

Cloud finding in the Milky Way

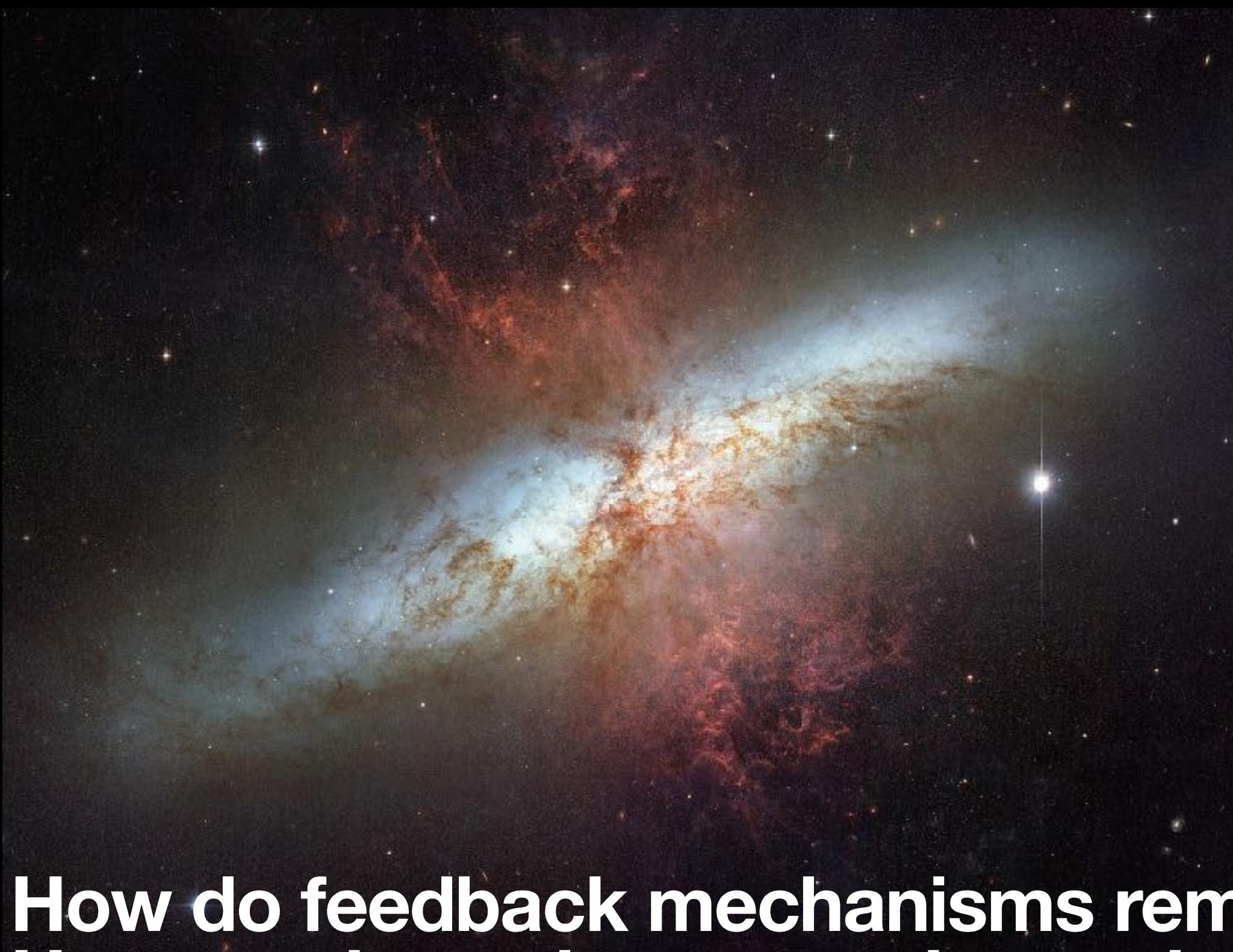
Dr. Helga Dénes
hdenes@usfq.edu.ec

Experimental Physics: Telescopes

The HI4PI survey of Hydrogen in the Milky Way

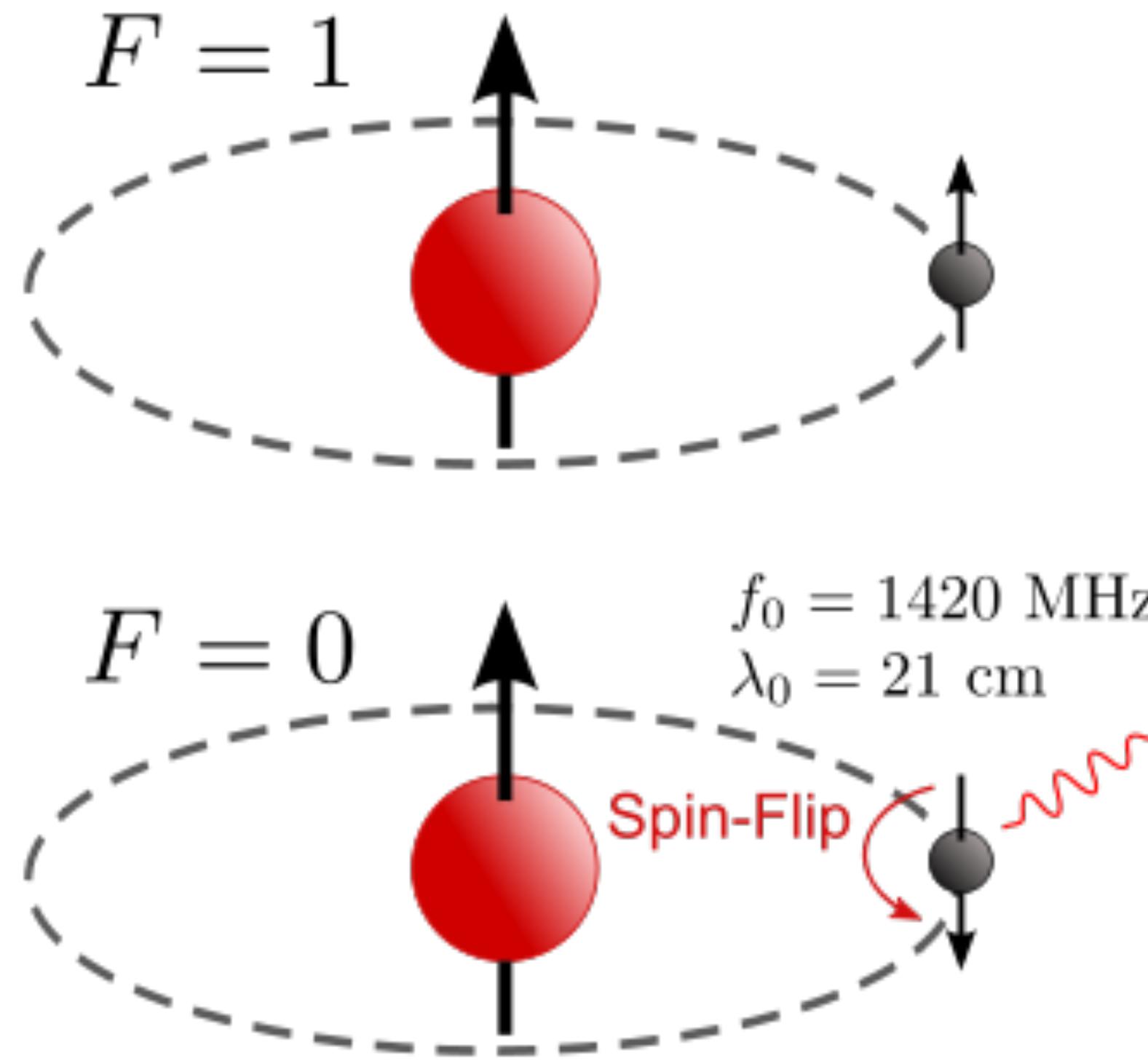
Most of the HI is in the disk, but not all. How much cold gas is in the halo?

Outflows in M82 caused by intense star formation



How do feedback mechanisms remove gas from the disk?
How much gas is accreted onto the disk?

Observing neutral hydrogen (HI)

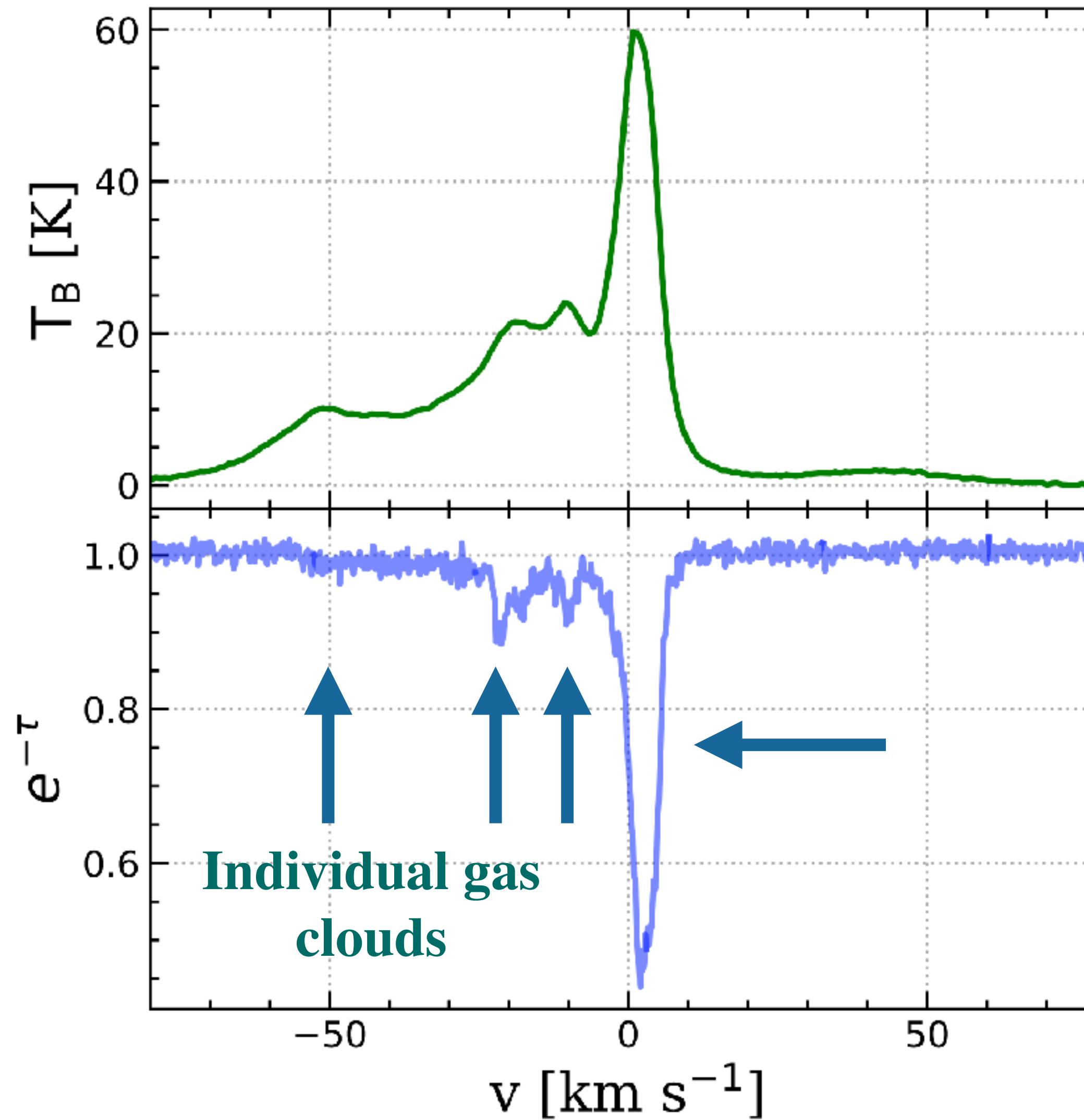


- The **21cm line of neutral hydrogen**.
- The proton and the electron in the hydrogen atom can have their spins either parallel or antiparallel.
- When transition from the higher state to the lower state takes place, radiation with wavelength 21 cm is expected to be emitted.

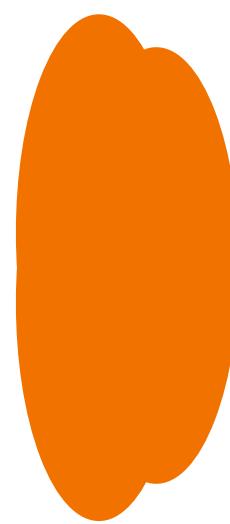
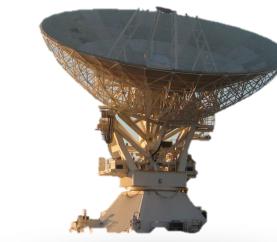


The Australia Telescope Compact Array (ATCA)

Warm and cold HI in the Galaxy



Warm HI



Warm Neutral Medium

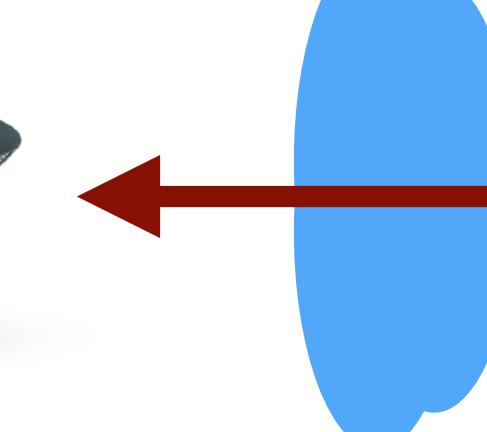
in emission
 $T \sim$ few thousand K
~70% of the HI

Cold Neutral Medium

in absorption
 $T \sim 40$ K
~30% of the HI



cold HI



Continuum source



A super bubble?

HI map between -5 and -20 km/s

The Norma HI shell?



Superbubbles

N44 is a **nebula** in the Large Magellanic Cloud filled with **glowing hydrogen gas**, dark lanes of **dust**, **massive stars**, and many populations of stars of different ages.

Possible origin:

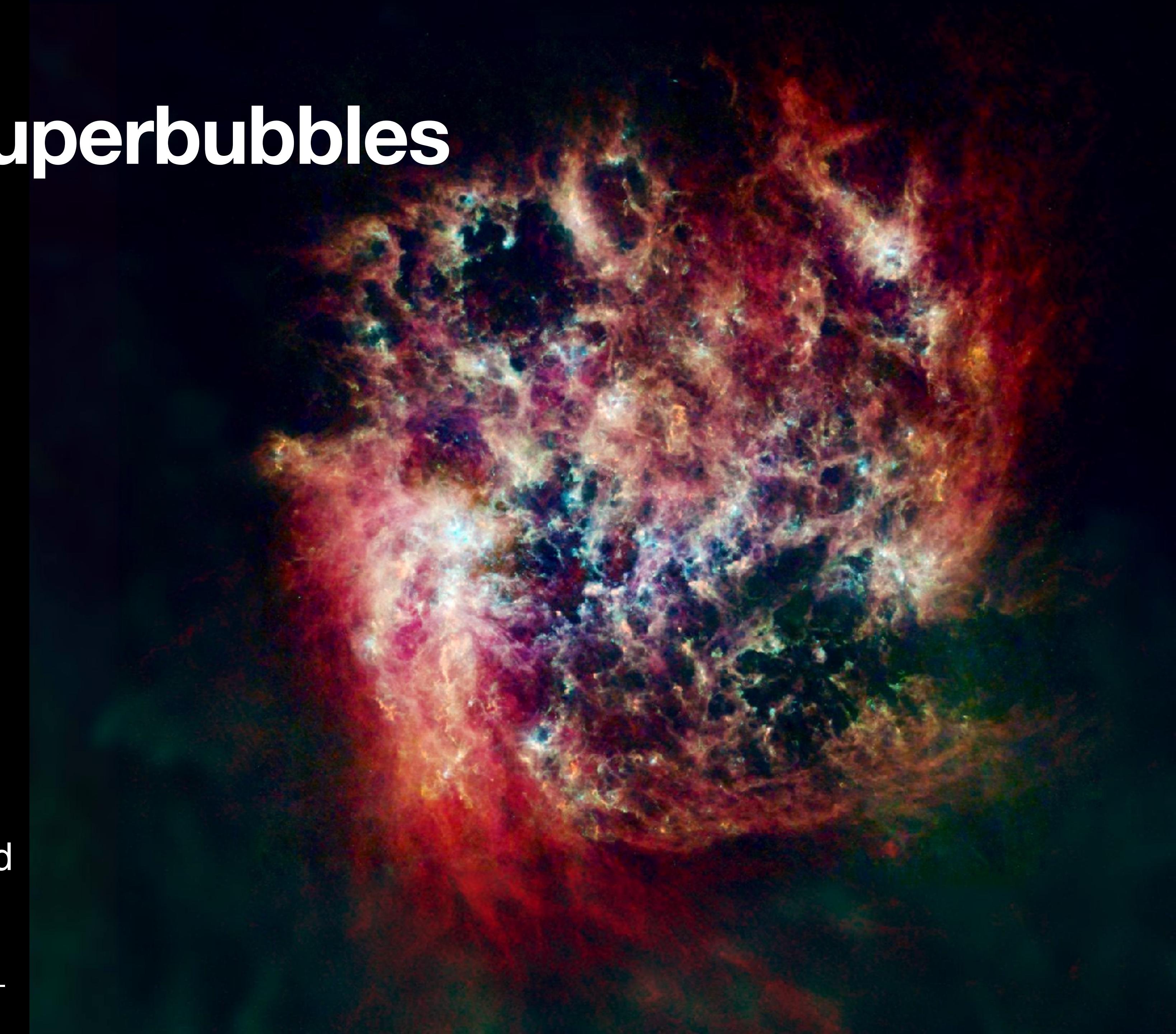
- **Stellar winds**
- **Supernova explosions**



HI shells and Superbubbles

Dust in the Large Magellanic Cloud

<https://www.jpl.nasa.gov/images/pia25162-large-magellanic-cloud-imaged-by-herschel-planck-iras-cobe/>



Superbubbles



Hot gas at the centre of 3079



This is a type of AGN, so the bubble is most likely related to the activity of the supermassive black hole.

The challenge

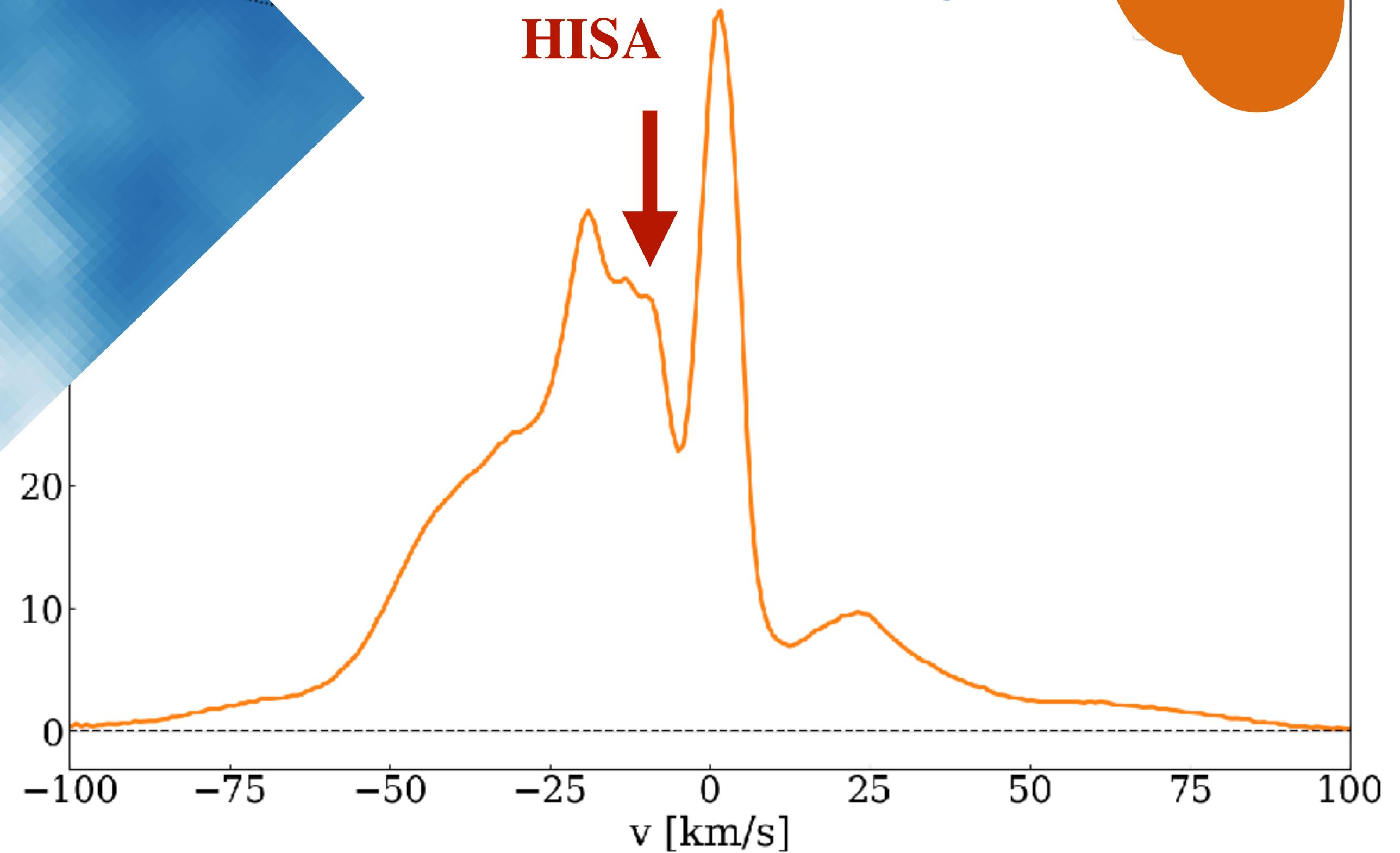
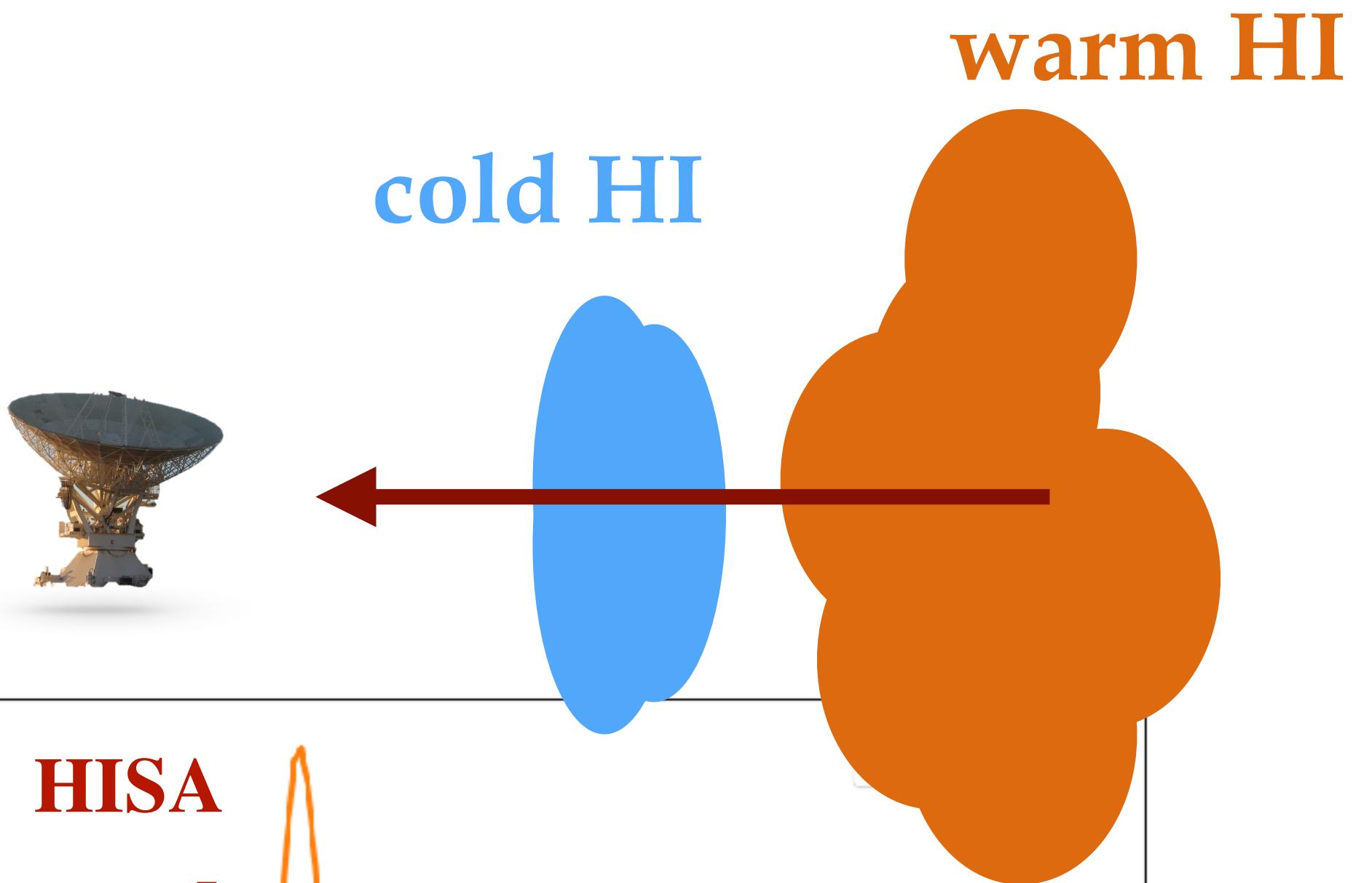
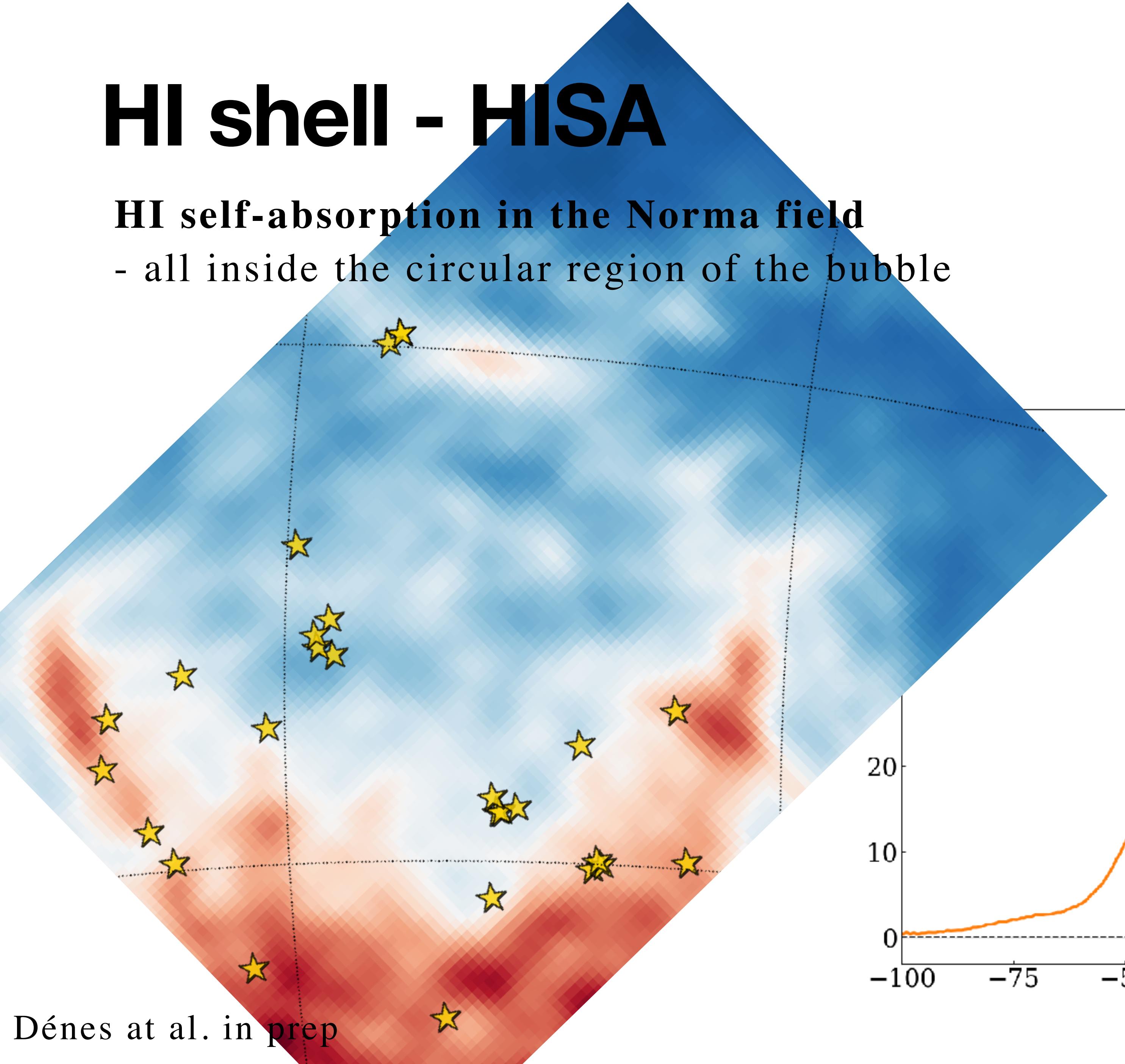
Cloud finding in the gas of the Milky Way

- Find the bubble.
- Find the counterpart on the other side of the disk of the MW.
- Characterise the properties of the edge of the bubble.

HI shell - HISA

HI self-absorption in the Norma field

- all inside the circular region of the bubble





Thank you!