# Cloud finding in the Milky Way

**Dr. Helga Dénes**

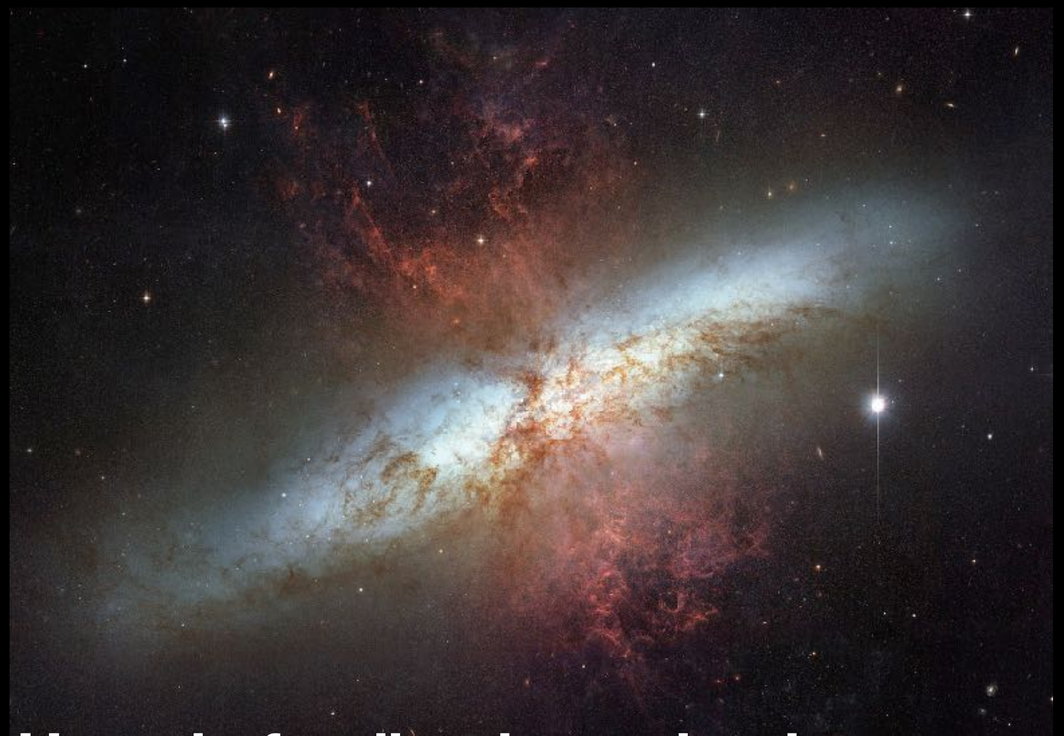
hdenes@usfq.edu.ec

# Experimental Physics: Telescopes

The HI4PI survey of Hydrogen in the Milky Way

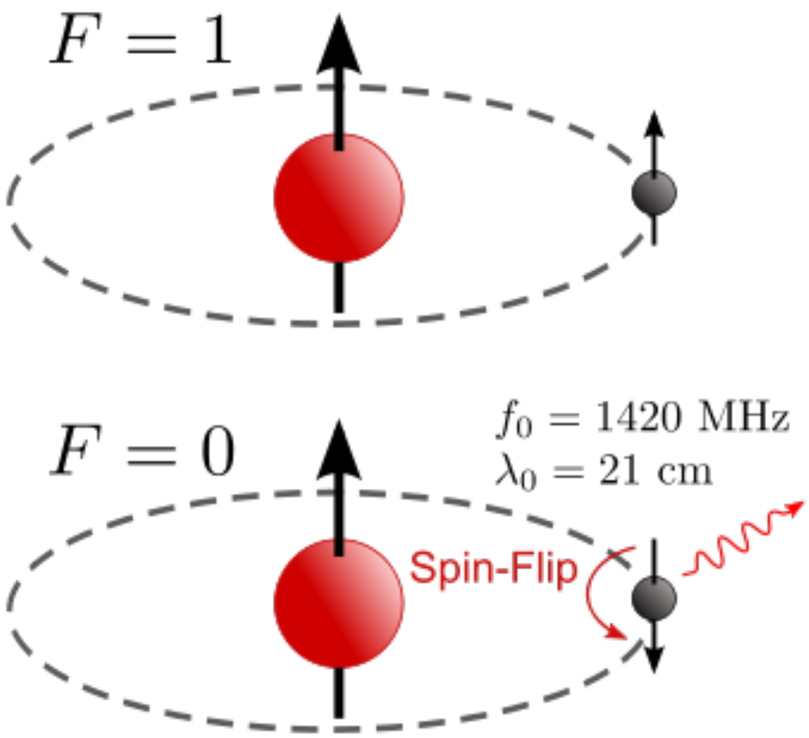
# Most of the HI is in the disk, but not all. How much cold gas is in the halo?

**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?**

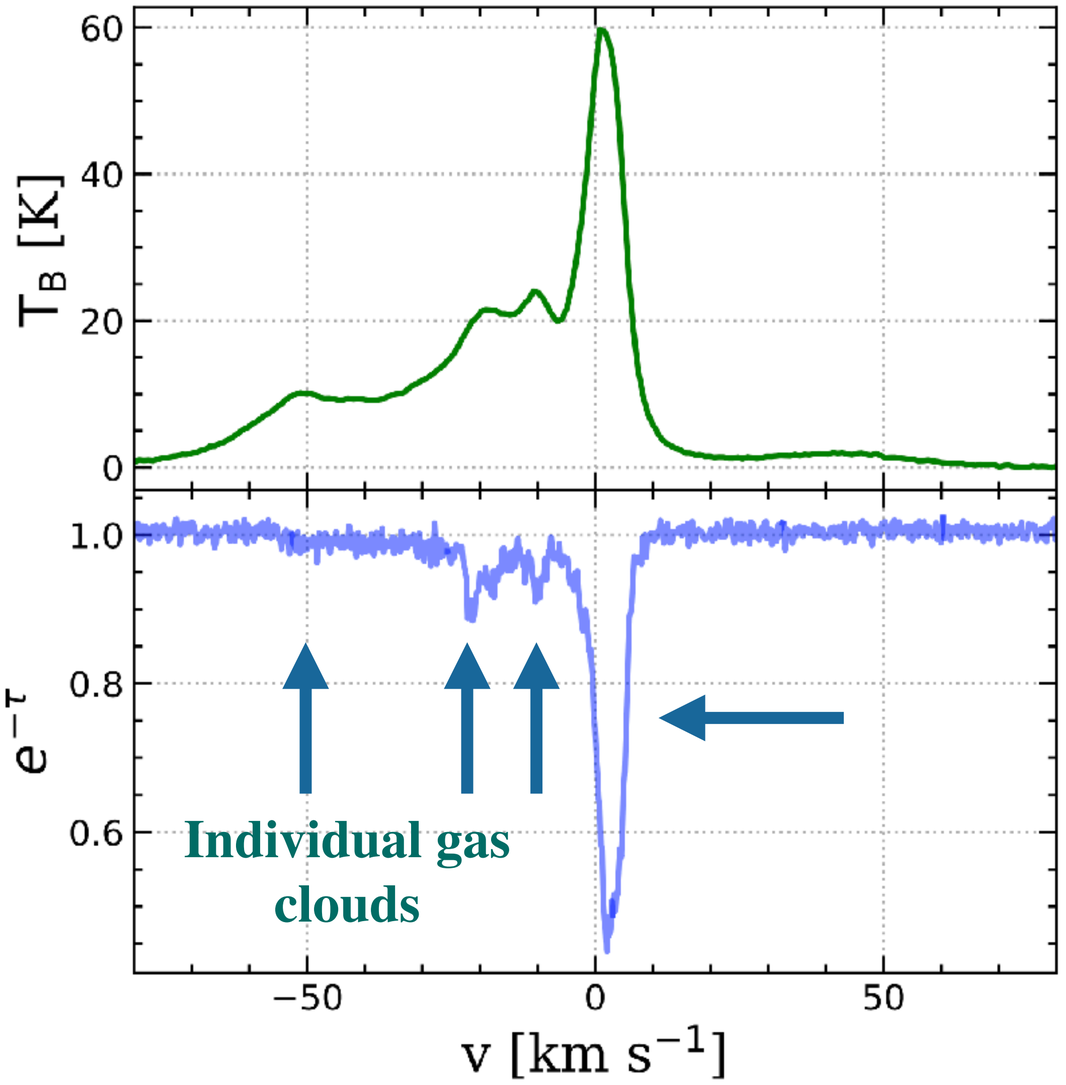
# Observing neutral hydrogen (HI)



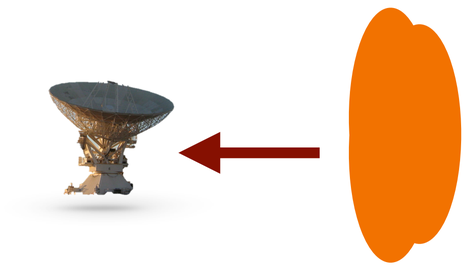

- The **21cm line of neutral hydrogen**.
- The proton and the electron in the hydrogen atom can have their spins either parallel or antiparallel.
- When transition from the higher state to the lower state takes place, radiation with wavelength 21 cm is expected to be emitted.

The Australia Telescope Compact Array (ATCA)

# Warm and cold HI in the Galaxy




Warm HI



**Warm Netral Medium**

in emission

T ~ few thousand K

**~70% of the HI**

**Cold Neutral Medium**

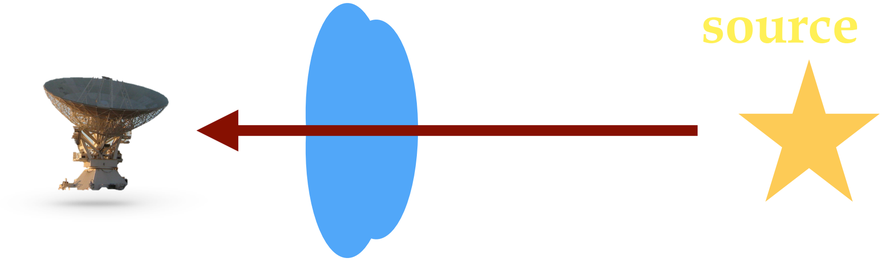
in absorption

T ~ 40 K

**~30% of the HI**

cold HI

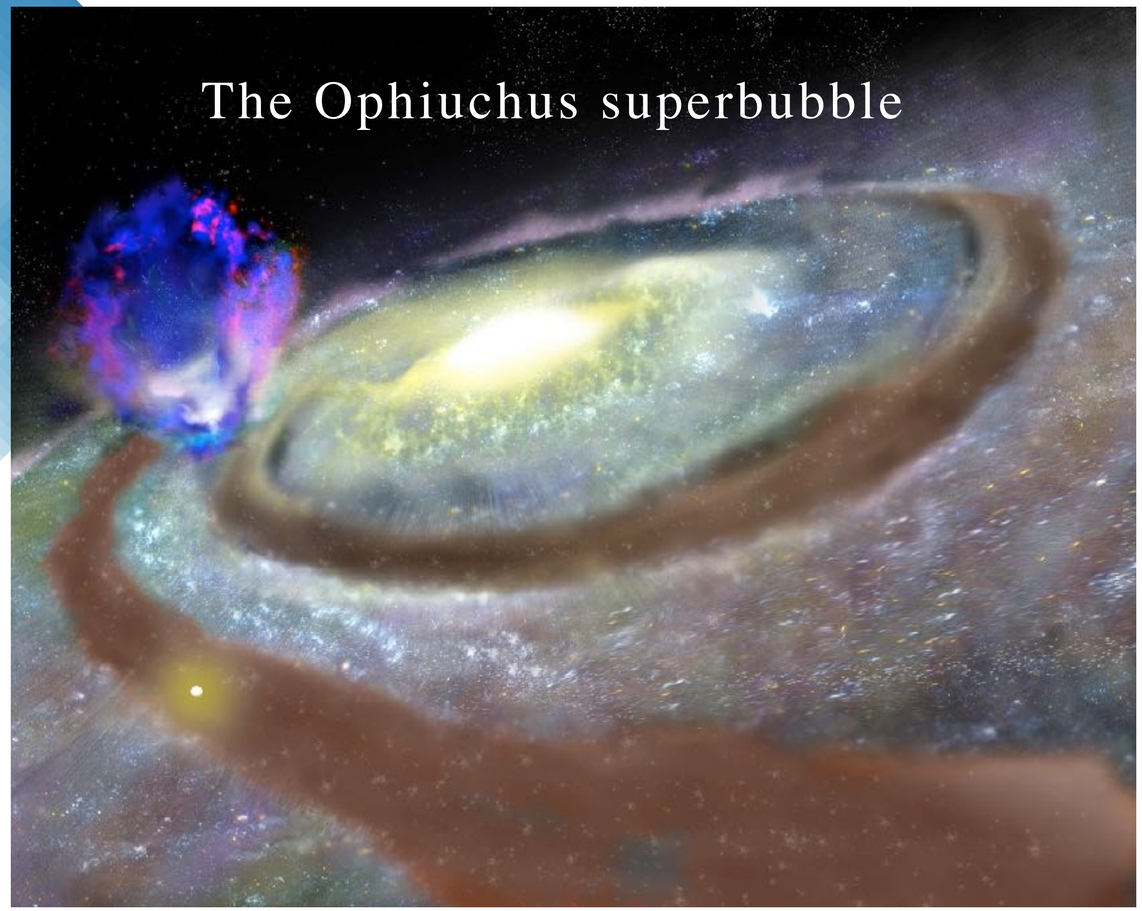
Continuum source



# A super bubble?

HI map between -5 and -20 km/s

The Norma HI shell?

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https://public.nrao.edu/gallery/the-milky-ways-superbubble/

# 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**

https://science.nasa.gov/missions/hubble/mysterious-asuperbubblea-hollows-out-nebula-in-new-hubble-image/

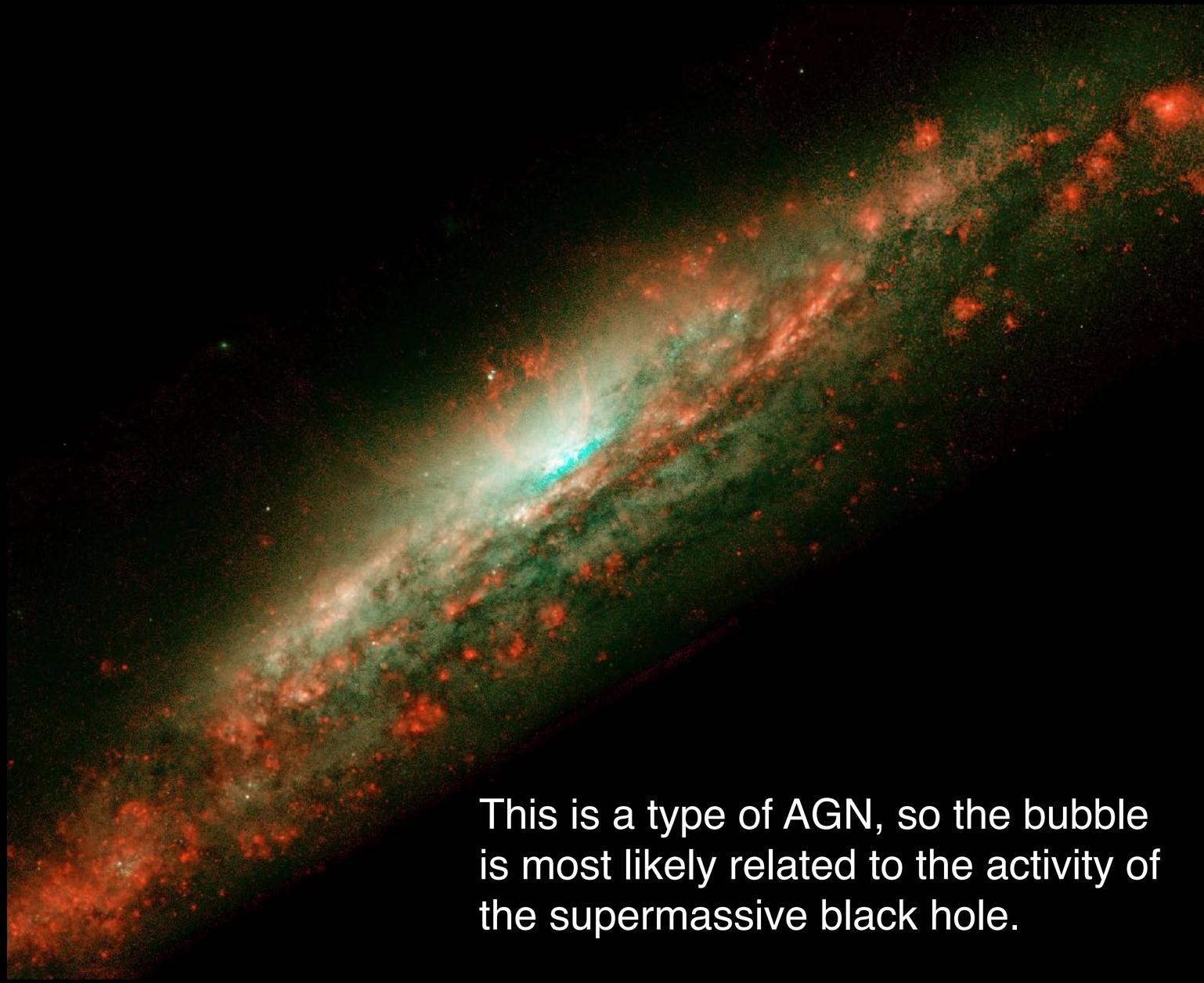
# HI shells and Superbubbles

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.

https://en.wikipedia.org/wiki/NGC_3079

# The challenge

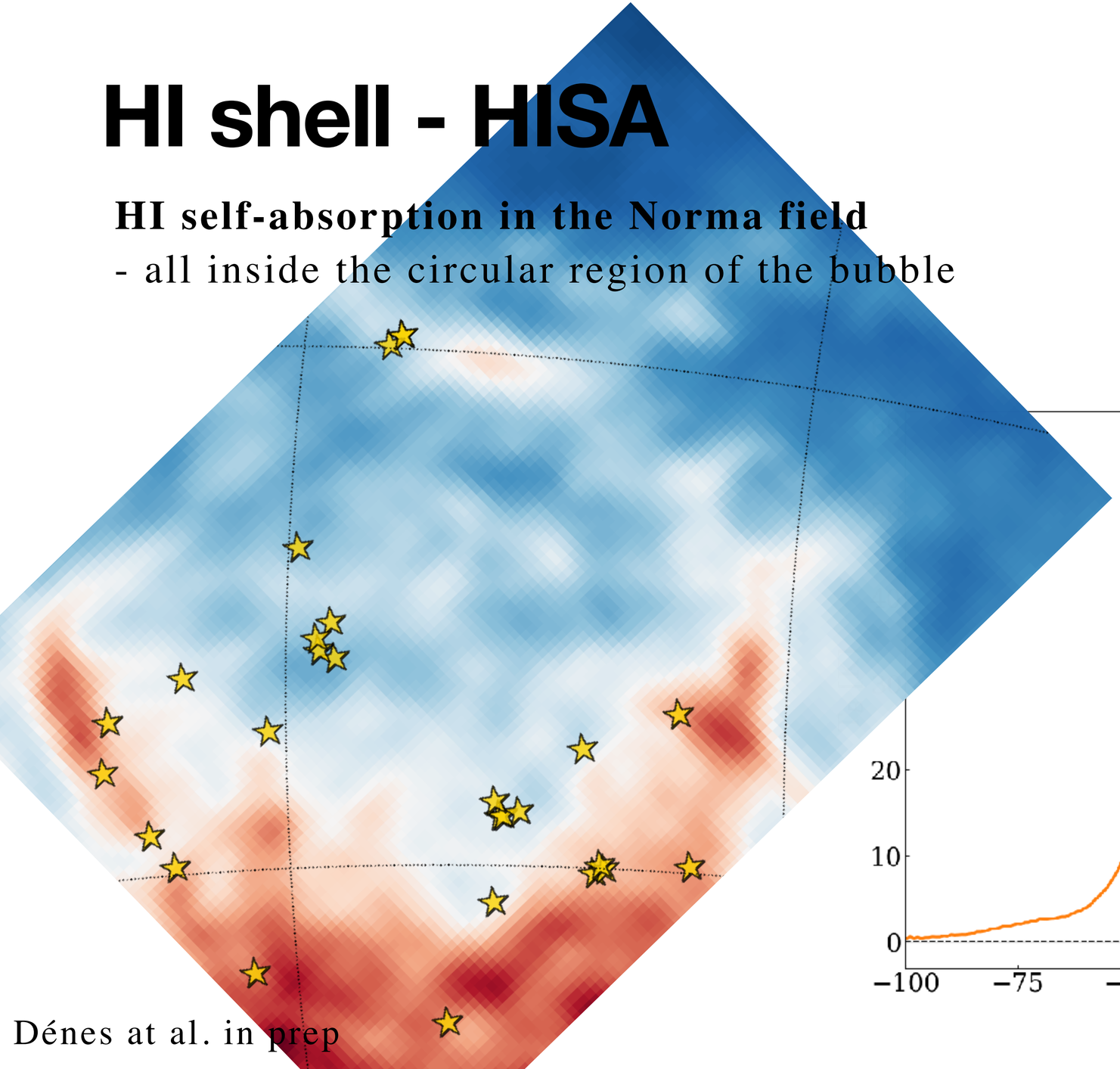
**Cloud finding in the gas of the Milky Way**

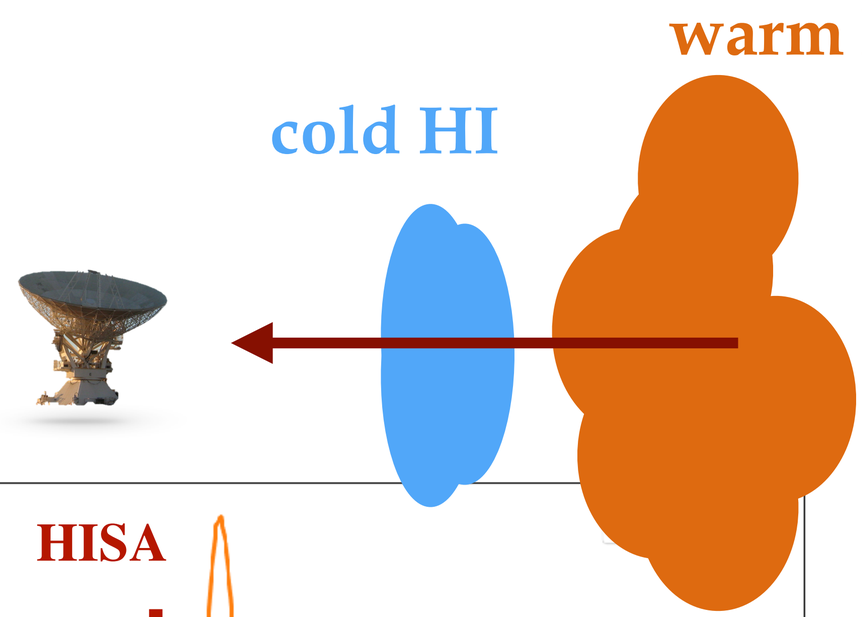
- **Find the bubble.**
- **Find the counterpart on the other side of the disk of the MW.**
- **Characterise the properties of the edge of the bubble.**

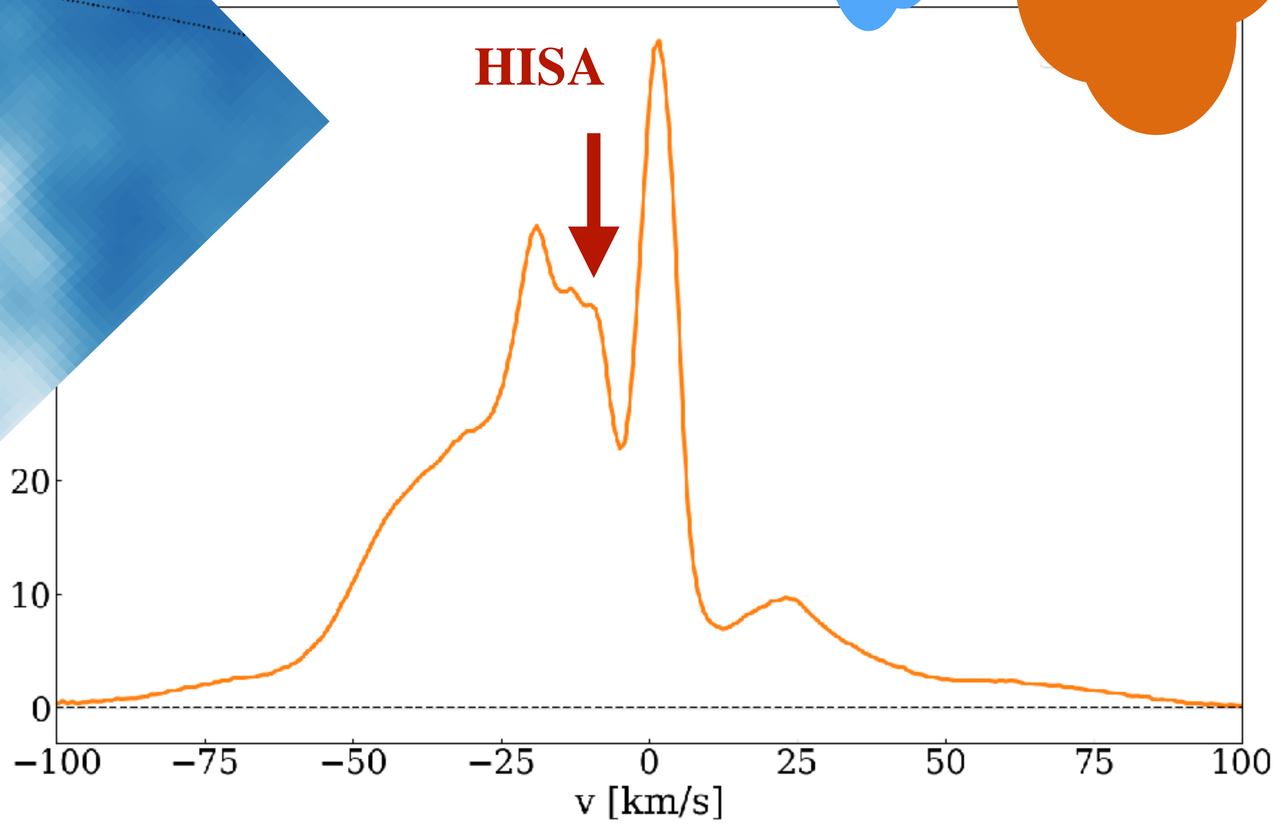
# HI shell - HISA

**HI self-absorption in the Norma field**

- all inside the circular region of the bubble



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Thank you!