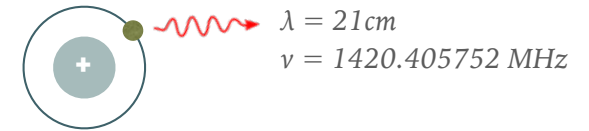


HI emission and radio continuum study on the local X-ray AGN host galaxies

Jeein Kim, Aeree Chung, Junhyun Baek

21cm HI line observation & 1.4GHz radio continuum

- cool gas => **reservoir of star forming cold gas**



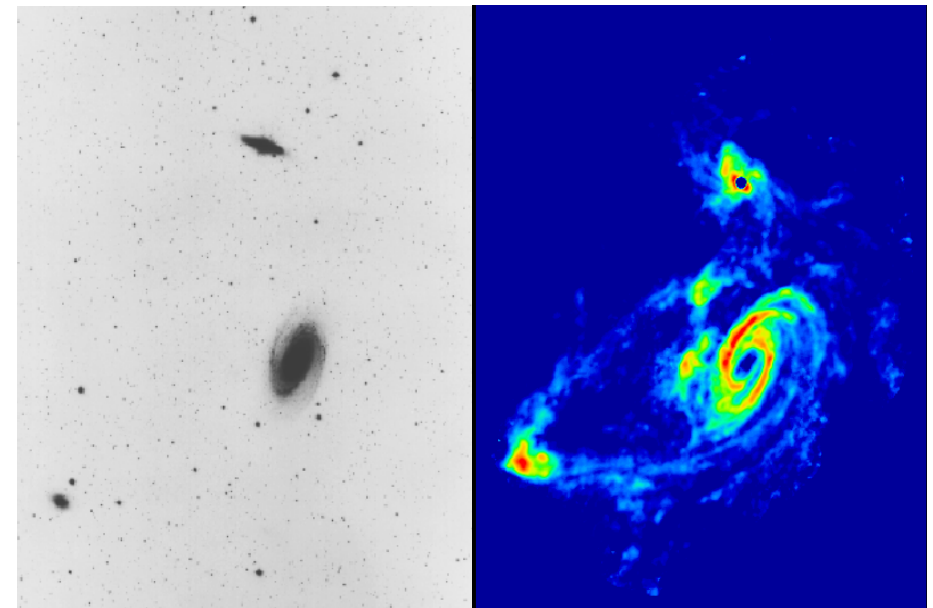
- Diffuse & extended gas

=> **Sensitive tracer to explore the impact of the surroundings on galaxies.**

(e.g., environmental interactions, or the injection of (mechanical energy))

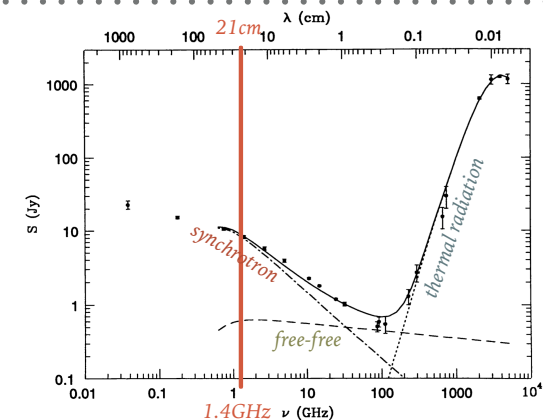
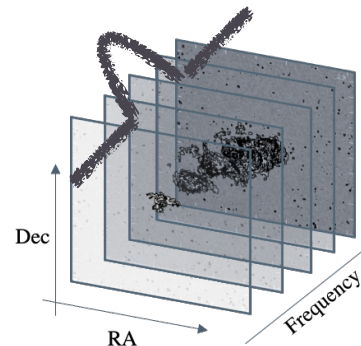
- Known rest frequency: 1420.405752MHz

=> **redshift determination using Doppler shift**



(Yun et al. 1994)

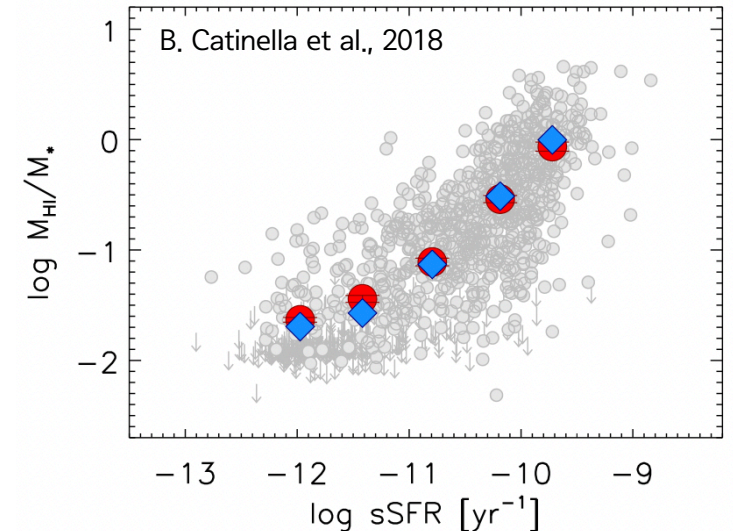
- **Radio continuum:** supernova remnants after the death of massive stars



AGN host galaxies & HI/radio observation

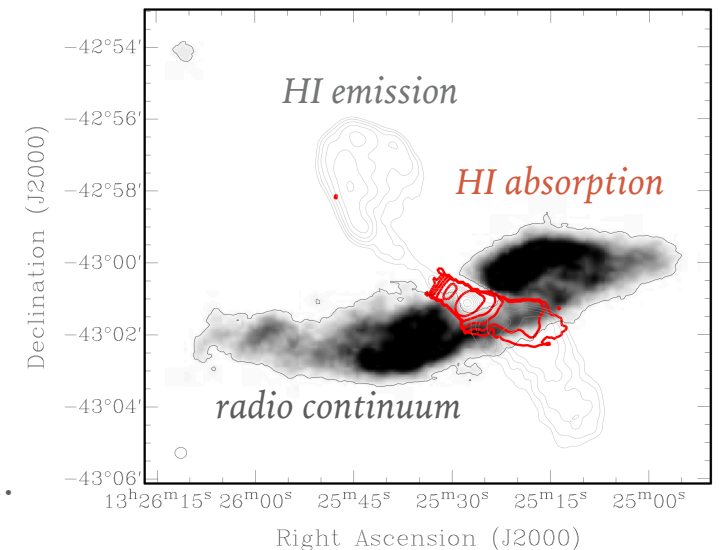
➤ AGN feedback

- Quenching the star formation in AGN host galaxies
- Gas kinematics -> feedback from AGN & SF process
- The outflow traced by HI absorption



➤ AGN feeding

- Gas morphology -> Interactions with the environments (potential gas donors)
- Gas kinematics -> stochastic accretion events
- The distribution and total angular momentum of the gas can only be directly observed through HI observations in emission.
- The inflow traced by HI absorption



BASS-HI SAMPLE

➤ Swift/BAT hard X-ray (14-195 keV) all-sky spectroscopic survey (BASS).

➤ **The hard X-ray (14-195 keV)**

- *less biased by dust obscuration*
- *less star formation contamination*

=> More complete AGN sample

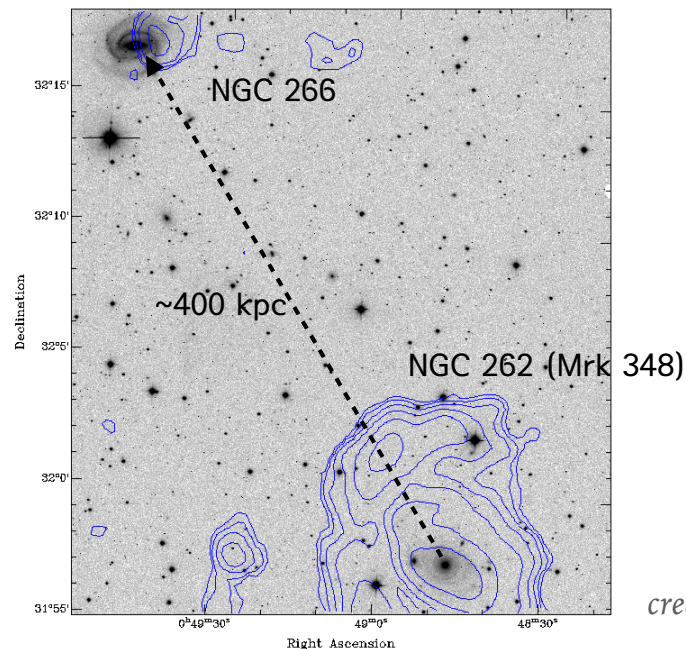
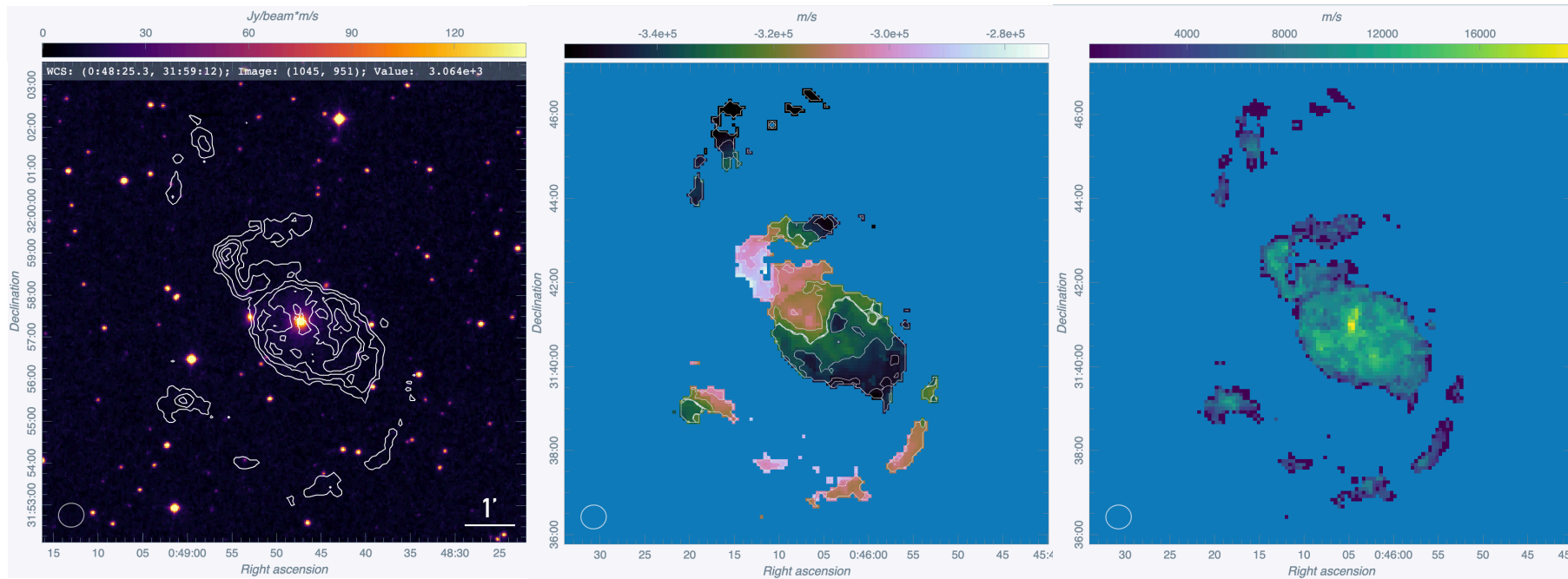
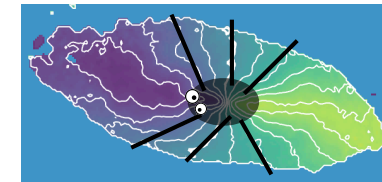
➤ **BASS ancillary observations**

- *X-ray spectra (0.5-195 keV; NuSTAR)*
- *Herschel PACS+SPIRE imaging*
- *APEX/JCMT/IRAM/ALMA CO surveys*
- *Optical & NIR spectroscopy*

➤ 82 Northern JVLA sample (Yonsei) + 18 Southern ATCA sample (PI: I. Wong) = 100

Parent sample	# of source
Swift-BAT AGN	836
BASS DR1	642
$z < 0.0275$ (DL < 120 Mpc)	213
Dec > -20 deg	141
Single dish detection	82

1) Warped kinematics (hint of accretion history)



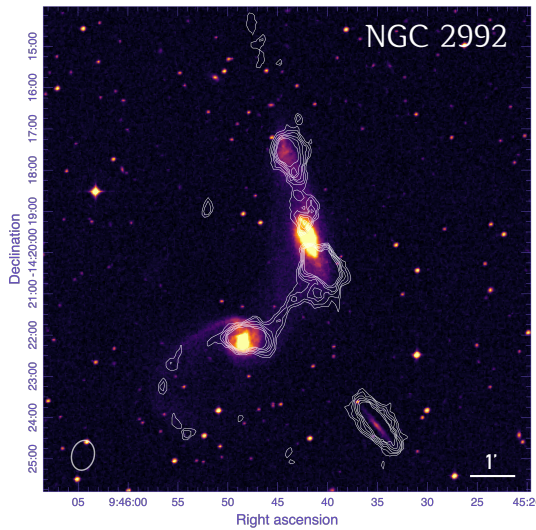
➤ Mrk348

- HI disk extent ($\sim 42\text{kpc}$) is 8.1 times bigger than its stellar disk.
- Tidal disruption (Simkin et al. 1987)
- Interaction with NGC 266 (Heckman et al. 1982)

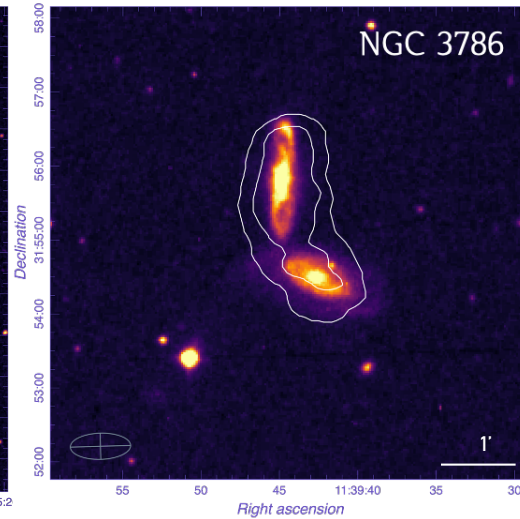
credit: John Hibbard, NRAO

Environments of AGN host galaxies

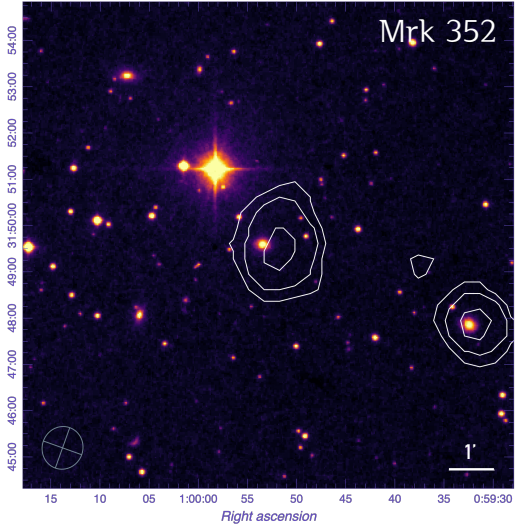
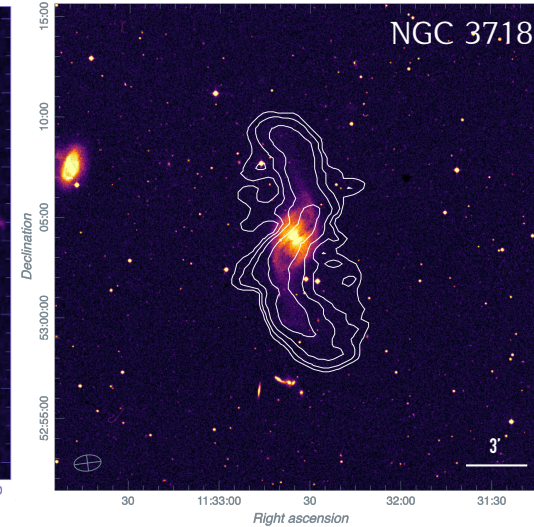
1. direct interaction case



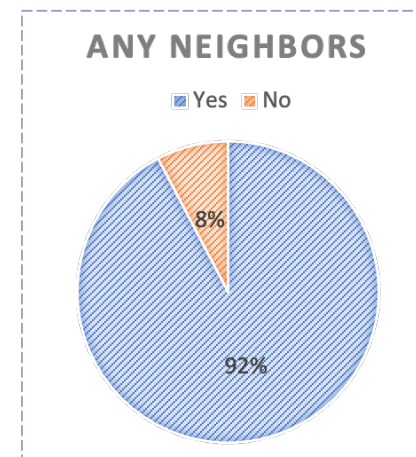
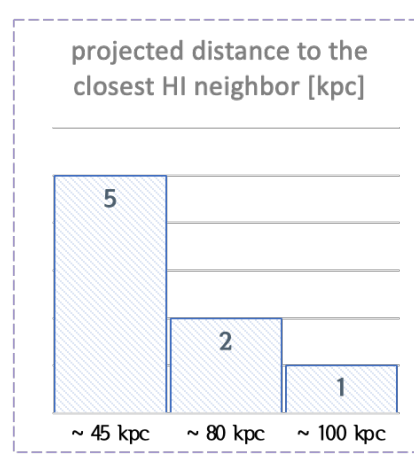
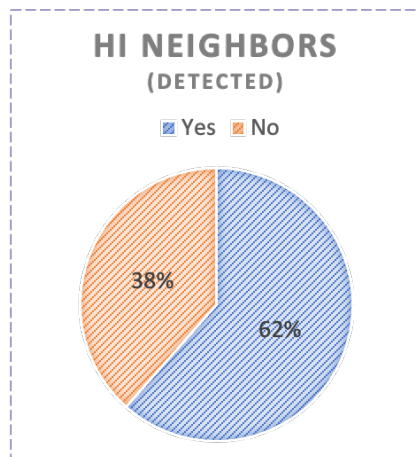
2. close neighbor in optical



3. potential gas doner case



- **HI neighbors:** another galaxy with HI detected within the same cube (spatial + spectral)
- **Any neighbors:** HI or optical neighbors



Conclusion

- We found that a considerable fraction of our sample have close neighbors or are located in group/cluster environments, suggesting that the association with the surrounding environment is important to the AGN activity.
- This tentative conclusion will have to be further verified with a bigger sample.

Future Work

- With the increase of the sample size (~ 80), more detailed study on each galaxy case.
- Interaction? How? When?
- Furthermore, we will investigate in more detail to study the impact of AGN onset on the star formation process not only on this relation but also by combining HI and radio continuum maps with other BASS observation data.