Taiwan's Possible Interests in SKA

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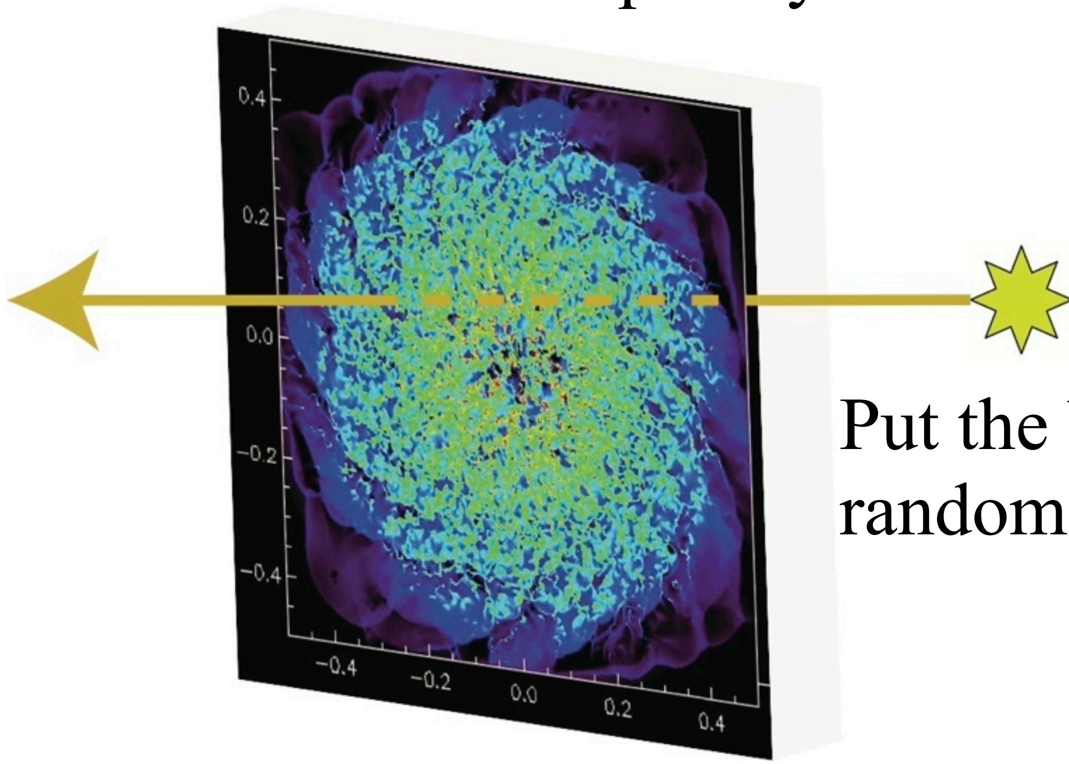
Outline

1. Gas Absorption and Emission
2. Continuum (Galaxies, AGNs)
3. Wide Frequency Range
4. Summary

1. Gas Absorption and Emission

Hirashita et al. (2003)

Statistical work on Damped Lyman α clouds



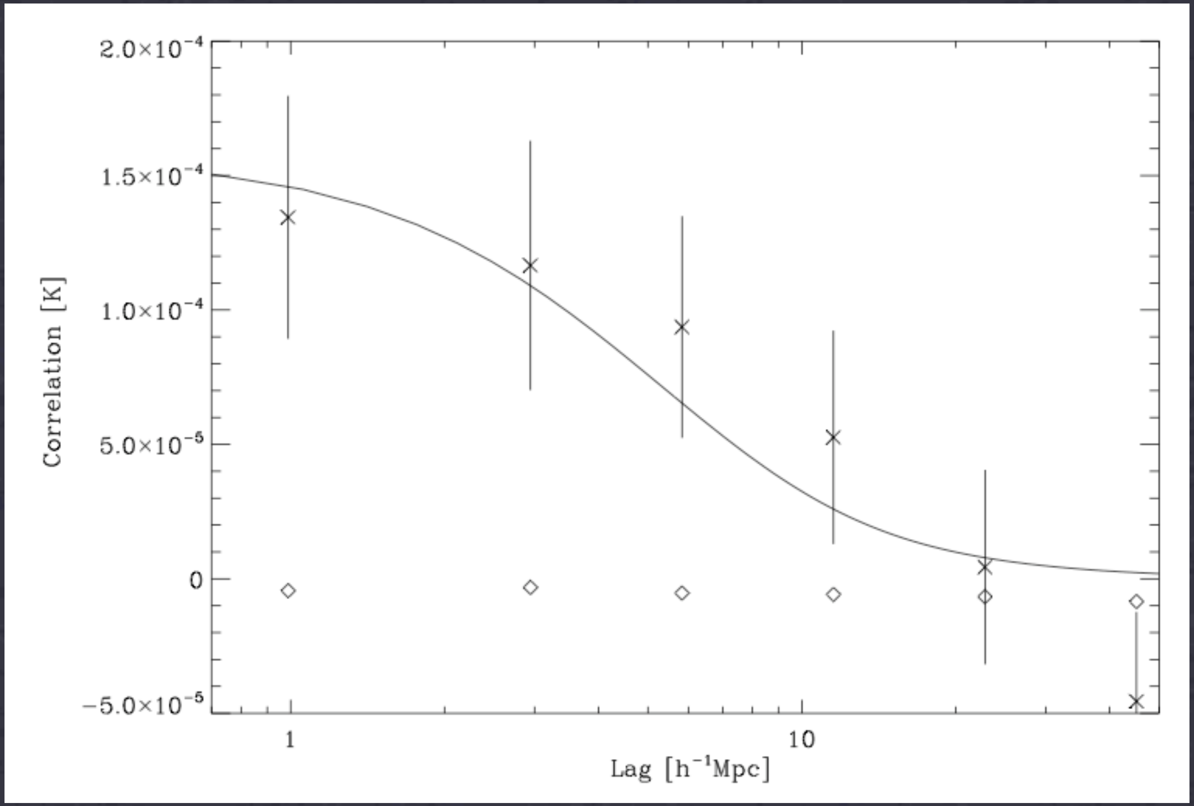
Put the background source randomly

This method is applied for 21 cm line statistics.
Merit of 21 cm ⇒ Spin temperature, Velocity dispersion

HI Emission: Intensity Mapping at z=0.8

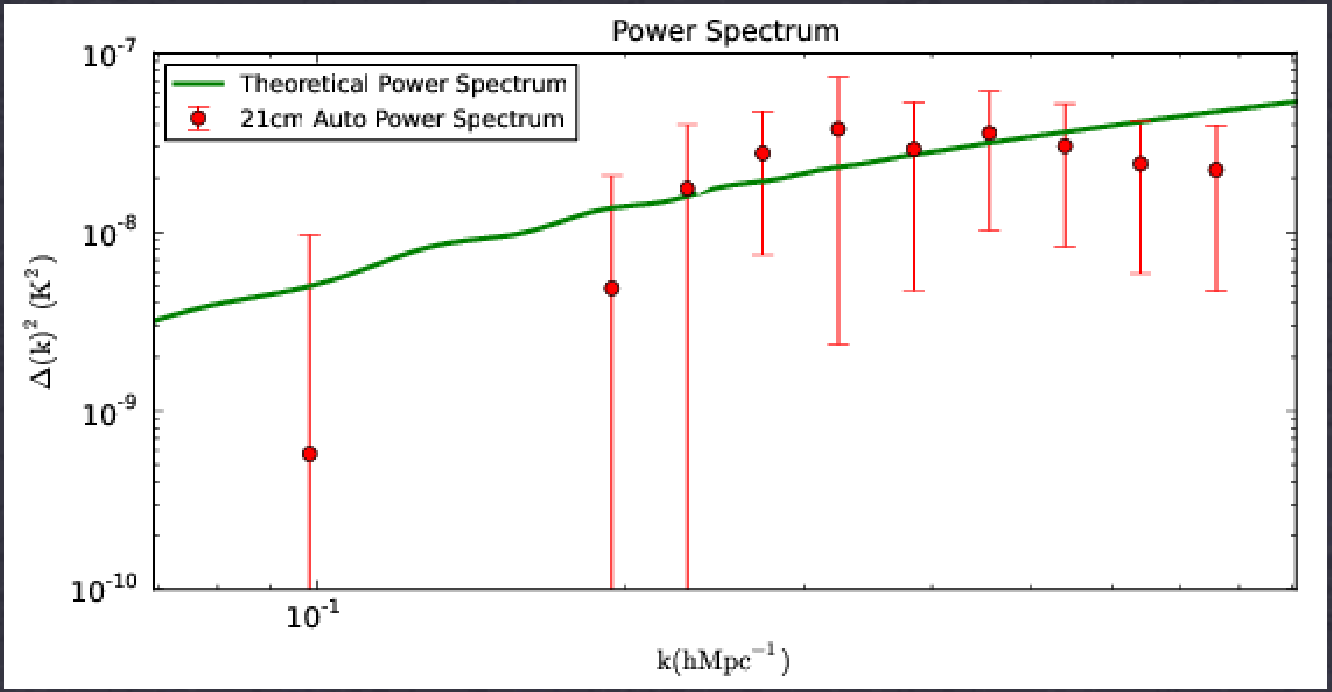
Cross-correlating GBT HI & DEEP2 optical galaxies at z ~ 0.7-1.1

Chang, Pen, Bandura, Peterson, in Nature 2010



- Measure HI & DEEP2 optical cross-correlation on 9 Mpc (spatial) x 2 Mpc (redshift) comoving scales
- HI brightness temperature on these scales at z=0.8:
- T = 157 ± 42 μK
- Ω_{HI} r b = (5.5 ± 1.5) x 10^{-4}
- Highest-redshift detection of HI in emission at 4-sigma statistical significance.

GBT: preliminary 3D HI power spectrum at z~1



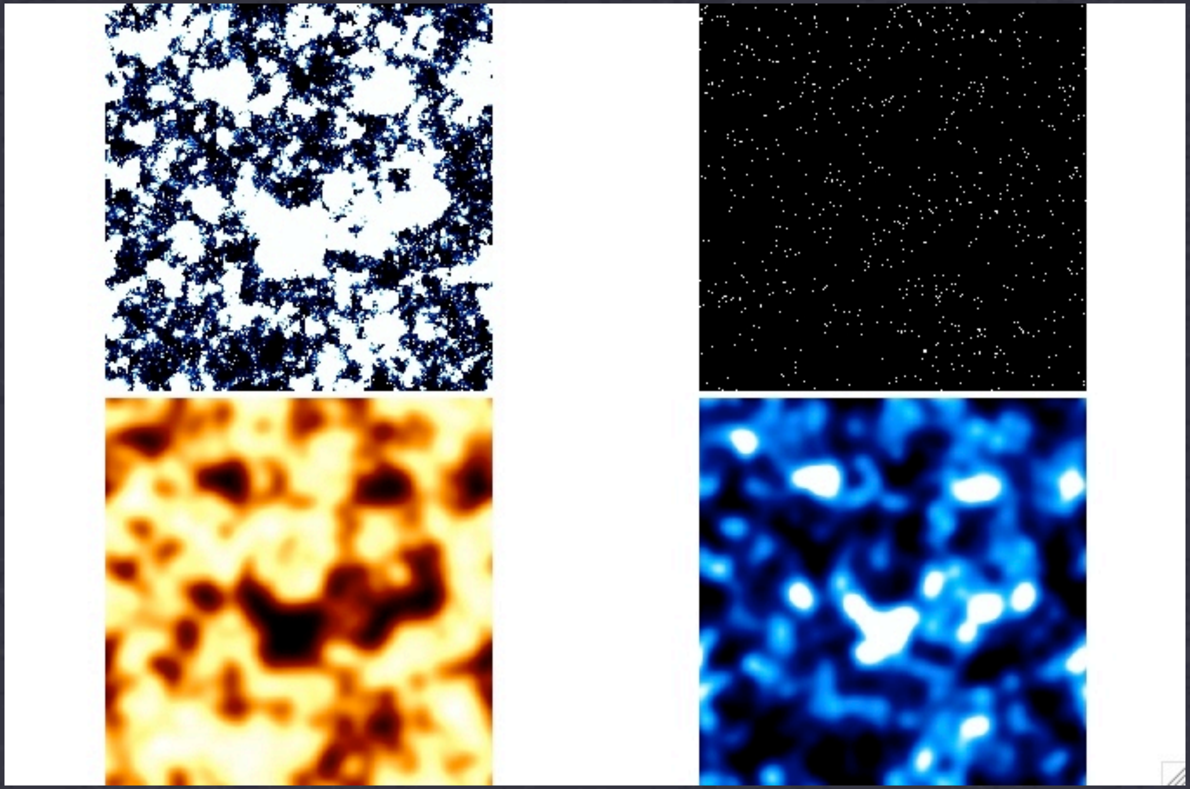
The GBT HIM collaboration
Tzu-Ching Chang's slide

CO Intensity Mapping

- CO large-scale structure 3D maps of the universe at around the redshifts of EoR
- CO (1-0): 115 GHz / (1 + z)

CO intensity mapping at EoR

LIDZ, FURLANATTO, OH, AGUIRRE, CHANG, DORE, PRITCHARD 2011
TZU-CHING CHANG'S SLIDE



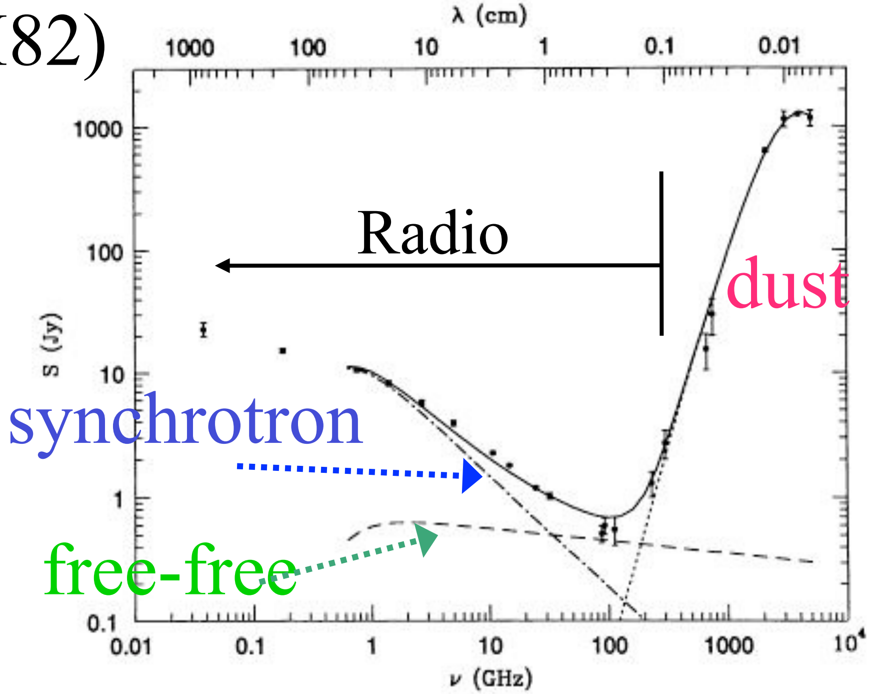
- CO (star formation) large-scale structure at high redshifts (T ~ 1 μK)
- HI-Co anti-correlates on large-scales, constraining size evolution of ionized regions at EoR (Lidz et al. 2009)
- Righi et al. 2008, Gong et al 2010, Carilli 2011, Lidz et al 2011

CO intensity mapping with AMiBA-DACOTA

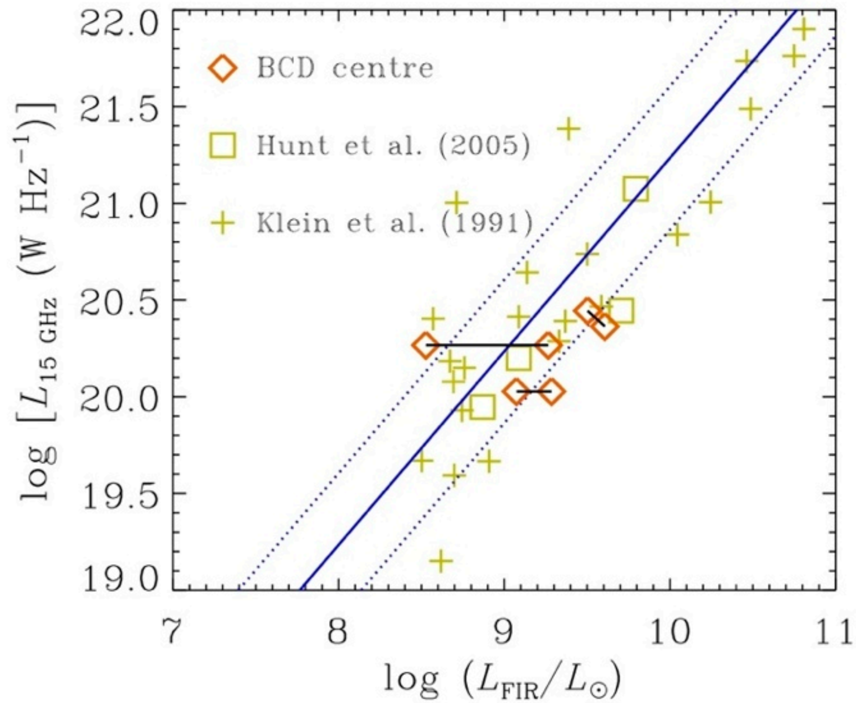
- 1.2 m dish, 6 m baseline, currently operate at 83-102 GHz
- At 30-32 GHz, probes $6.19 < z < 6.67$ for CO[2-1], $2.59 < z < 2.83$ CO[1-0]
- At 31 GHz, resolution=6.7’, FoV =28’, probes >10 Mpc scales
- AMiBA team (ASIAA): Paul Ho, Kai-Yang Lin, Ming-Tang Chen, Homin Jiang+
- DACOTA team (Berkeley/Arizona): Geoff Bower, Dave Deboer, Dan Marrone+

2. Continuum

Condon (1992)
(M82)



Hirashita (2012)



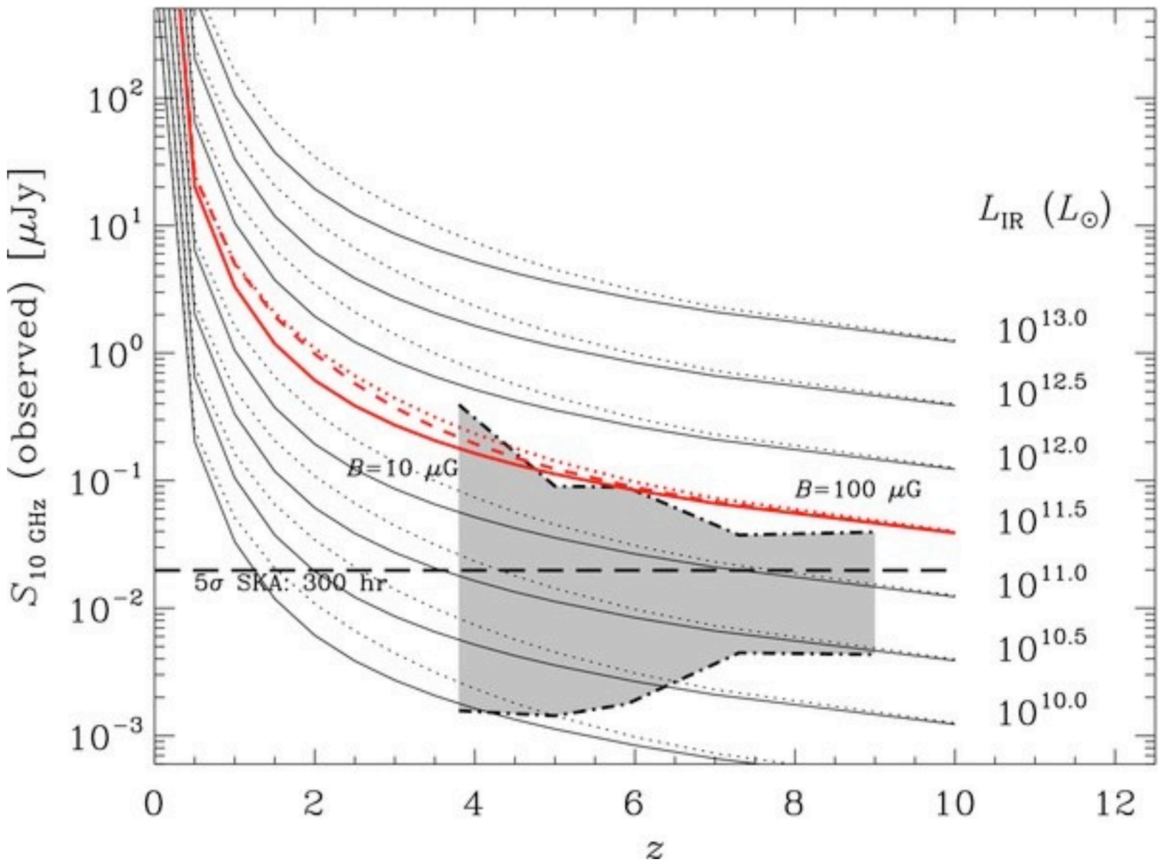
nearby dwarf galaxies (BCDs)

Synchrotron from Supernova Remnants
→ Related to star formation activity

ν > 15/(1+*z*) GHz is favorable to avoid f-f absorption in dense (>10^3 cm^{-3}) regions

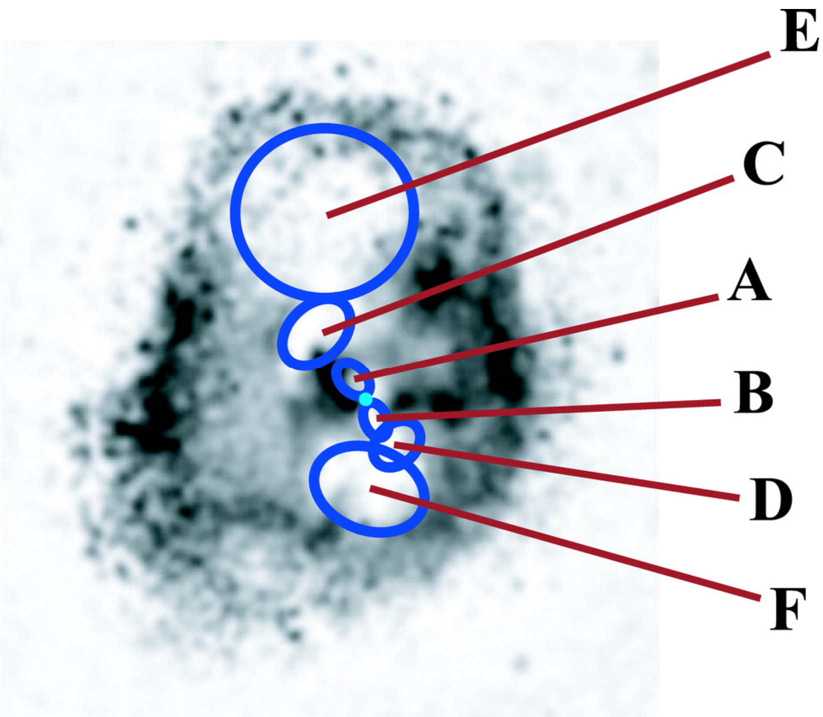
Continuum Flux Levels

Expected Radio continuum from galaxies (Murphy 2009)

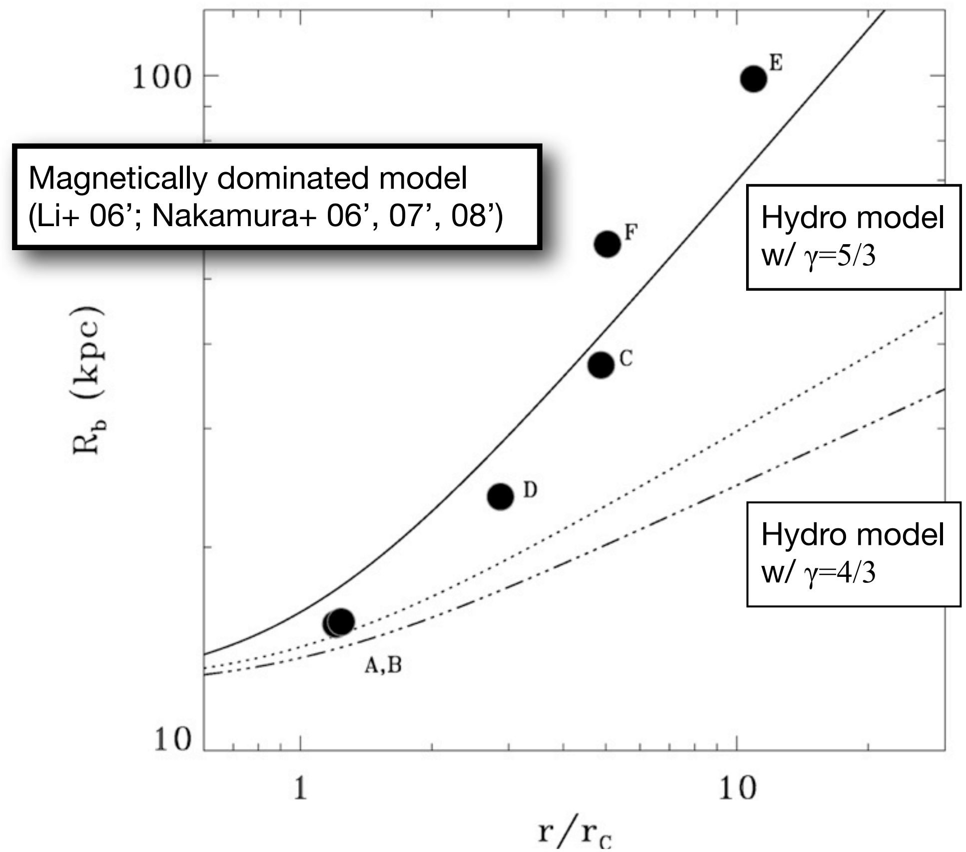


AGN Feedback in Cooling Core Cluster

Nakamura et al.

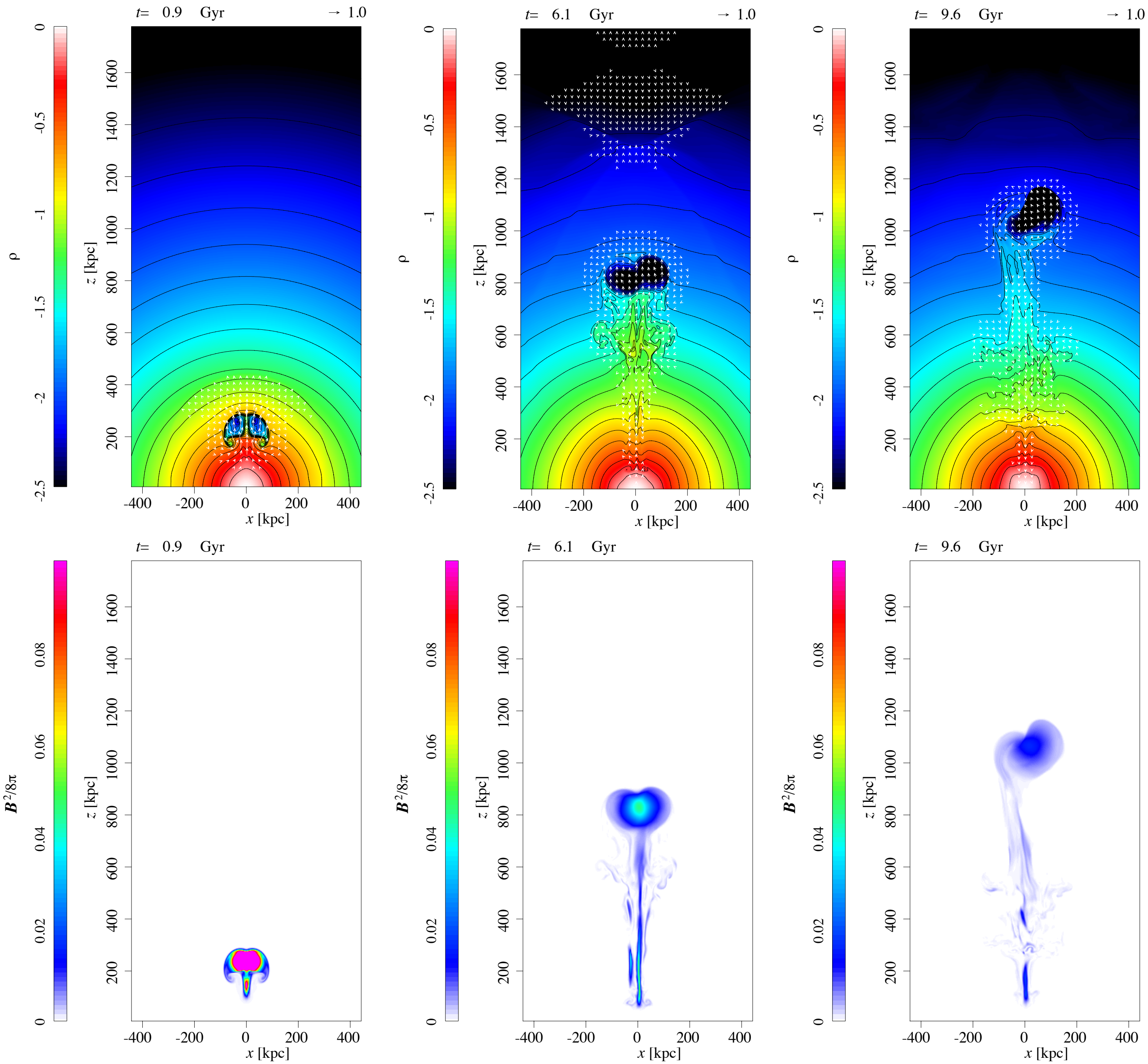


Wise+ (2007), ApJ



Diehl+ (2008), ApJ

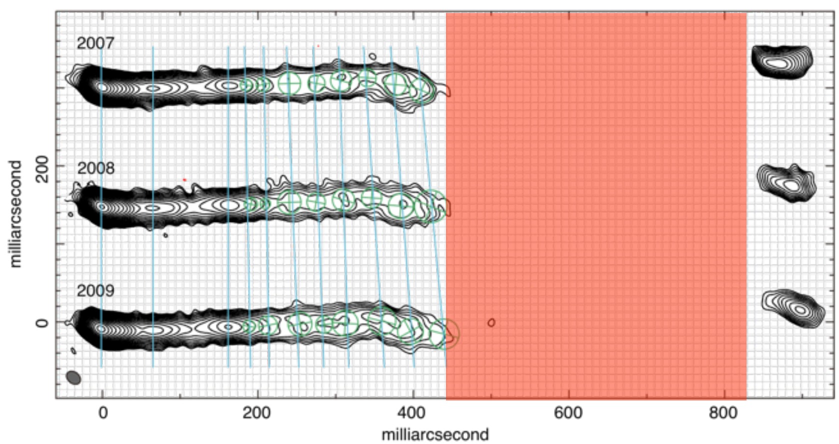
- Exploring fossil radio bubbles (X-ray cavities) at low freq.
- **SKA** will give further constraints on models
- Do AGN inflations carry magnetic energy over ICM scales?

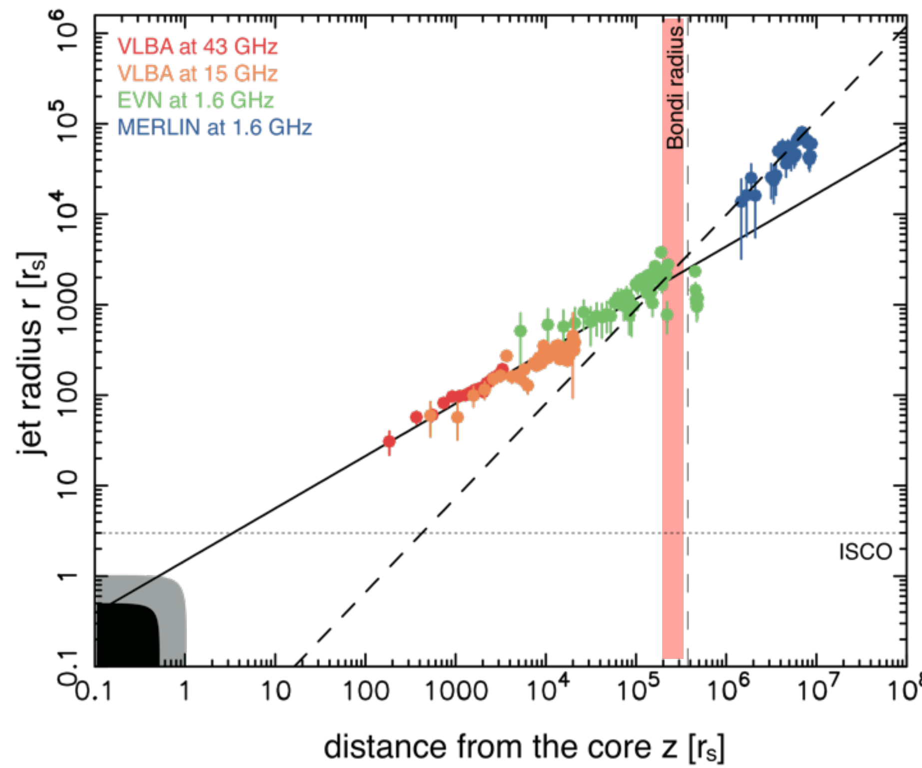


t= 0.9 Gyr
→ 1.0
t= 6.1 Gyr
→ 1.0
t= 9.6 Gyr
→ 1.0
ρ
z [kpc]
x [kpc]
$B^2/8\pi$

Imaging Re-collimation Process of the M87 jet

Asada et al.



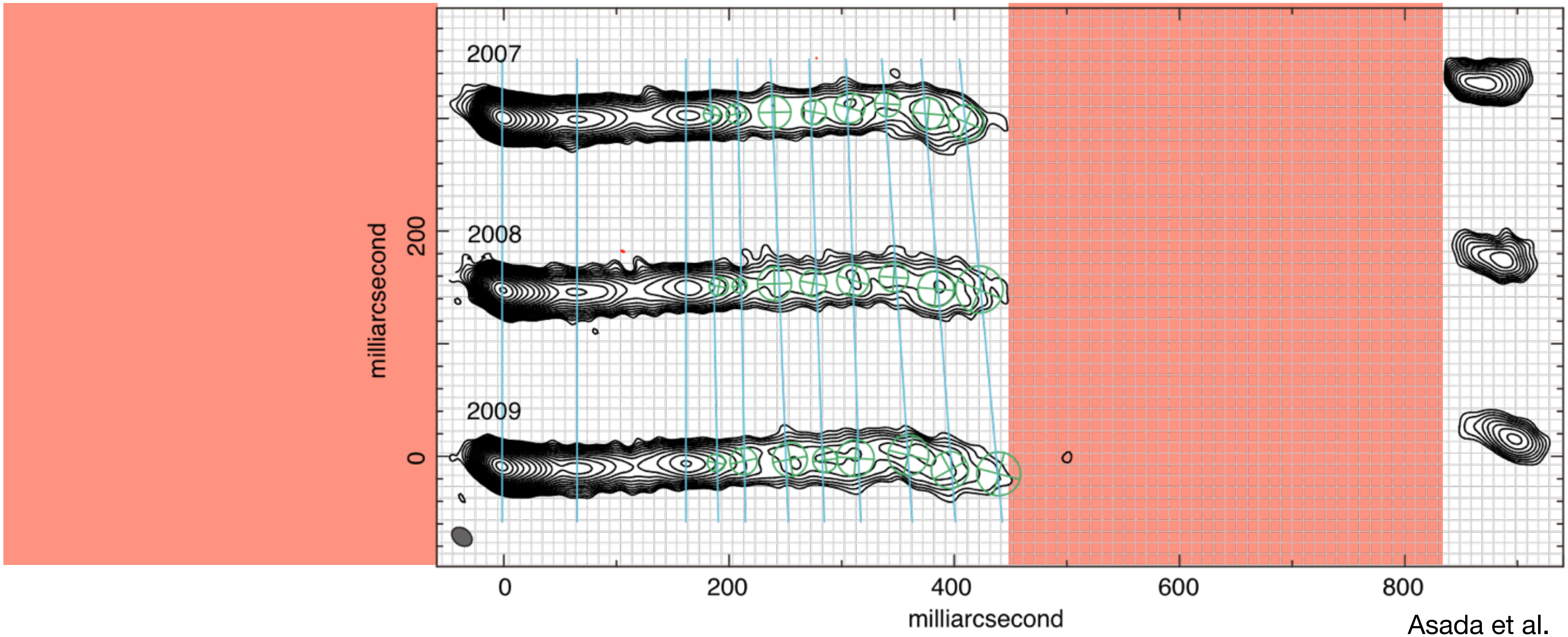


Dynamic Range of current our EVN image is ~ 2500 !!

- **SKA** will improve it > 1,000,000

- Is the M87 jet over-collimated ?

Imaging the counter-jets



Asada et al.

Detection of counter-jets is important !!

- evaluation of jet true speed. ▶ **jet physics**
- estimation of viewing angle. ▶ **AGN geometry**

3. Wide Frequency Range

(1) Lines
- Can trace the evolution along z
- Can determine the excitation temperature and density (ex. CO(1-0) and CO(2-1))

(2) Continuum
- Can receive a larger number of photons
- A special imaging technique to deal with a large dynamic range should also be developed.

4. Summary

(1) Small science group $\Rightarrow$ Collaboration is necessary.

(2) Possible science collaborations

a. H I emission and absorption at high z

b. Galaxy evolution in radio

c. AGN and magnetism

(3) Requirements:

a. Microjansky sensitivities

b. Imaging techniques should also be developed.