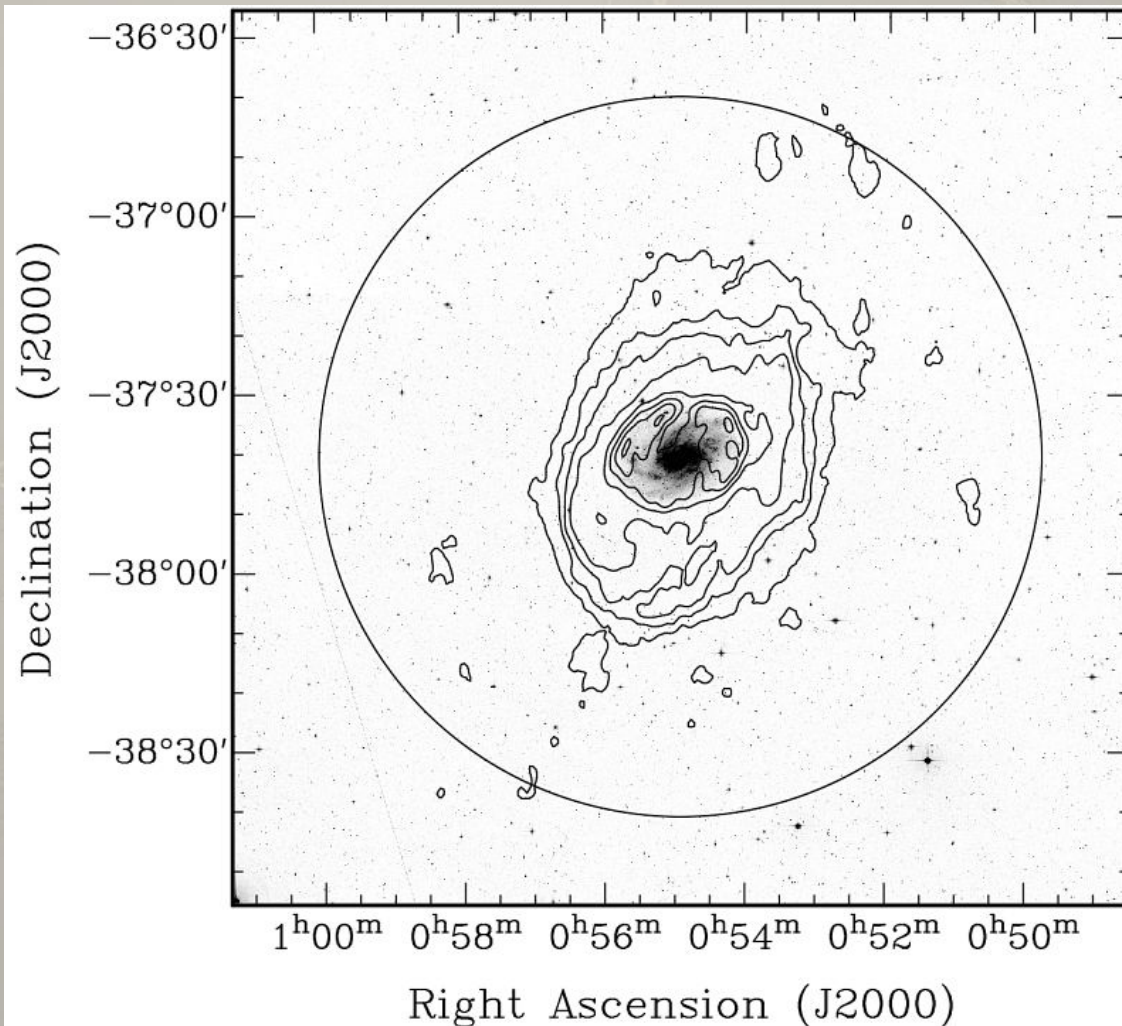


DSS Image of NGC 300



DSS Image of NGC 300

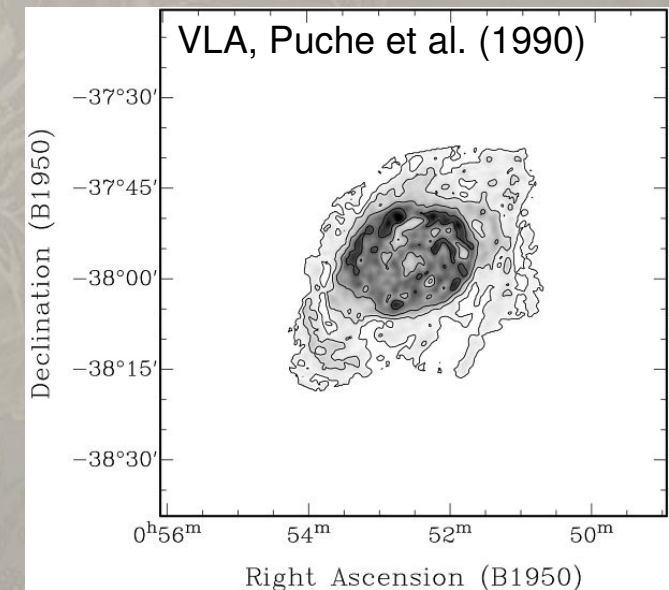
Lowest H I contour: $5 \times 10^{20} \text{ cm}^{-2}$



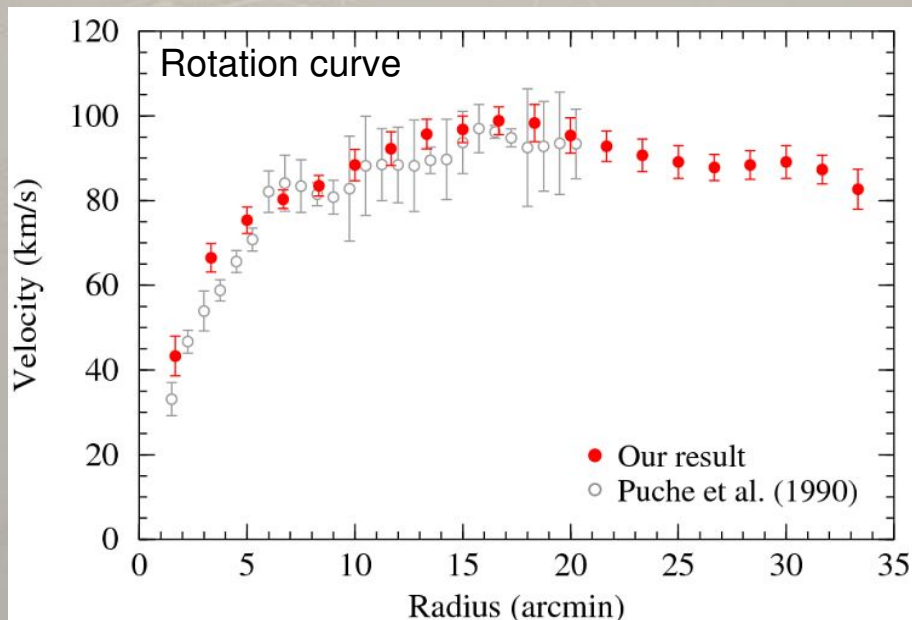
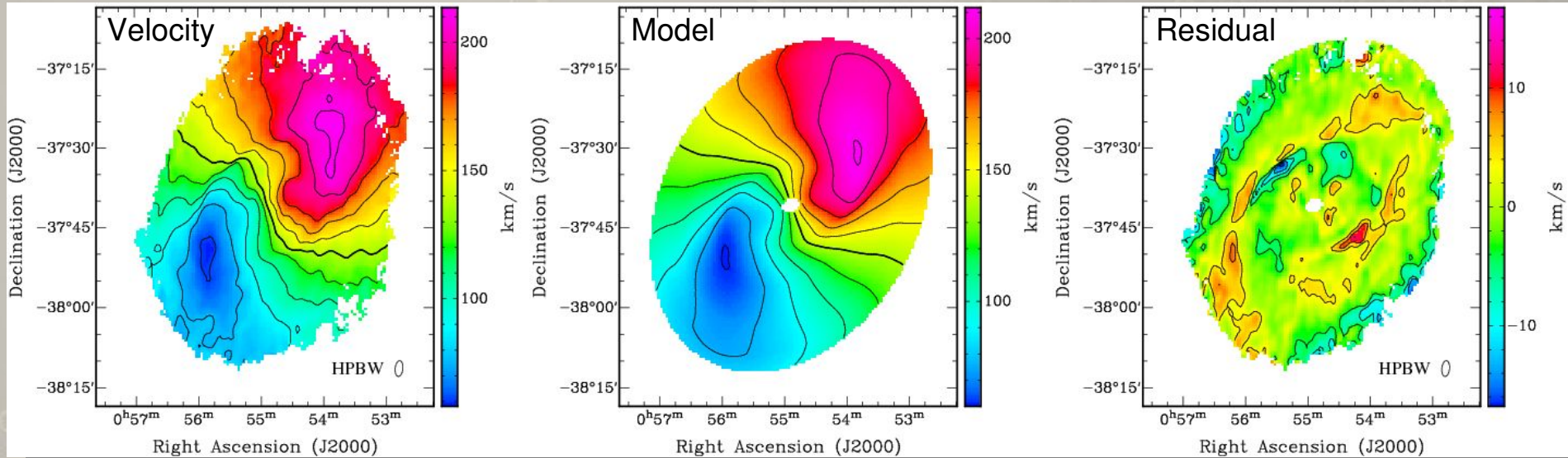
DSS Image of NGC 300

Lowest H I contour: $1 \times 10^{19} \text{ cm}^{-2}$

Very **extended outer disc** with different orientation angle.

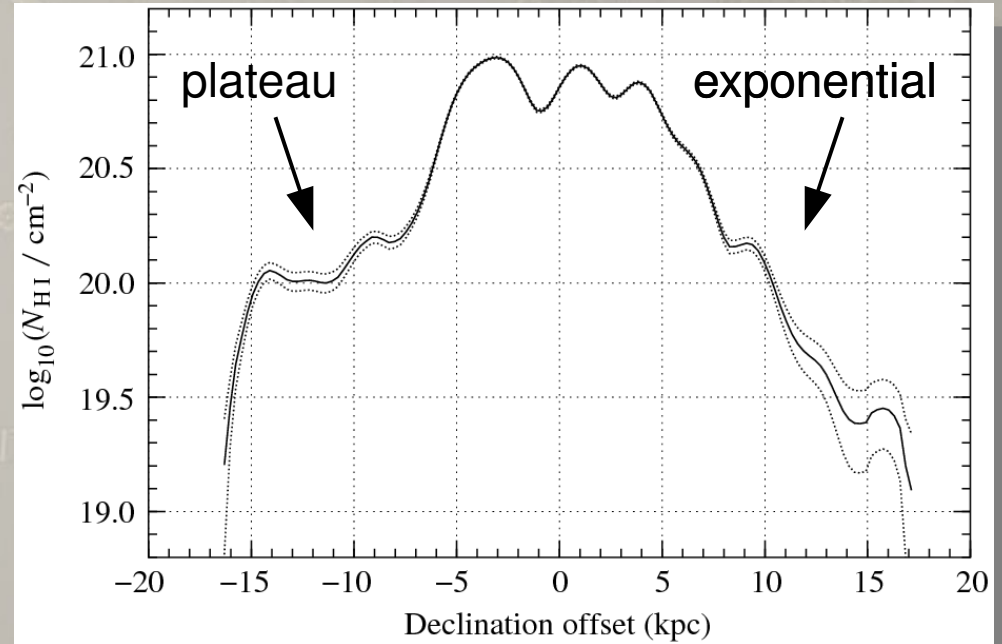
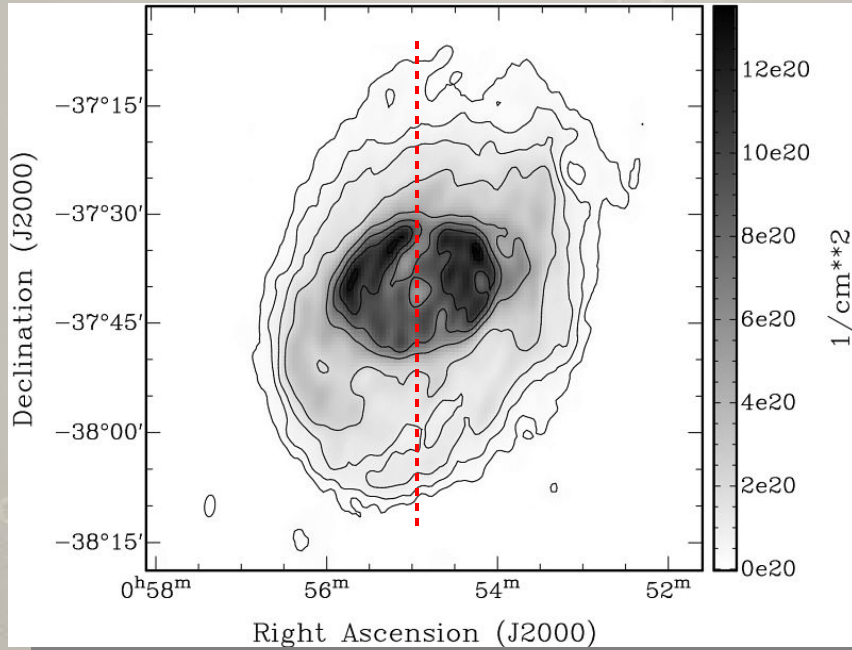


NGC 300: Rotation Curve and Mass Modelling



- Rotation curve out to about **20 kpc**, almost twice as far out as Puche et al. (1990).
- Maximum rotation velocity of about **100 km/s** at about 9 kpc.
- Rotation **velocity decreases** beyond about 10 kpc.
- Important constraint for **dark matter models** that need to explain the declining velocity.

NGC 300: Intergalactic Medium



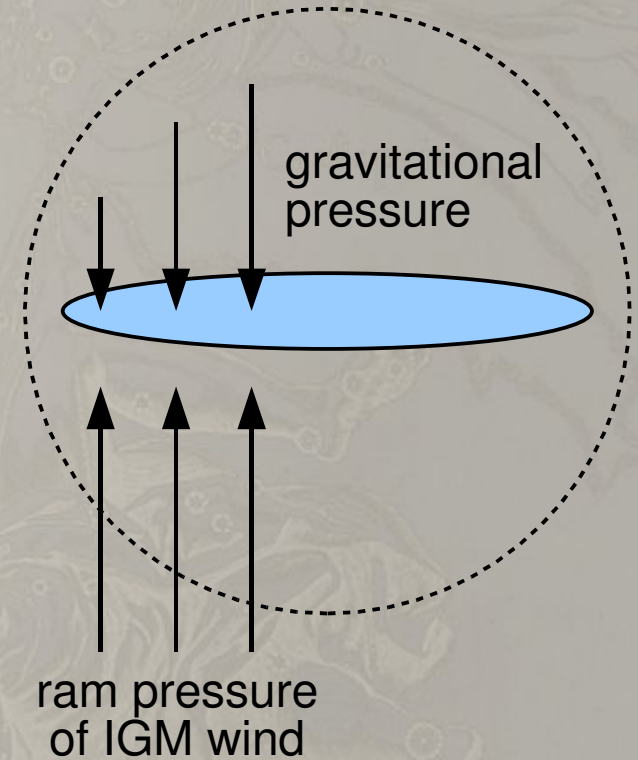
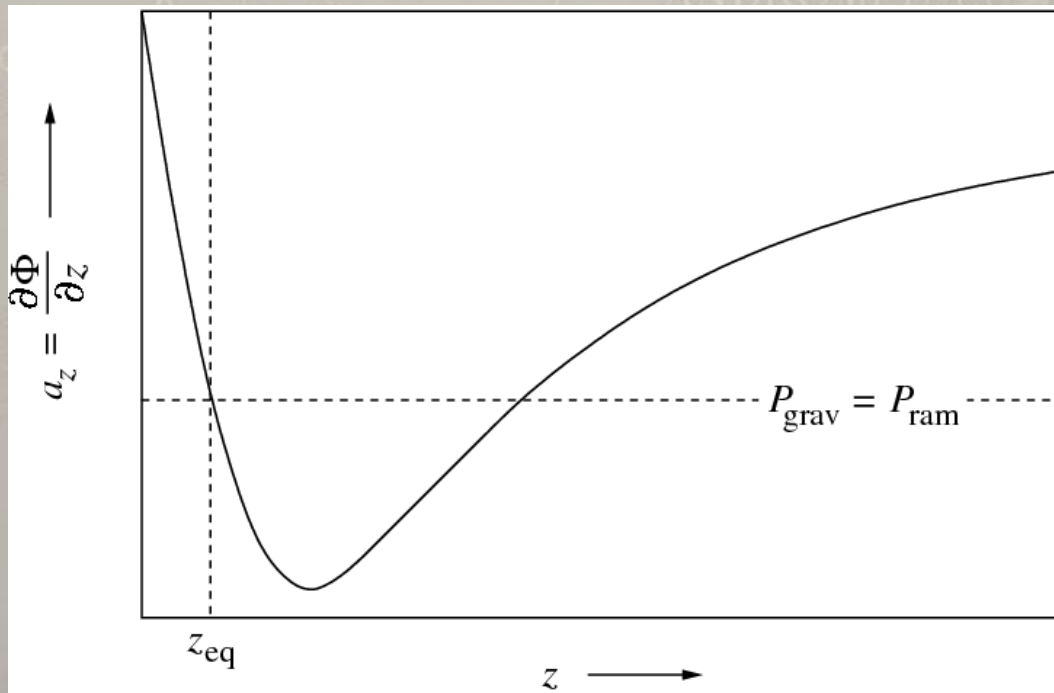
- Strong **asymmetries** in the H I disc of NGC 300.
- South-eastern edge sharp and smooth
- North-western edge broad and ragged
- Possible explanation: **ram-pressure** interaction as NGC 300 is moving through intergalactic medium (or result of **tidal** forces?)

Ram-pressure Stripping

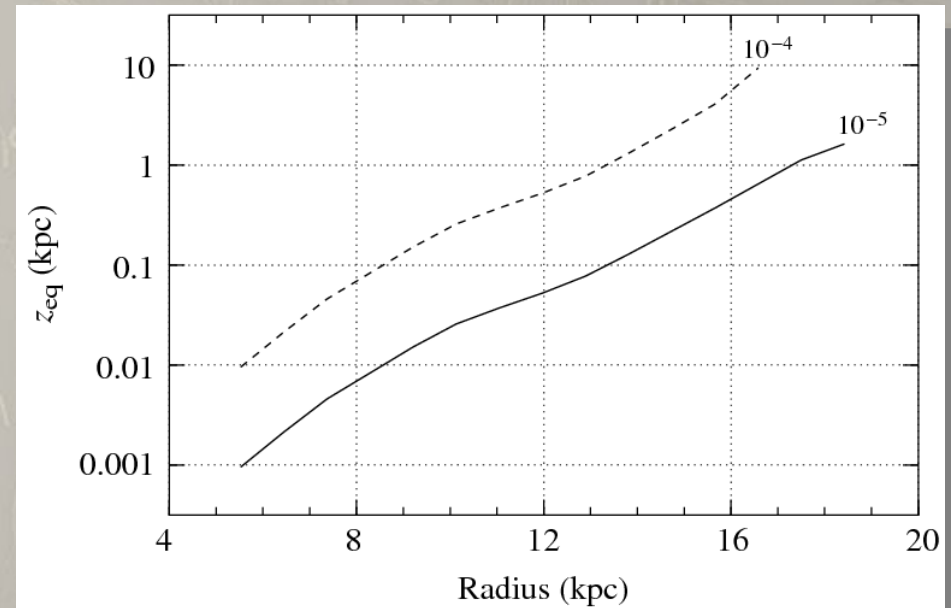
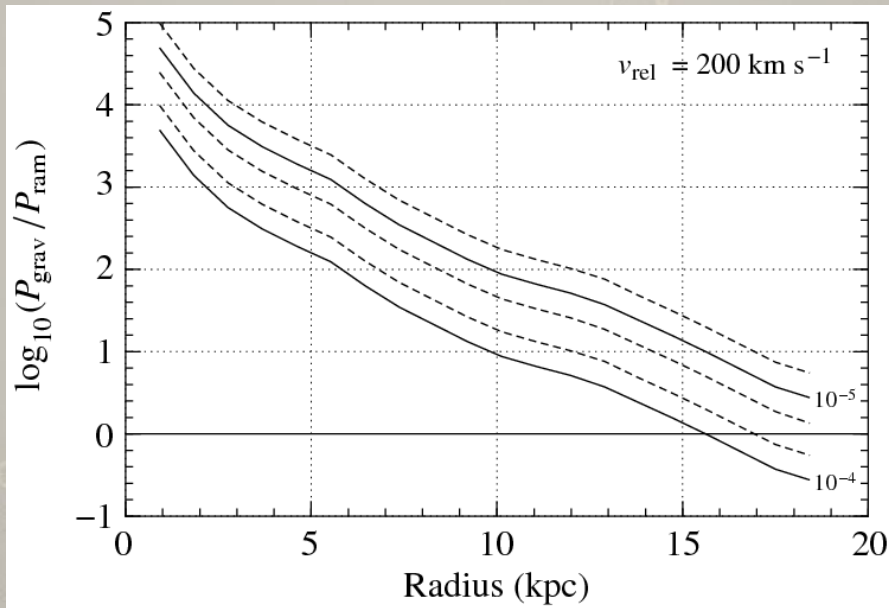
Ram pressure: $P_{\text{ram}} = \rho_{\text{IGM}} v^2$

Gravitational pressure: $P_{\text{grav}} = \Sigma_{\text{gas}}(r) \left| \frac{\partial \Phi(r)}{\partial z} \right|_{\text{max}}$

(Gunn & Gott 1972)



Face-on situation, but also valid for inclination angles of up to 60° (Rödiger et al. 2005).



- Ram-pressure stripping does occur in **galaxy groups** (not only in clusters) at reasonable assumptions about the IGM density ($10^{-4} \dots 5 \times 10^{-6} \text{ cm}^{-3}$) and relative velocities (**100 ... 300 km/s**).
- It affects the faint **outer gas discs** of galaxies and possibly contributes to the **warping** observed in many galaxies (U-shaped warps?).
- A systematic study of ram-pressure stripping in groups will allow us to constrain the **properties of the IGM** in galaxy groups.

ASKAP / WALLABY

- Sensitivity: $9 \times 10^{19} \text{ cm}^{-2}$ (21 km s⁻¹, 8 h)
- Angular resolution: 30''
- Field of view: 30 (°)²
- Science areas: Galaxy structure and dynamics, Influence of the environment, Gas accretion and mergers



MeerKAT

- Sensitivity: $4 \times 10^{19} \text{ cm}^{-2}$ (20 km s⁻¹, 8 h)
- Angular resolution: 30''
- Field of view: 1 (°)²
- Key science area: Deep observations of groups or galaxies and detection of the cosmic web

