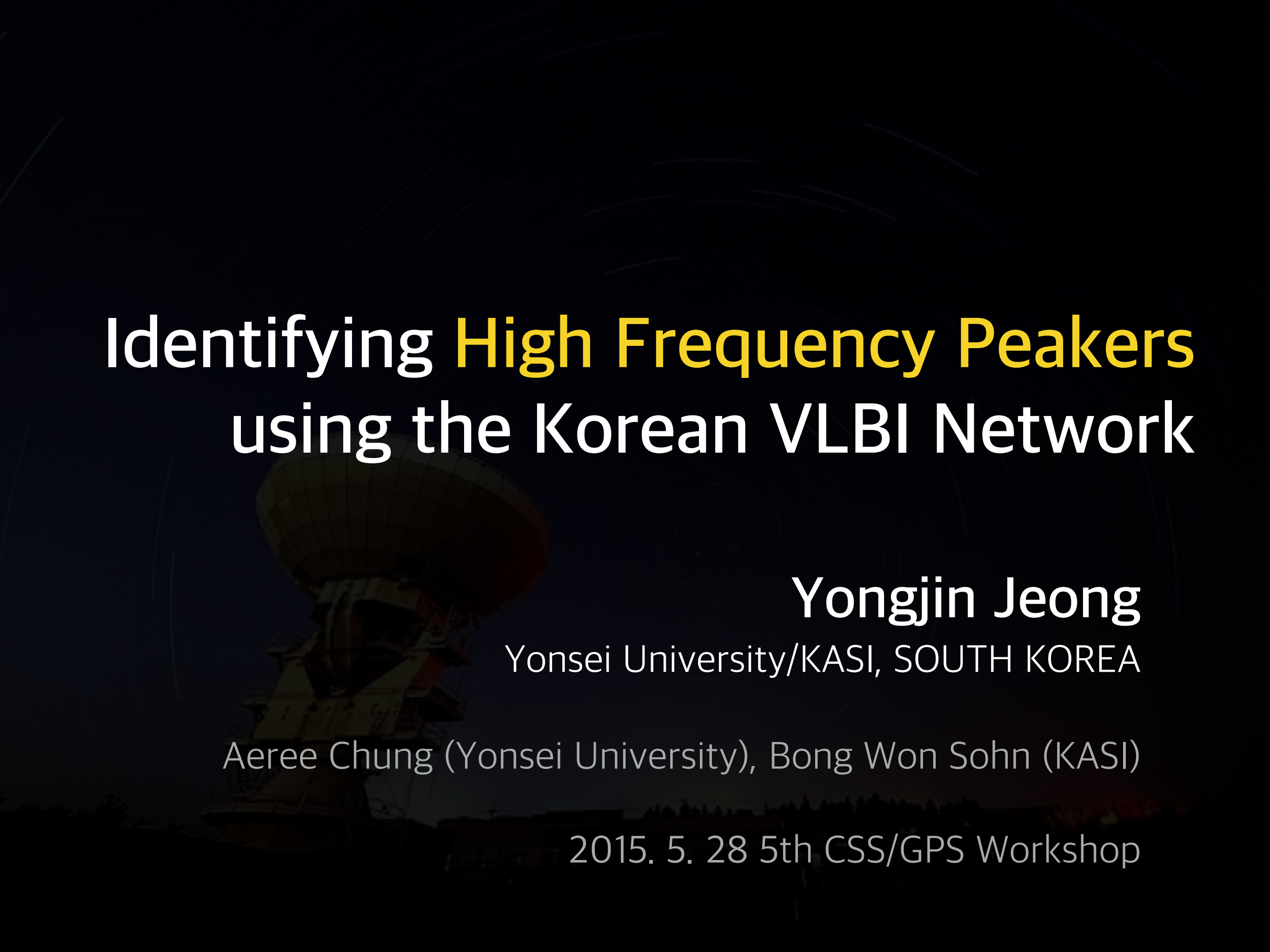




Identifying **High Frequency Peakers** using the Korean VLBI Network

Yongjin Jeong

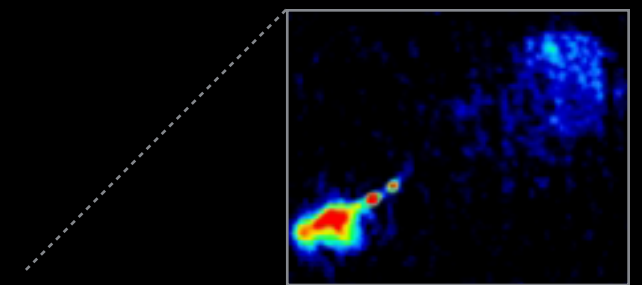
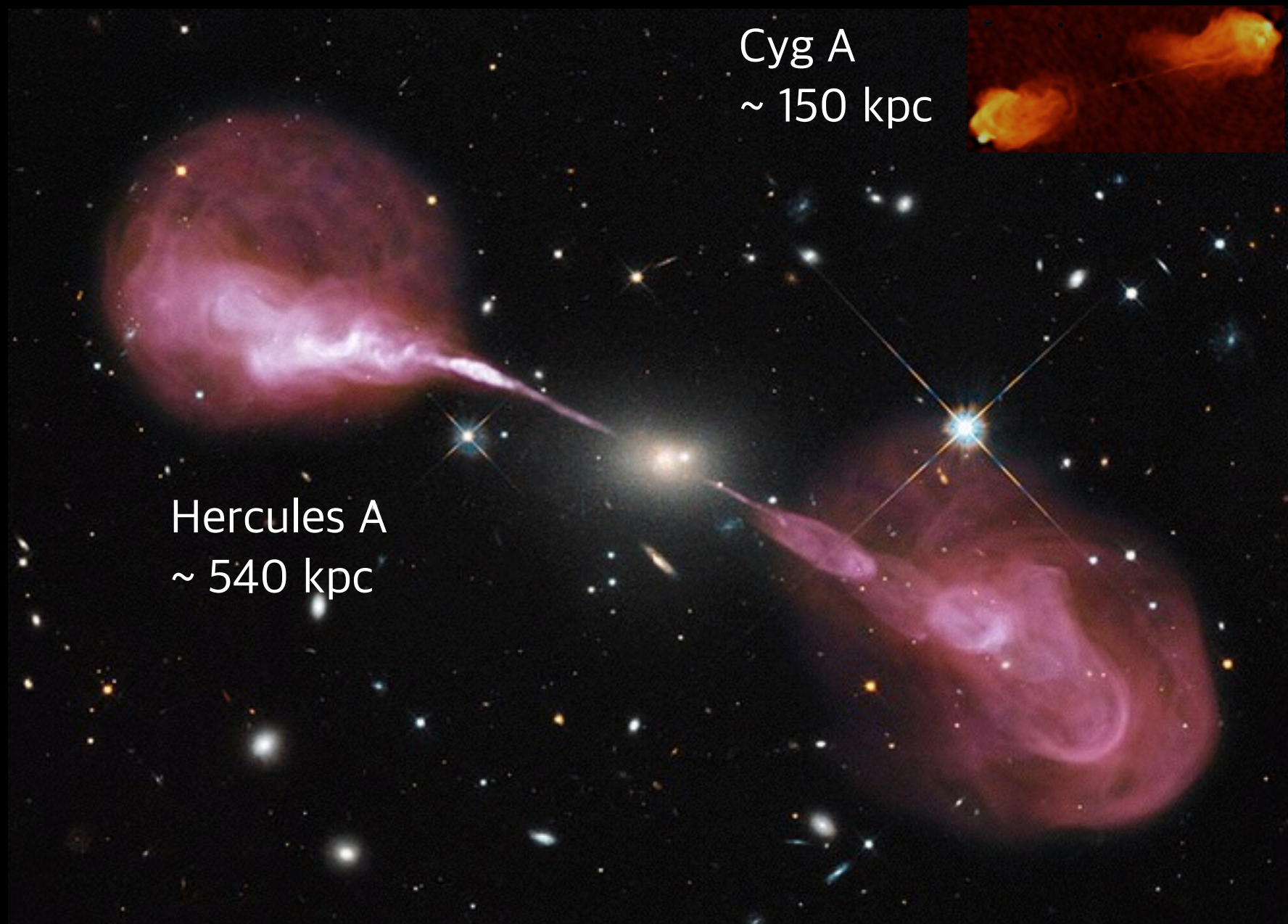
Yonsei University/KASI, SOUTH KOREA

Aeree Chung (Yonsei University), Bong Won Sohn (KASI)

2015. 5. 28 5th CSS/GPS Workshop

High Frequency Peaker

- Size $\ll 1$ kpc



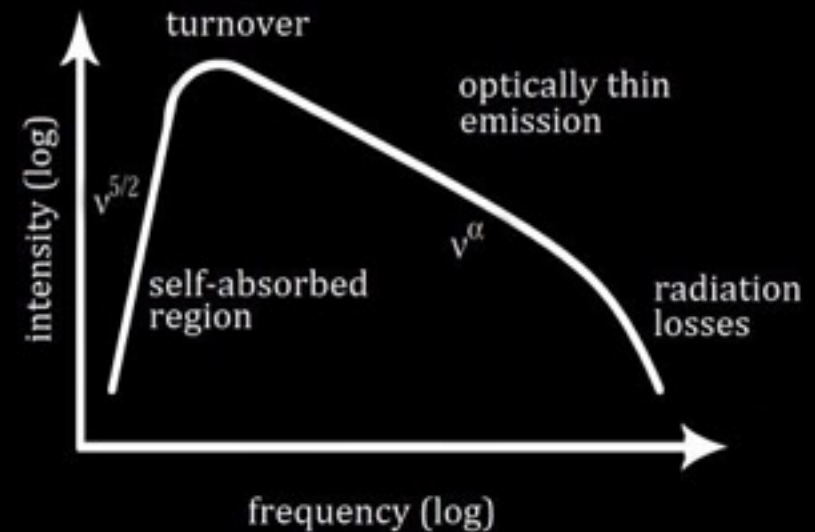
HFP
< 1 kpc



Host galaxies
(giant elliptical)
~ 30 kpc

High Frequency Peaker

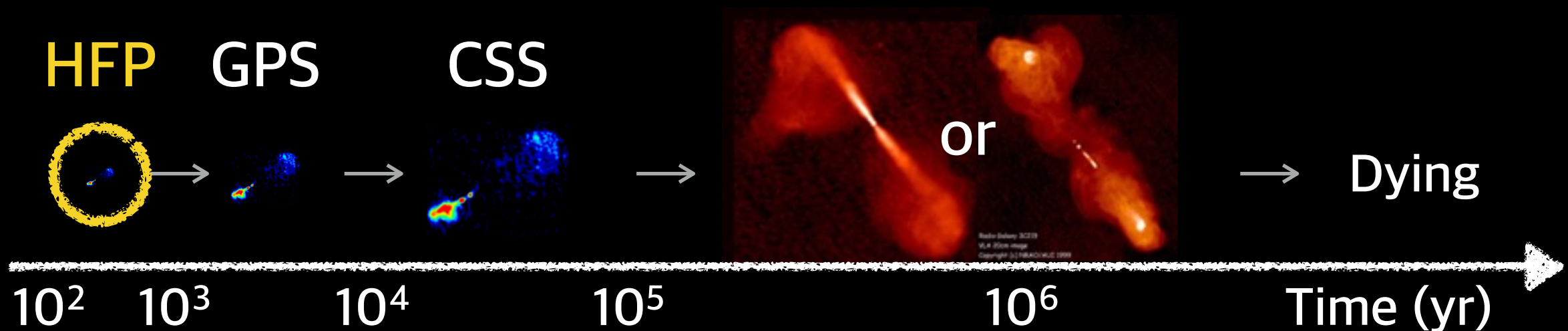
- Size $\ll 1$ kpc
- Peak frequency > 5 GHz



Convex spectrum peaking at high radio frequency

High Frequency Peaker

- Size $\ll 1$ kpc
- Peak frequency > 5 GHz
- Age 100–1000 yrs



The evolution of radio-loud AGN

PROBLEM

Problem:

Contamination by other types of radio sources (**blazars**) among the HFP samples

HFP selection tools

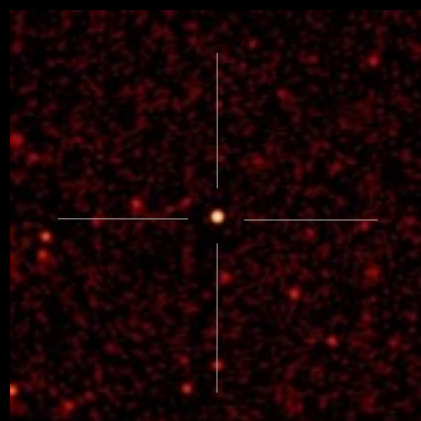
- Compact size
- Convex spectrum peaking at frequency

PROBLEM

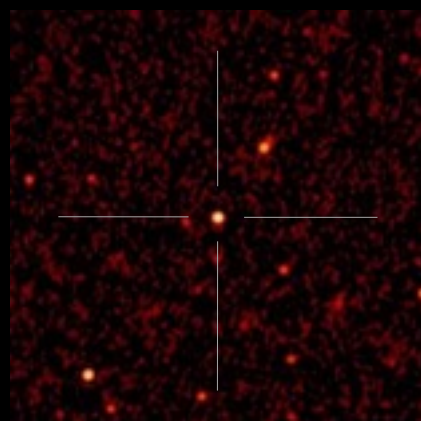
1. Compact size

HFP

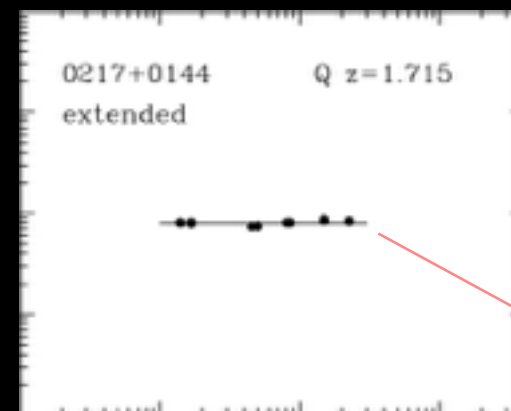
low resolution



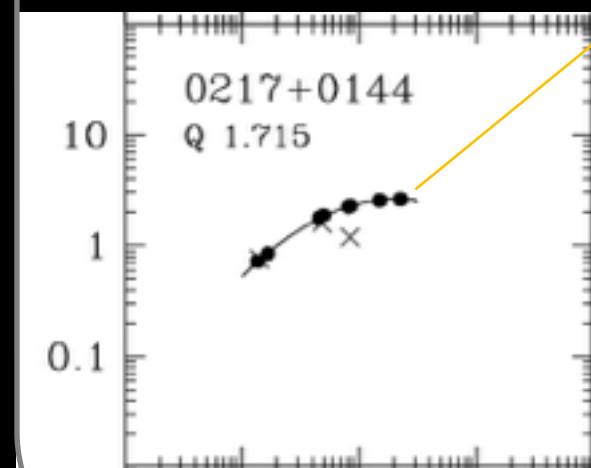
Blazar



2. Convex spectrum peaking at high frequency

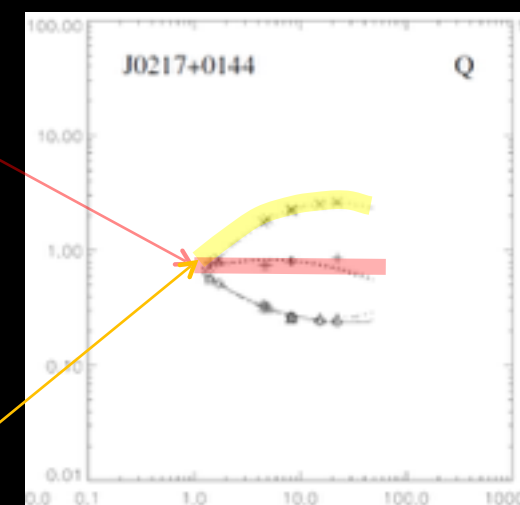


Tinti et al, 2005



Dallacasa et al, 2000

Blazar



Orienti et al, 2007

PROBLEM

Problem:

Contamination by other types of radio sources (**blazars**) among the HFP samples

HFP selection tools

- Compact size
- Convex spectrum peaking at frequency

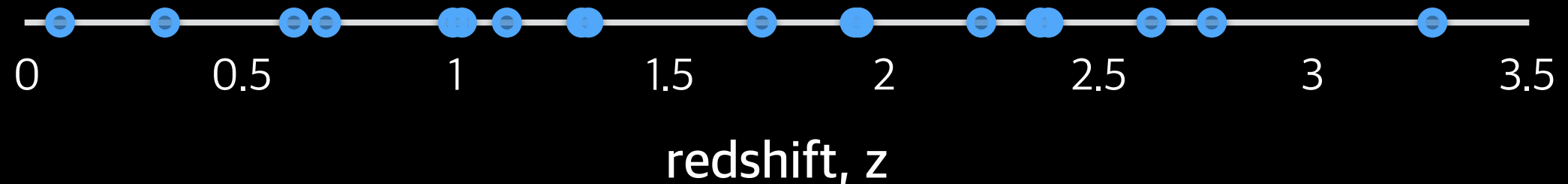
Aims:

Obtain a sample of genuine

young radio sources (HFPs)

19 HFP candidates

- Sample selection
 - Selected from Dallacasa+ 2000; Labiano+ 2007; Vollmer+ 2008
 - Peak frequency > 5 GHz
 - Peak flux density > 1 Jy
 - $\delta \geq -32.5$ deg (accessible with KVN)
- $0.077 < z < 3.280$



19 HFP candidates

No.	Name		z	Ref.
	J2000	B1950		
1	J0217+0144	0215+015	1.715	D
2	J0251+4315	0248+430	1.310	L
3	J0422+0219	0420+022	2.227	V
4	J0459+0229	0457+024	2.384	L
5	J0530-2503	0528-250	2.778	L
6	J0555+3948	0552+398	2.365	V
7	J0745+1011	0742+103	2.624	L
8	J0745-0044	0743-006	0.994	L
9	J0927+3902	0923+392	0.695	D
10	J1146-2447	1143-245	1.940	L,V
11	J1407+2827	1404+286	0.077	D,L,V
12	J1522-2730	1519-273	1.294	L
13	J1751+0939	1749+096	0.322	D,L,V
14	J2101+0341	2059+034	1.013	D
15	J2123+0535	2121+053	1.941	D,V
16	J2129-1538	2126-158	3.268	L,V
17	J2136+0041	2134+004	1.945	D,V
18	J2212+2355	2209+236	1.125	D,L
19	J2320+0513	2318+049	0.622	D

METHODS

Young radio sources
(HFPs)

Blazars

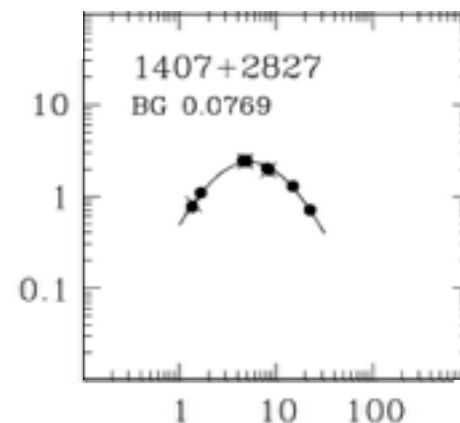
1. Variability

No variability

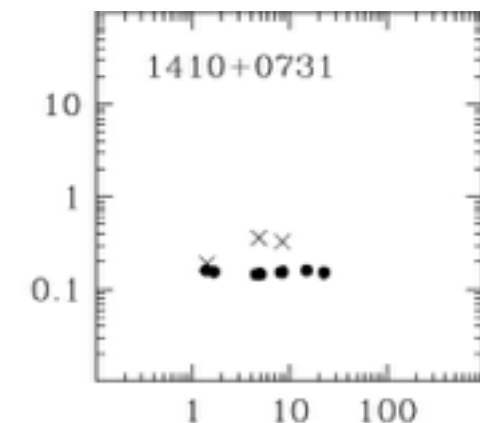
Strong flux variability
: due to doppler boosting

2. Spectral
Property

Convex spectrum



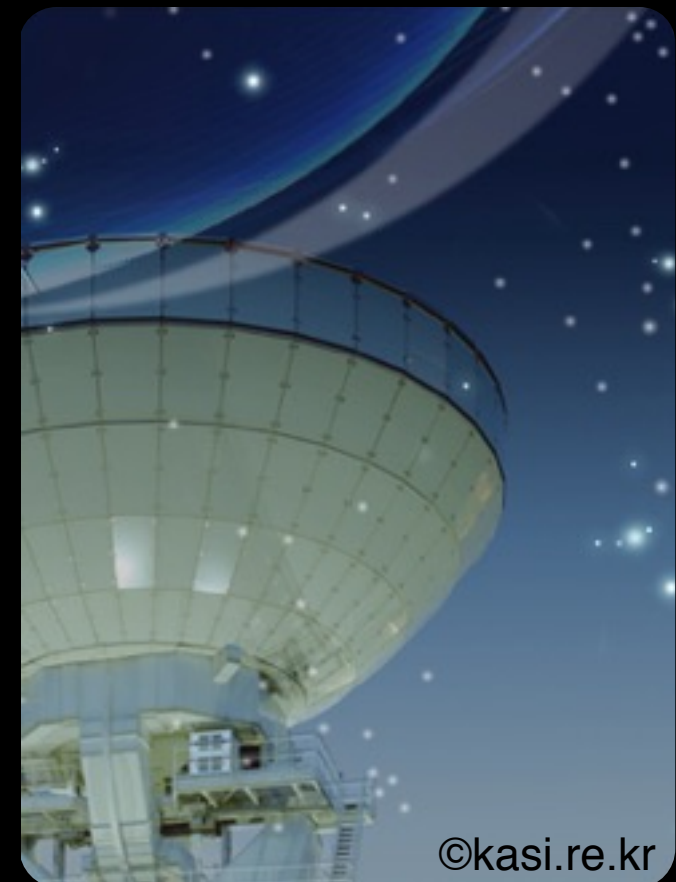
Flat spectrum



Dallacasa et al, 2000

Observation 1

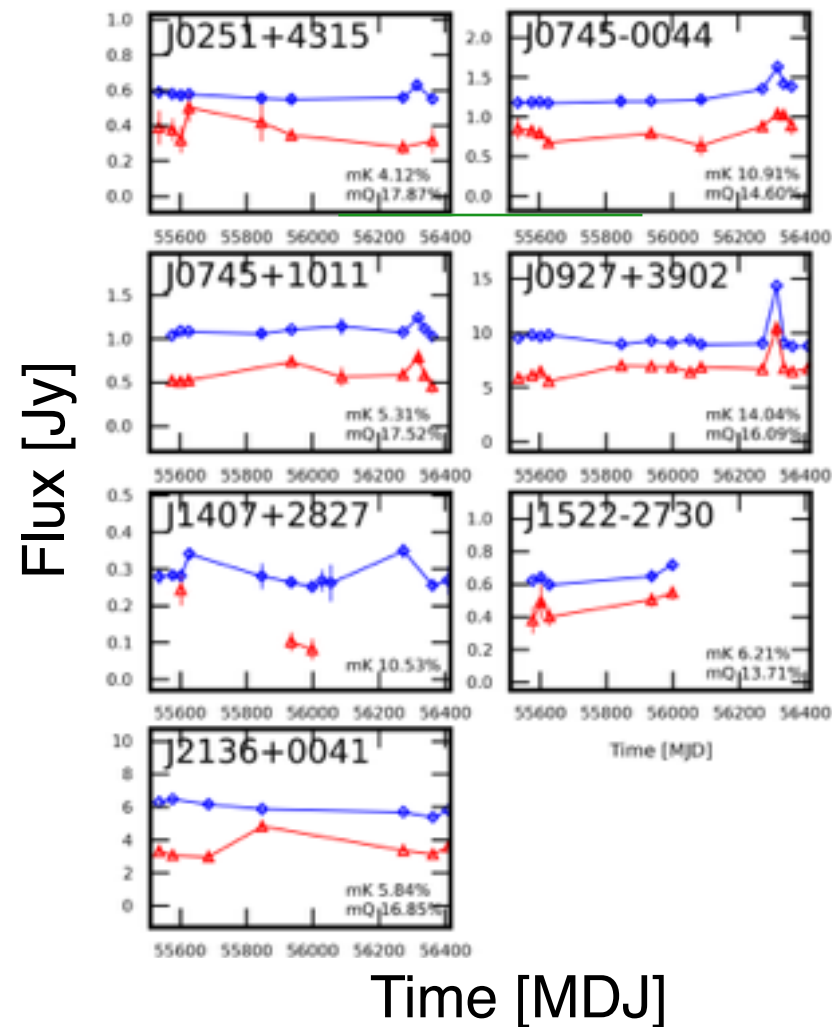
- KVN (Korean VLBI Network) single-dish observation
- Long-term Monitoring
 - Dec. 2010 – Apr. 2013 (2.5 years)
 - 18 epochs
- Simultaneous multifrequency
 - 22 GHz (K-band), 43 GHz (Q-band)
 - Bandwidth 512 MHz



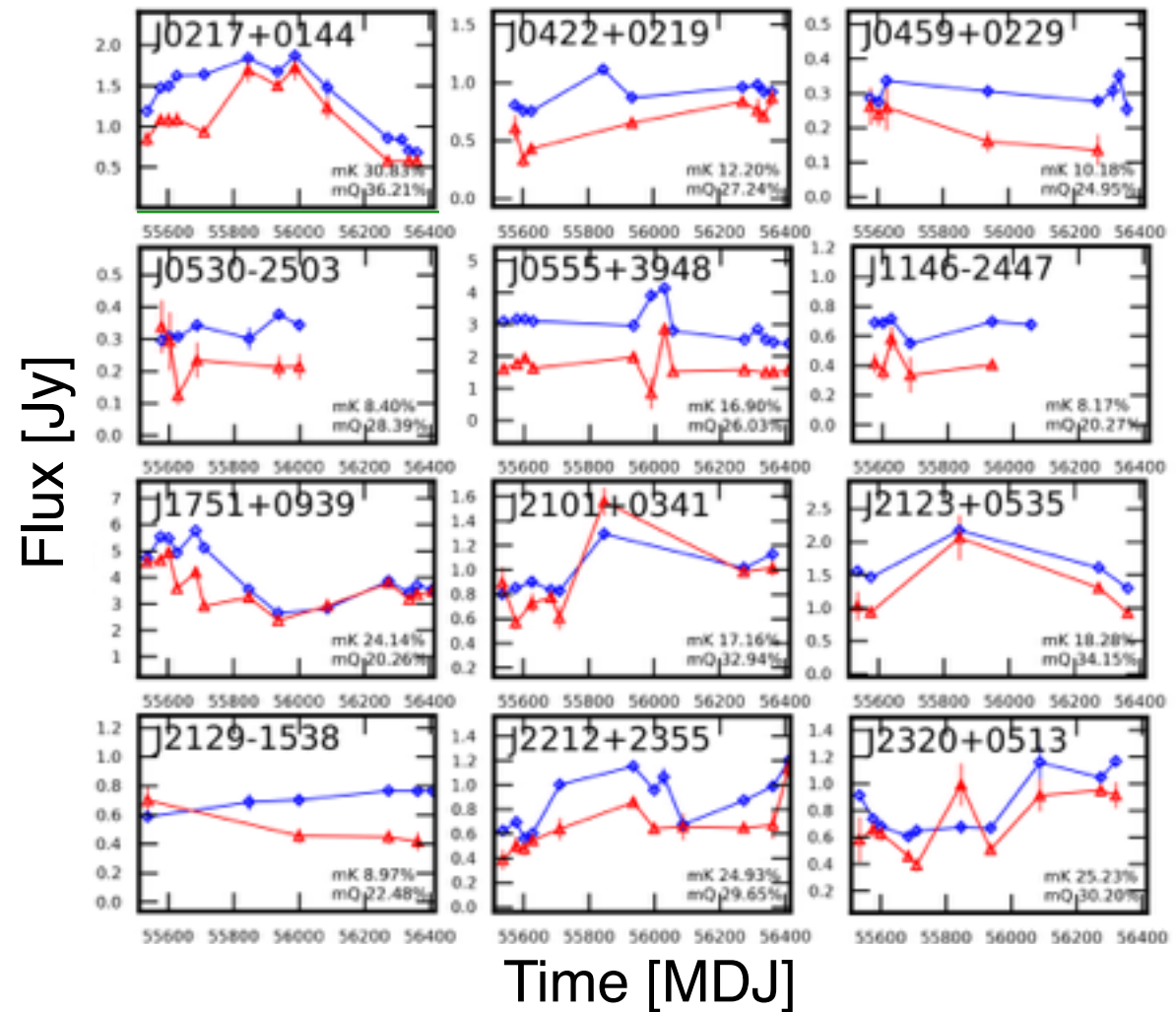
Results 1-1. Variability

◆ 22 GHz (K-band)
▲ 43 GHz (Q-band)

HFP candidates
 $M < 20\%$ (Non-V)



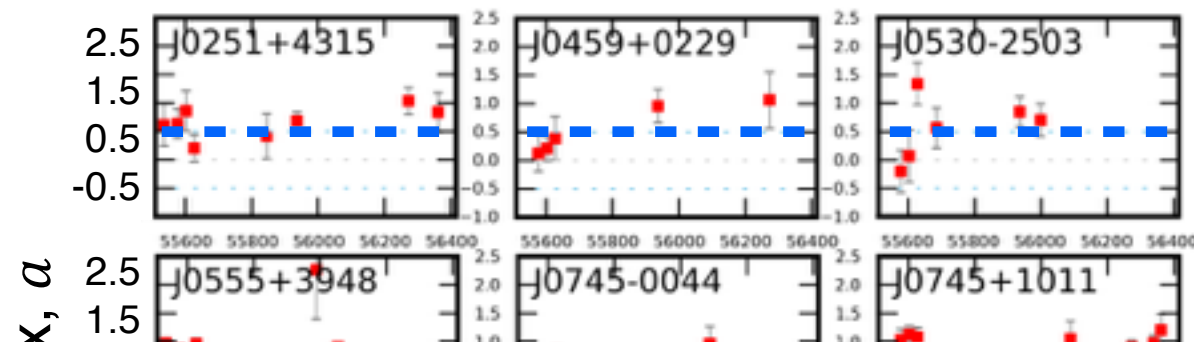
Blazar candidates
 $M > 20\%$ (V)



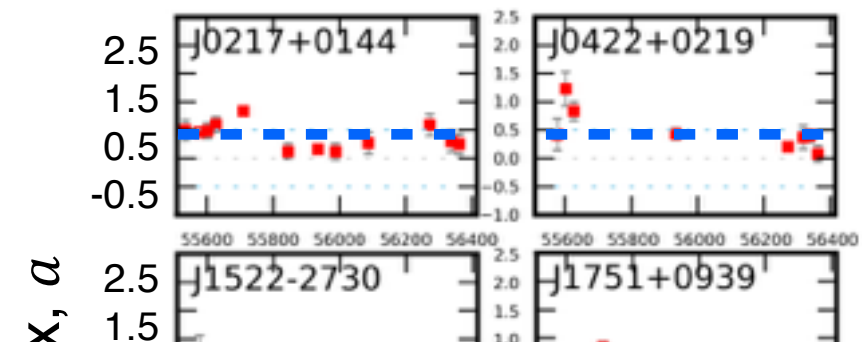
- Modulation index was adopted to quantify variation.
- In total, 12 out of 19 are found with significant variability whereas the rest 7 sources can be classified as HFPs

Results 1-2. Spectral properties

HFP candidates
 $\alpha > 0.5$ (Steep spectrum)

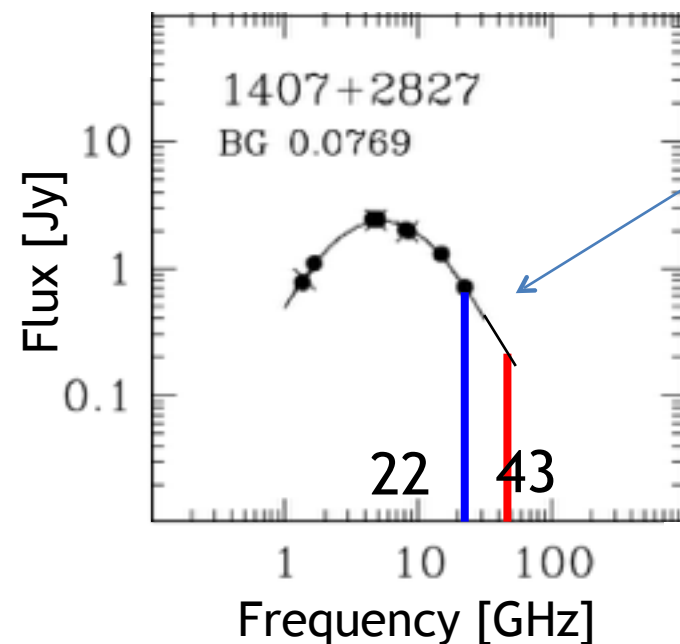


Blazar candidates
 $\alpha < 0.5$ (flat spectrum)



HFP

Convex spectral shape



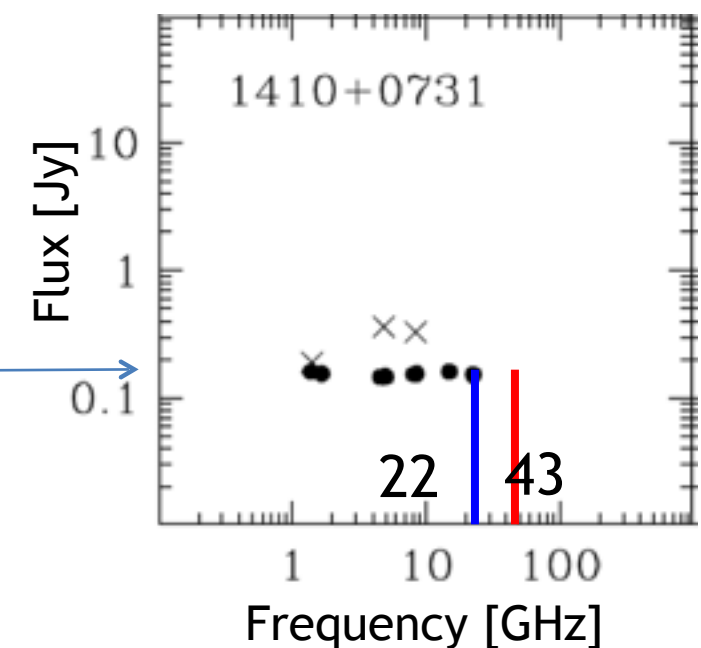
Dallacasa et al, 2000

Steep spectrum
 $0.5 < \alpha$

Flat spectrum
 $-0.5 < \alpha < 0.5$

Blazar

Flat spectral shape

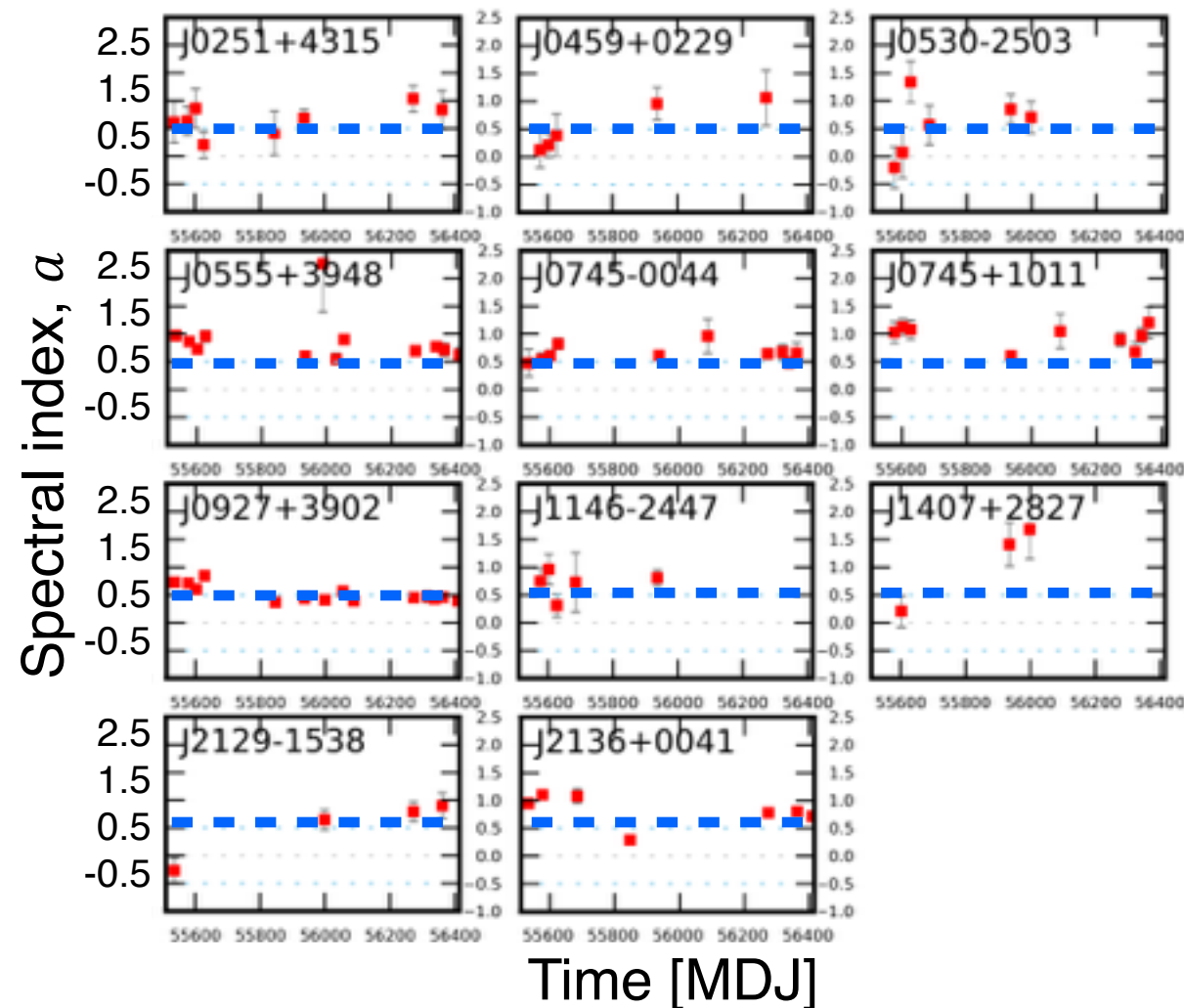


Dallacasa et al, 2000

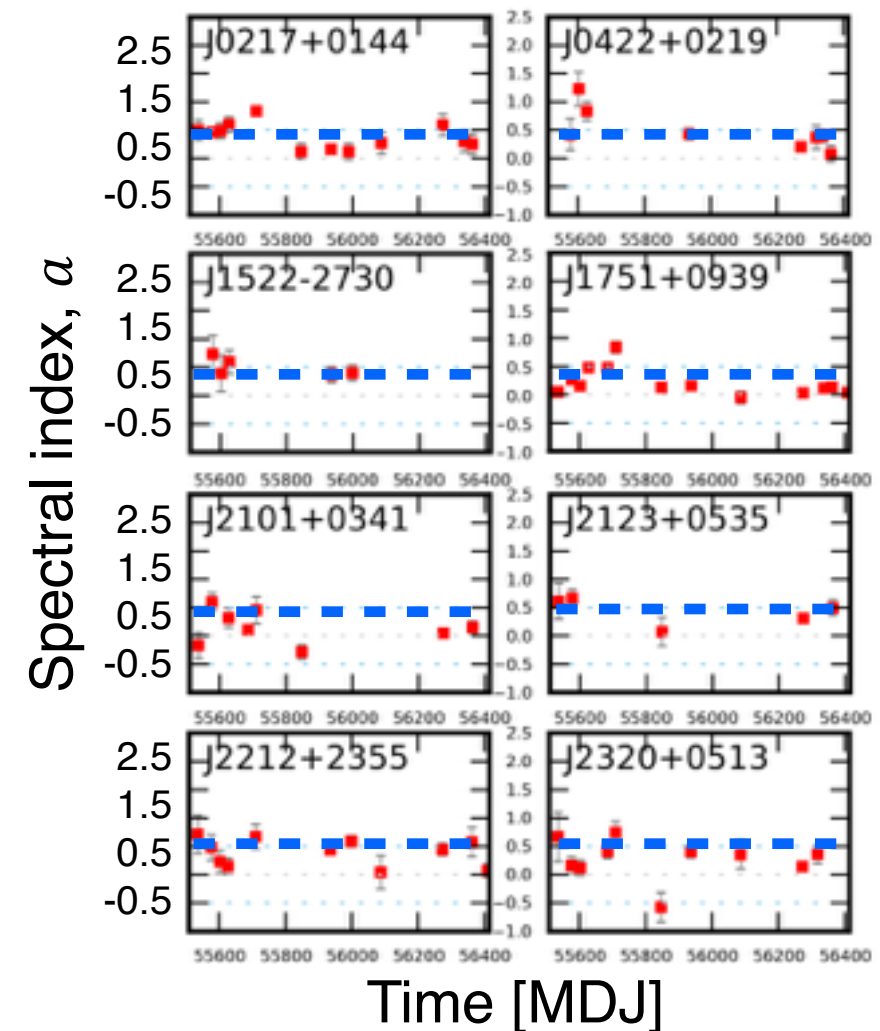
- In total, 11 out of 19 sources are classified as steep and 8 are classified as flat.

Results 1-2. Spectral properties

HFP candidates
 $\alpha > 0.5$ (Steep spectrum)



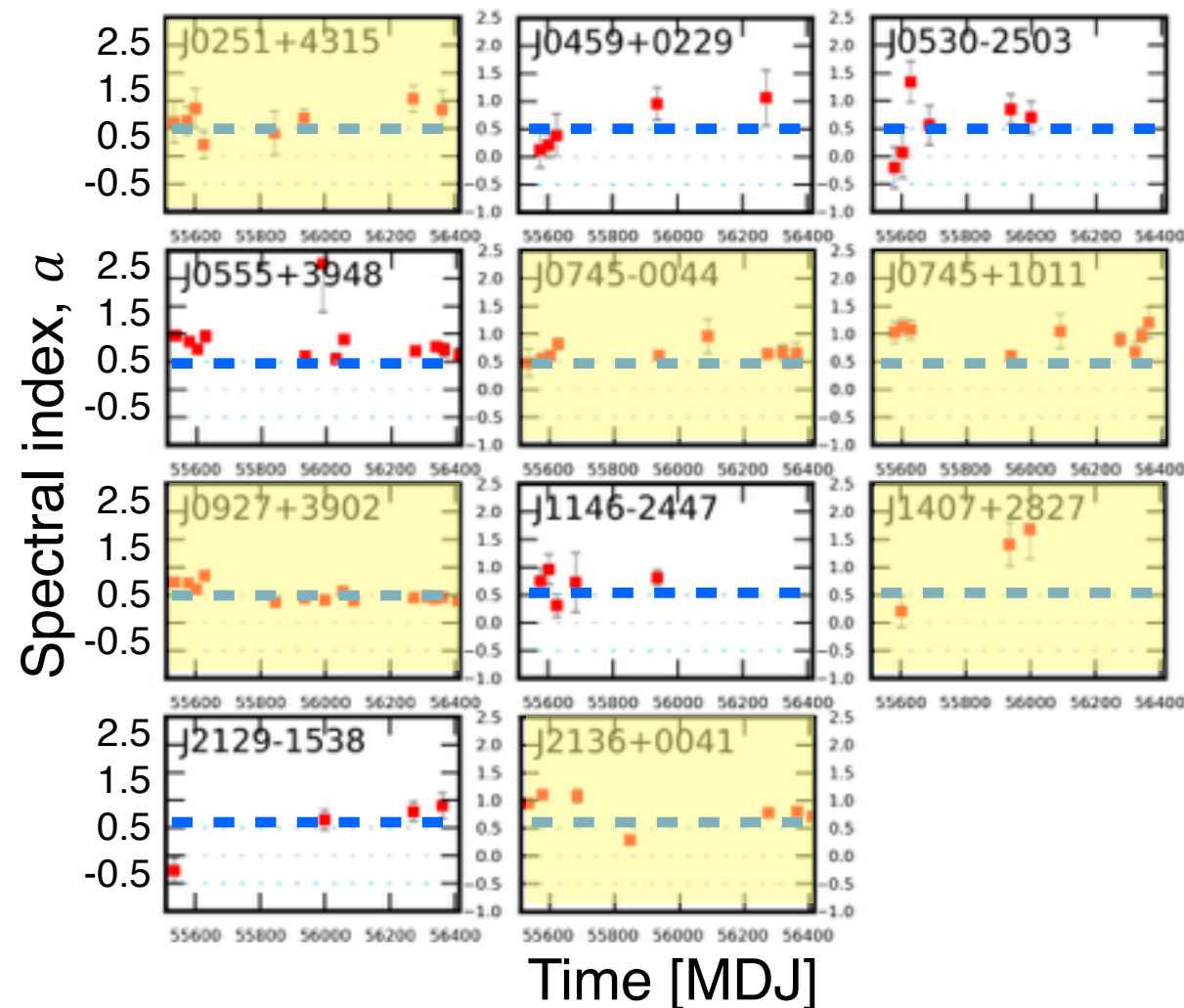
Blazar candidates
 $\alpha < 0.5$ (flat spectrum)



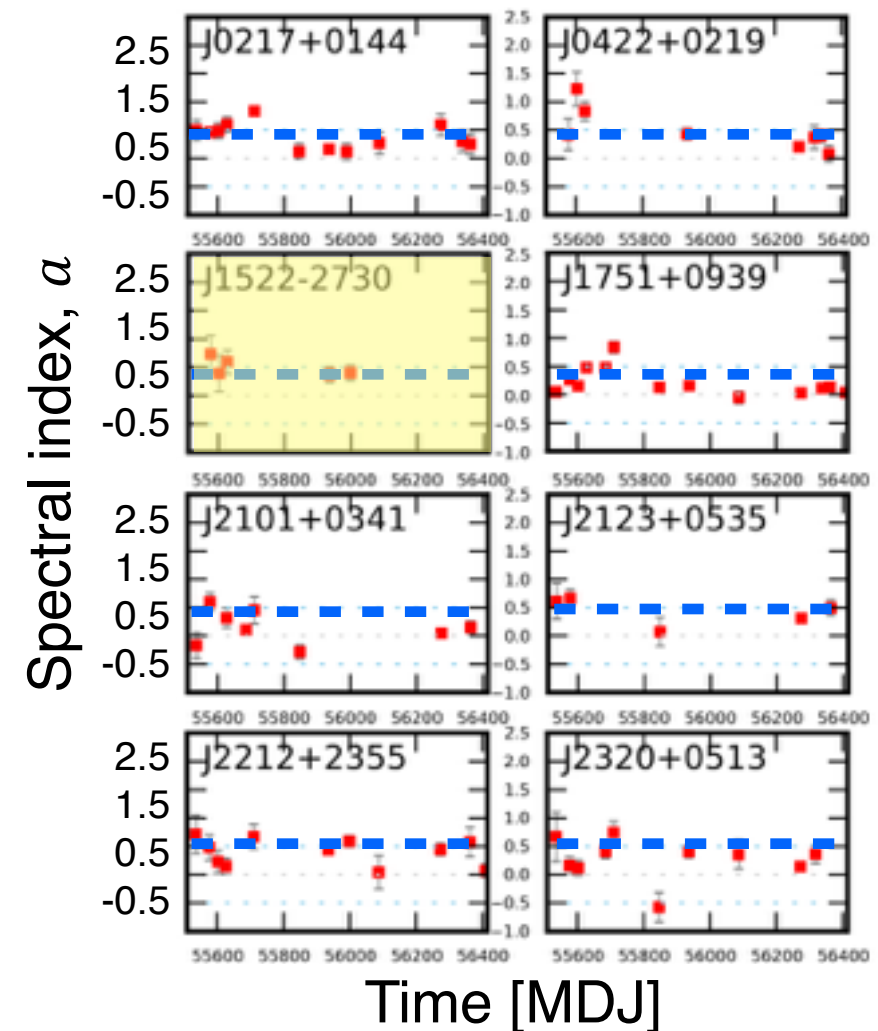
- Spectral index is the measure of how flat or steep the spectrum is.
- HFPs are expected to show steep spectra while the spectra of blazars are likely to be flat.
- In total, 11 out of 19 sources are classified as steep and 8 are classified as flat.

Results 1-2. Spectral properties

HFP candidates
 $\alpha > 0.5$ (Steep spectrum)



Blazar candidates
 $\alpha < 0.5$ (flat spectrum)



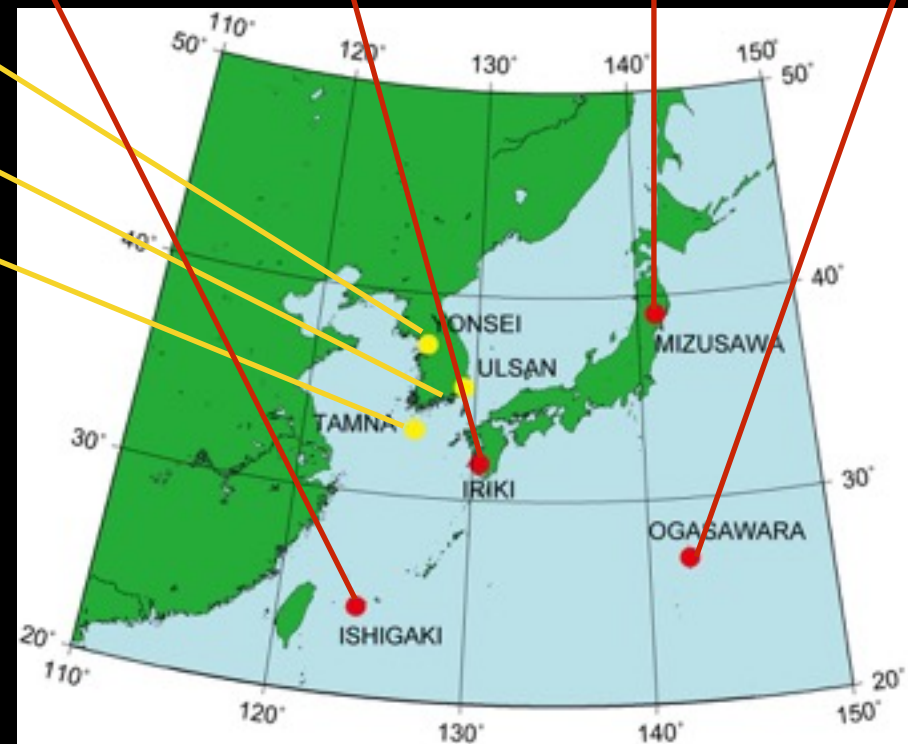
- Spectral index is the measure of how flat or steep the spectrum is.
- HFPs are expected to show steep spectra while the spectra of blazars are likely to be flat.
- In total, 11 out of 19 sources are classified as steep and 8 are classified as flat.

Observation 2



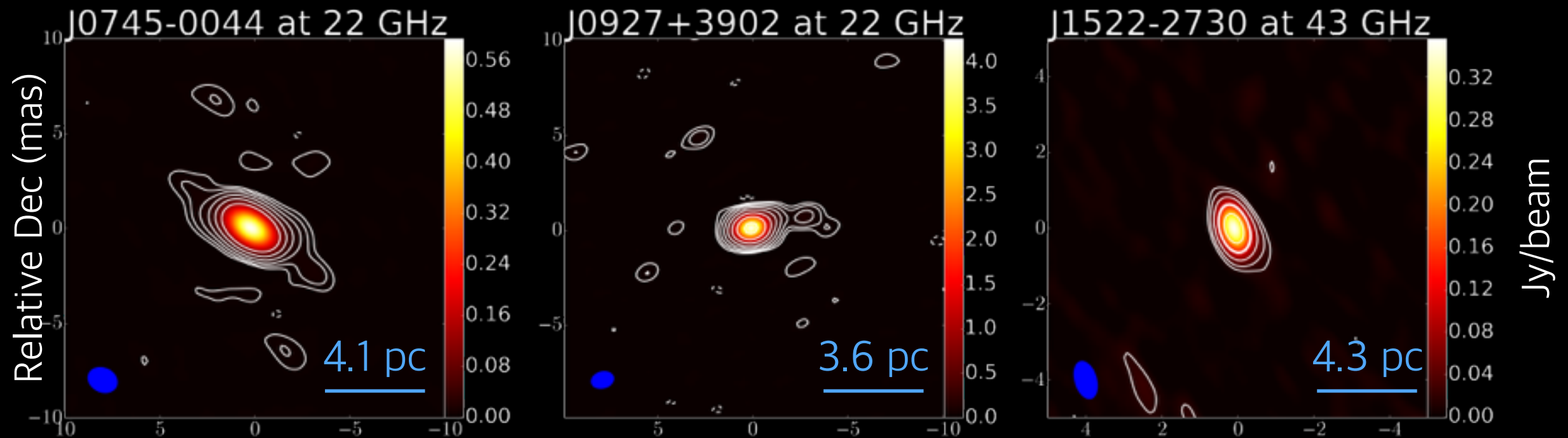
- Resolution: 1.2 mas at 22 GHz, 0.6 mas at 45 GHz

- 7 of 19 sources

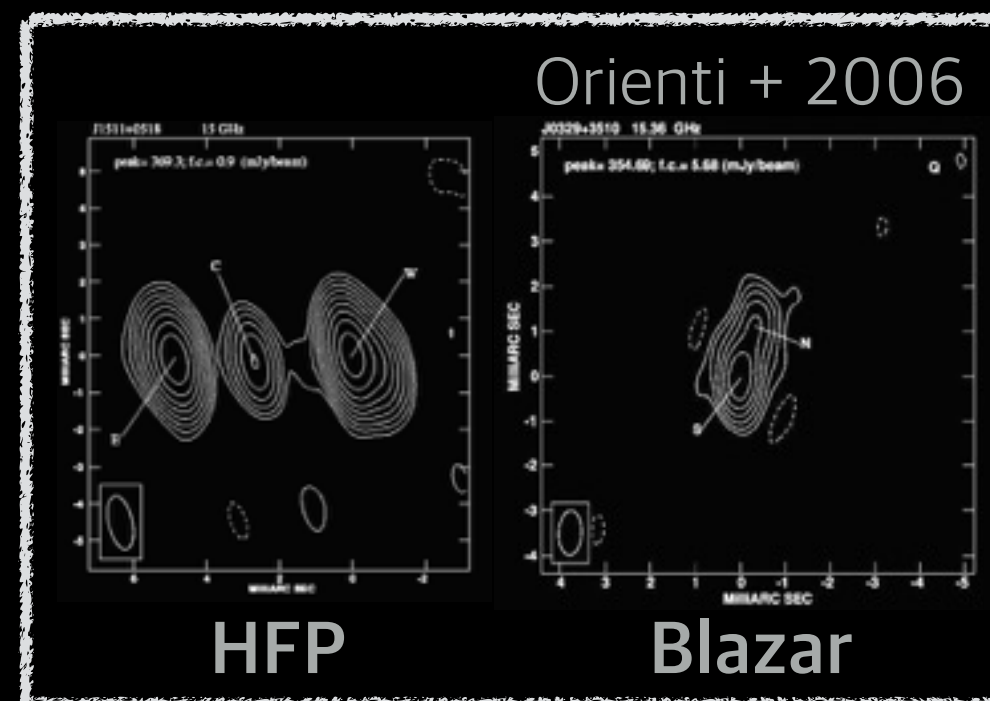
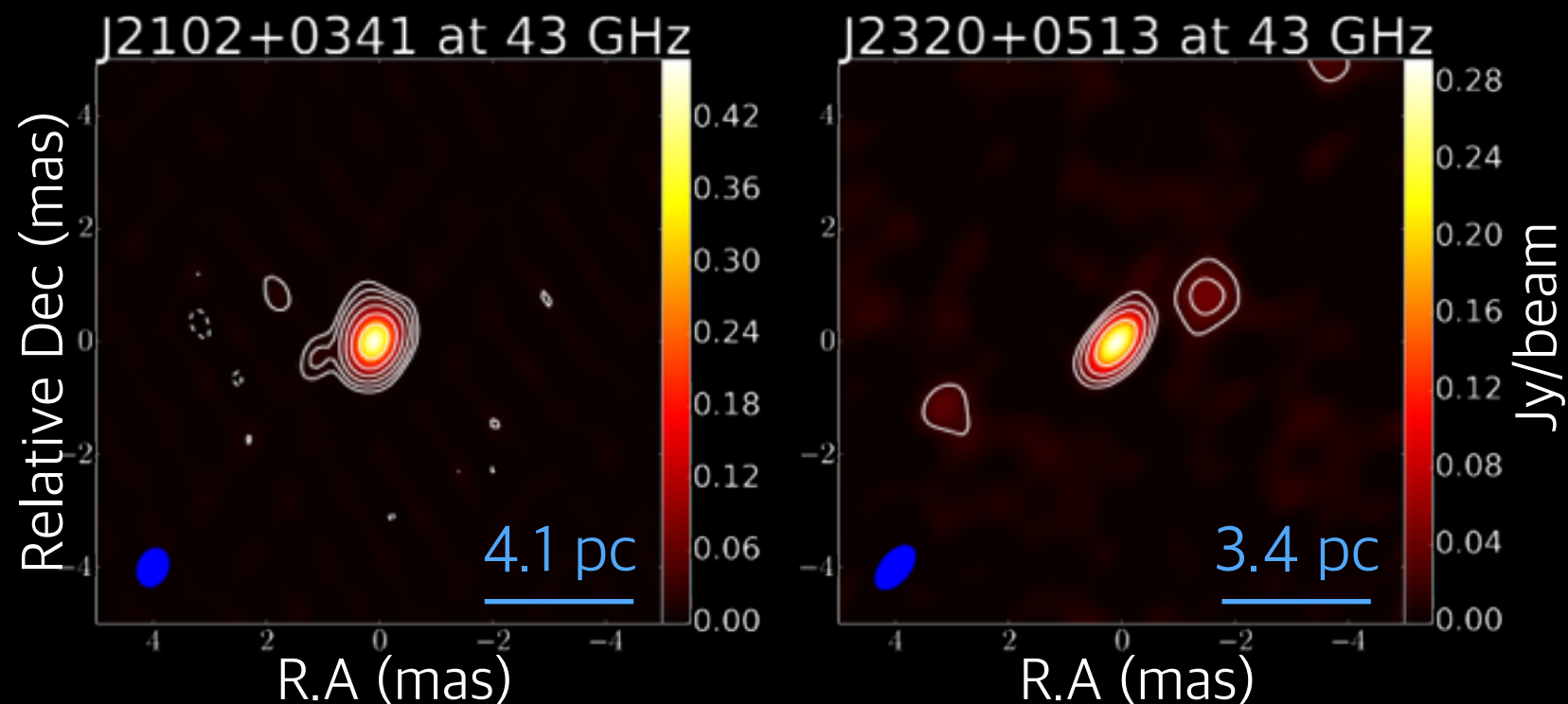


Results 2. Morphology

HFP candidates



Blazar candidates



Conclusion

1. We identified 7 HFP candidates among 19 sources in previous sample using KVN single-dish long term monitoring observation
 - Seven of nineteen sources (36.8 %) were HFPs
 - Twelve of nineteen sources (63.1%) were blazars
2. We compared morphological properties HFPs with blazars using KaVA VLBI observation
 - Five sources are resolved into 2 or 3 components

Future Works

1. Morphological study using spectral index map
 - KaVA VLBI observation at least two frequencies
2. Gas properties of host galaxy with 7 HFP candidates
 - Ionized gas emission line, molecular line observation

Thank you!

