

JVN UPDATE

KENTA FUJISAWA (YAMAGUCHI UNIVERSITY), JVN COLLABORATION

• Collaboration

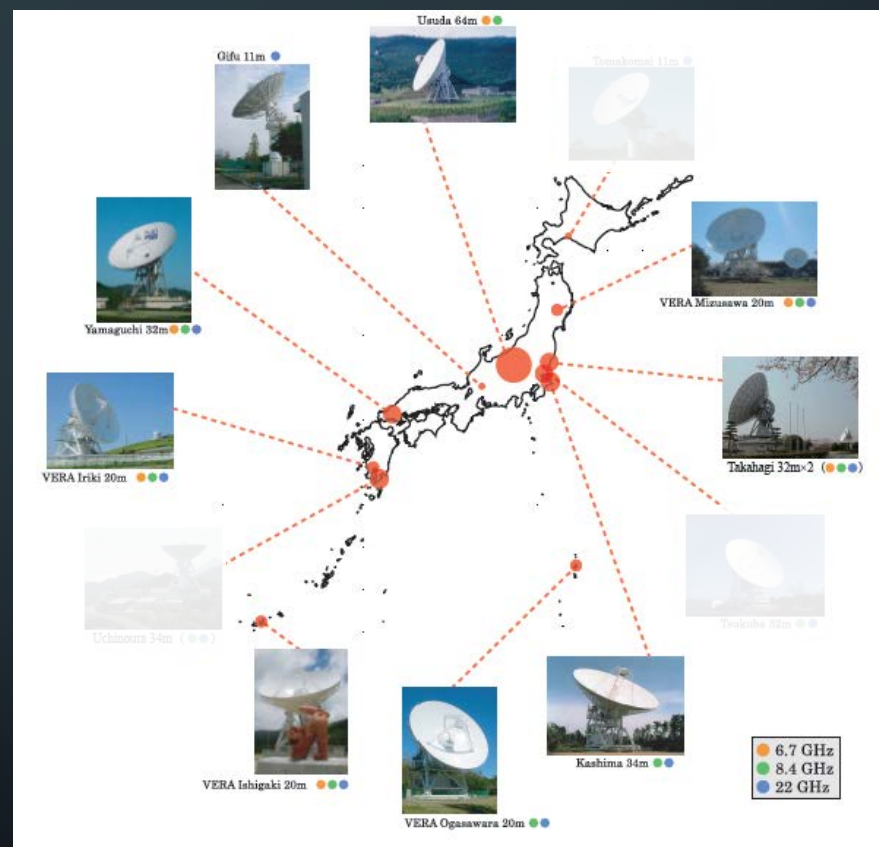
- NAOJ (VERA)
- Ibaraki, Tsukuba, Gifu, Osaka-Pref, Yamaguchi, Kagoshima universities
- JAXA, NICT

• Specifications

- 11 telescopes (11m ~ 64m)
 - 6~7 active telescopes
- Baseline 50 - 2500 km
- Frequency 6.7/8/22 GHz
- Sensitivities (8 GHz, 2 Gbps) 3 mJy

• Operation

- 200hr/yr, 30 observations/yr
 - Tomakomai 11m (Hokudai) stopped at 2016 March
 - Tsukuba 32m (GSI) stopped at 2017 January
 - Kashima 34m (NICT) stopped at 2019 September



Japanese VLBI Network (JVN)

TOPICS IN 2018 – 2019

- **Contribution to EAVN : Ibaraki & Yamaguchi**
 - Takahagi 32m (Ibaraki) will participate at 22 GHz
 - C-band test observation, under processing
 - Ibaraki & Yamaguchi will join EAVN C-band from 2020B
- **Ibaraki – Yamaguchi – Kashima Observation**
 - High sensitivity, No image
 - Fringe detection/survey mode

JVN OBSERVATION

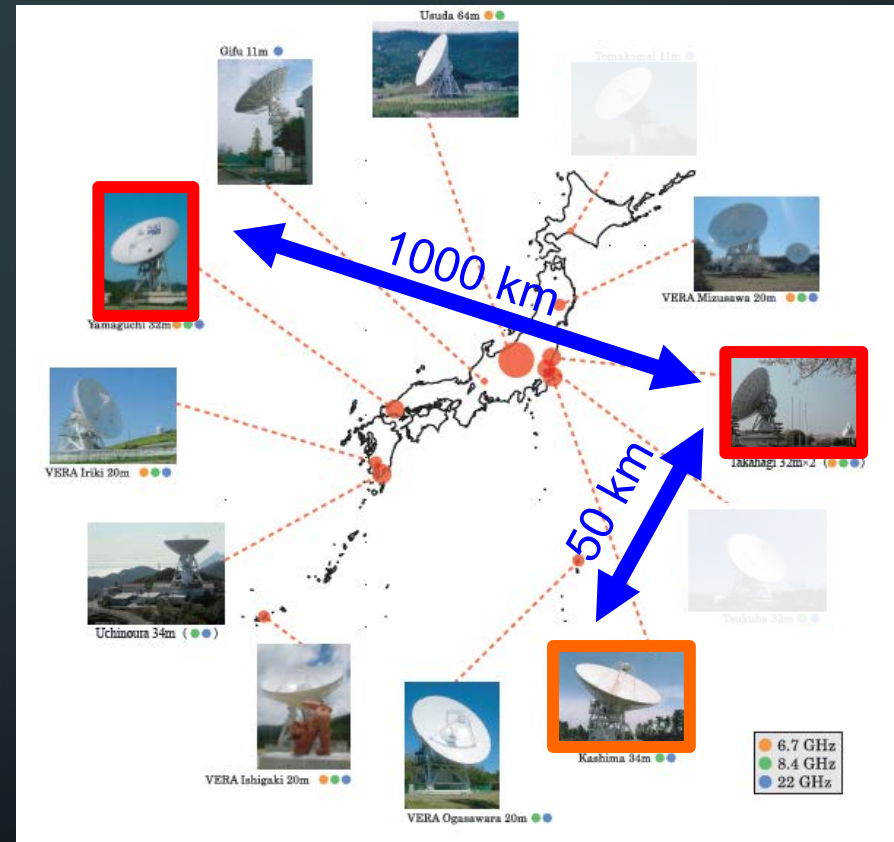
2018 OCT – 2019 SEP

band	# of obs.	Obs. time (hr)
C-band	42	130
X-band	50	268
Sum	92	398

- Imaging Observation
 - Methanol maser imaging
 - EAVN test observation
- Ibaraki - Yamaguchi observation
 - High-z AGN (Furuya)
 - Extremely compact HII region (Motogi, Ogura)
 - Galactic compact sources
 - Flare star

IBARAKI – YAMAGUCHI OBSERVATION

- Detection VLBI
 - Ibaraki-Yamaguchi-Kashima
 - Non-imaging, fringe detection
 - 32/34m high sensitivity
 - a few mJy @ 6/8 GHz
 - Different baseline length
 - Source size / brightness
 - Long observation time
 - 200~300 hr/yr (up to 1000 hr in future)
 - Correlation by universities

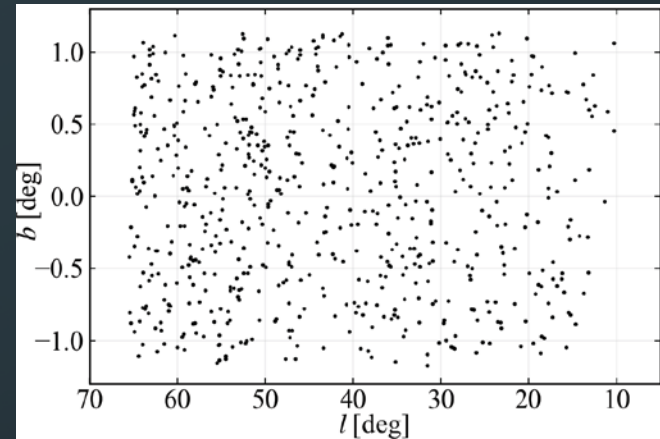


➔ Massive VLBI database construction for various class of radio source

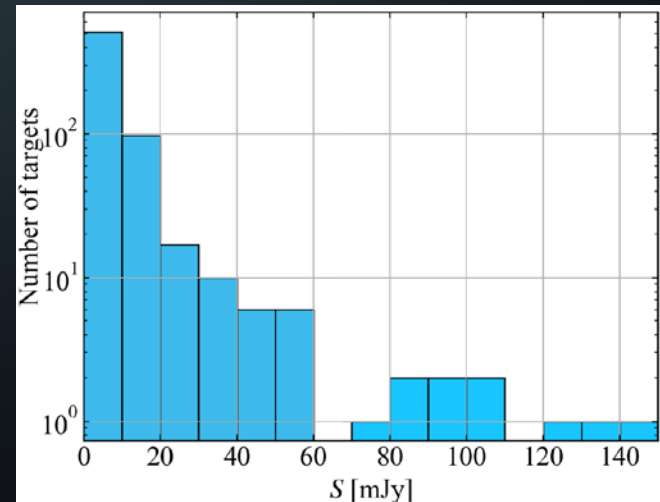
EXTREMELY COMPACT HII REGION SURVEY

(Motogi & Ogura)

- To find candidates of very first stage of high-mass star as extremely compact HII region
- VLBI survey of thermal object with $T_b \sim 10^4$ K
- Observation
 - Ibaraki – Kashima
 - 662 sources from CORNISH
 - 390 sources done



Target distribution



Flux density of the targets

IBARAKI-YAMAGUCHI OBSERVATION GAMMA-RAY EMITTING AGN SURVEY

- To find candidate AGNs in the field of Fermi unassociated γ -ray sources
- Observation
 - > 1000 sources in two years (2019 – 2020)
 - Ibaraki – Yamaguchi, X-band
- Pre-study
 - Fujinaga, Niinuma et al. (2016) PASJ, 68, 70
 - Surveyed gamma-ray unidentified **845 sources** in the Fermi catalog
 - Found **28 new gamma-ray AGNs** (\rightarrow)

Table 2. Detected sources.

2FGL name	Radio name	$F_{1.4}$ [mJy]	$F_{8.4}$ [mJy]	uv [M λ]	$T_B <$ [$\times 10^6$ K]	$\alpha_{1.4}^{8.4}$
2FGL J0226.1+0943	NVSS J022613+093726	374.6	64.7	20.5	16.02	0.98
2FGL J0227.7+2249	NVSS J022744+224834	45.6	56.2	18.6	11.46	-0.12
2FGL J0307.4+4915	NVSS J030727+491510	56.0	184.0	22.5	54.68	-0.66
2FGL J0600.9+3839	NVSS J060102+383828	704.0	90.5	22.0	25.83	1.14
2FGL J0723.9+2901	NVSS J072354+285930	36.3	60.5	22.2	17.59	-0.29
2FGL J1016.1+5600	NVSS J101544+555100	132.5	102.6	22.4	30.26	0.14
Fermi J1418+3541*	FIRST J141828.5+354249	49.33	77.3	18.0	14.74	-0.25
2FGL J1502.1+5548	FIRST J150229.0+555204	41.04	42.1	21.5	11.48	-0.01
2FGL J1548.3+1453	FIRST J154824.3+145702	24.21	32.8	21.8	9.17	-0.17
2FGL J1612.0+1403	FIRST J161137.8+141046	163.03	62.9	22.5	18.69	0.53
2FGL J1704.3+1235	NVSS J170409+123421	29.5	41.7	22.5	12.38	-0.19
2FGL J1738.9+8716	NVSS J173722+871744	61.3	27.7	22.2	8.02	0.44
2FGL J1835.4+1349	NVSS J183535+134853	205.5	83.9	21.1	21.99	0.50
2FGL J1844.3+1548	NVSS J184425+154646	83.5	63.1	20.37	15.40	0.16
2FGL J2107.8+3652	NVSS J210805+365526	75.0	60.7	20.8	15.43	0.12

SINGLE-DISH AND SHORT BASELINE INTERFEROMETER IN JVN

- Large-scale Single-Dish and VLBI Monitoring of 6.7 GHz methanol maser by Ibaraki University
- HR1099 (RS CVn type binary) monitoring with Hitachi – Takahagi Interferometer
- X-ray binary GRS1915+105 monitoring with Yamaguchi Interferometer



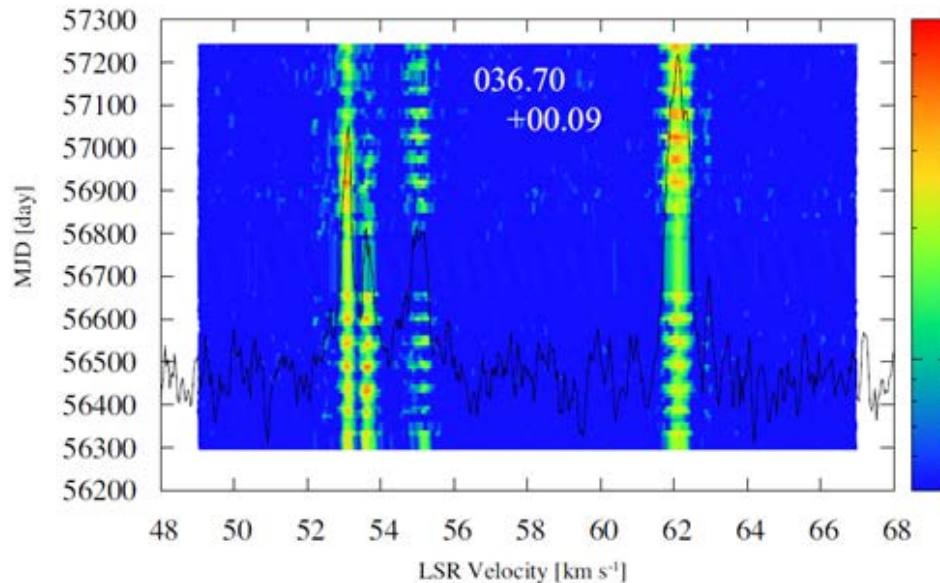
LARGE-SCALE SINGLE-DISH AND VLBI MONITORING OF 6.7 GHz METHANOL MASER BY IBARAKI UNIVERSITY

- Goals

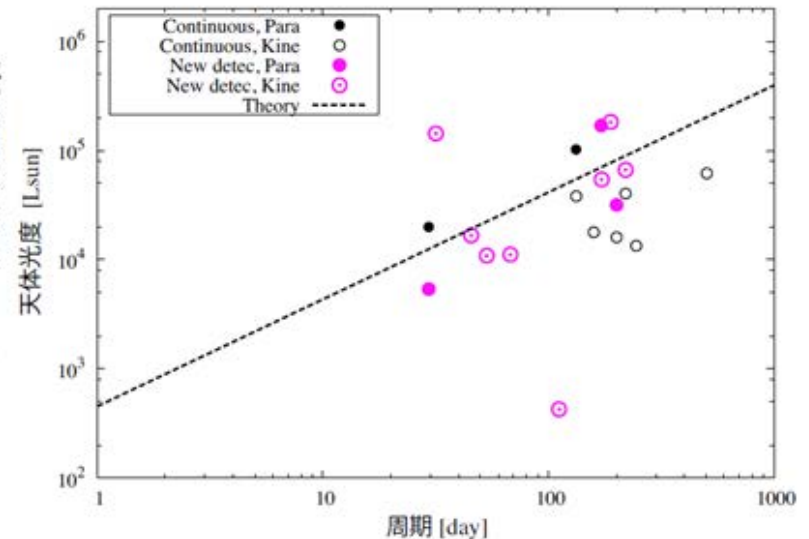
- Mass accretion process of high-mass YSOs
- At 1000au - 10au with theoretical background

- Method

- To find new periodic sources by daily – monthly monitoring for 400 sources
- To test if there is a Period-Luminosity relation for high-mass YSOs



New periodic source discovered at Ibaraki



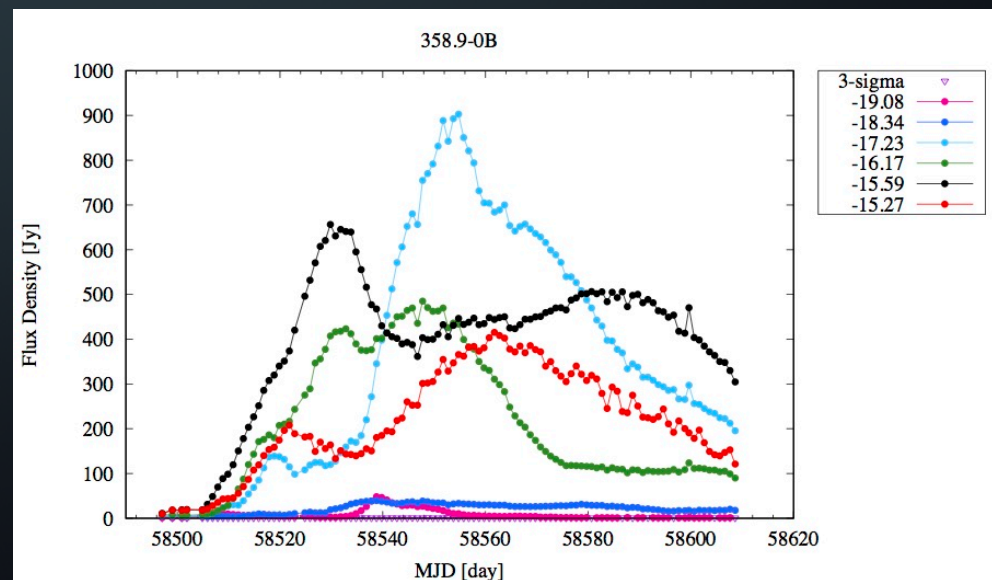
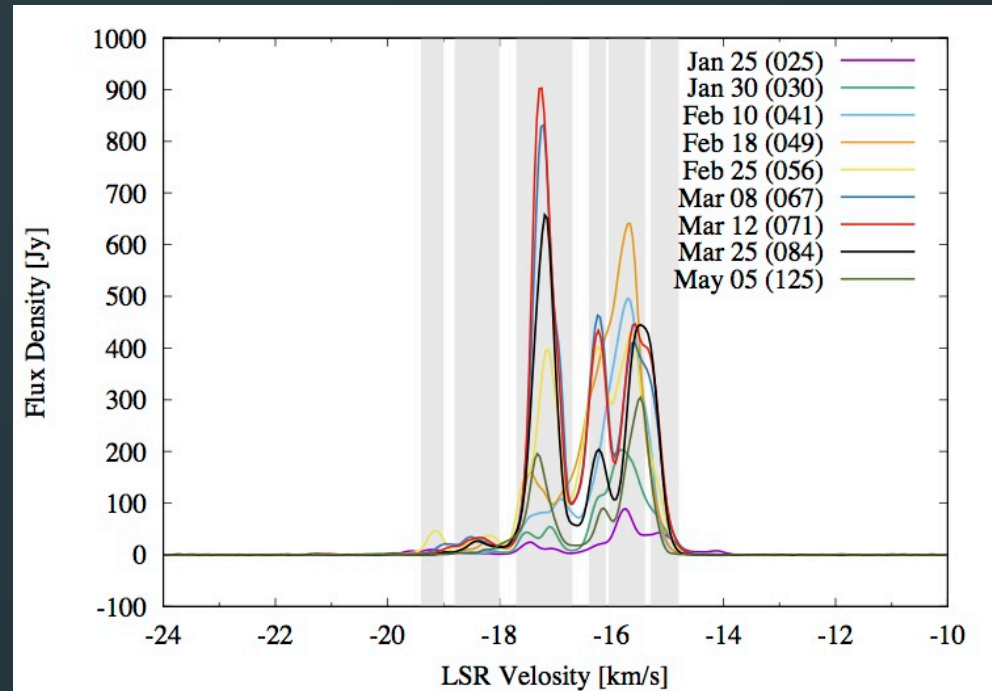
Period – Luminosity relation of HMYSOs

A serendipitous result

DISCOVERY OF AN ACCRETION BURST: G358.93-00.03

THE ASTRONOMER'S TELEGRAM, NO.
12446, JANUARY 2019

- Bursting activity of the 6.668-GHz CH₃OH maser detected in G 358.93-00.03 using the Hitachi 32-m
- Sugiyama, K., Saito, Y., Yonekura, Y., Momose, M.



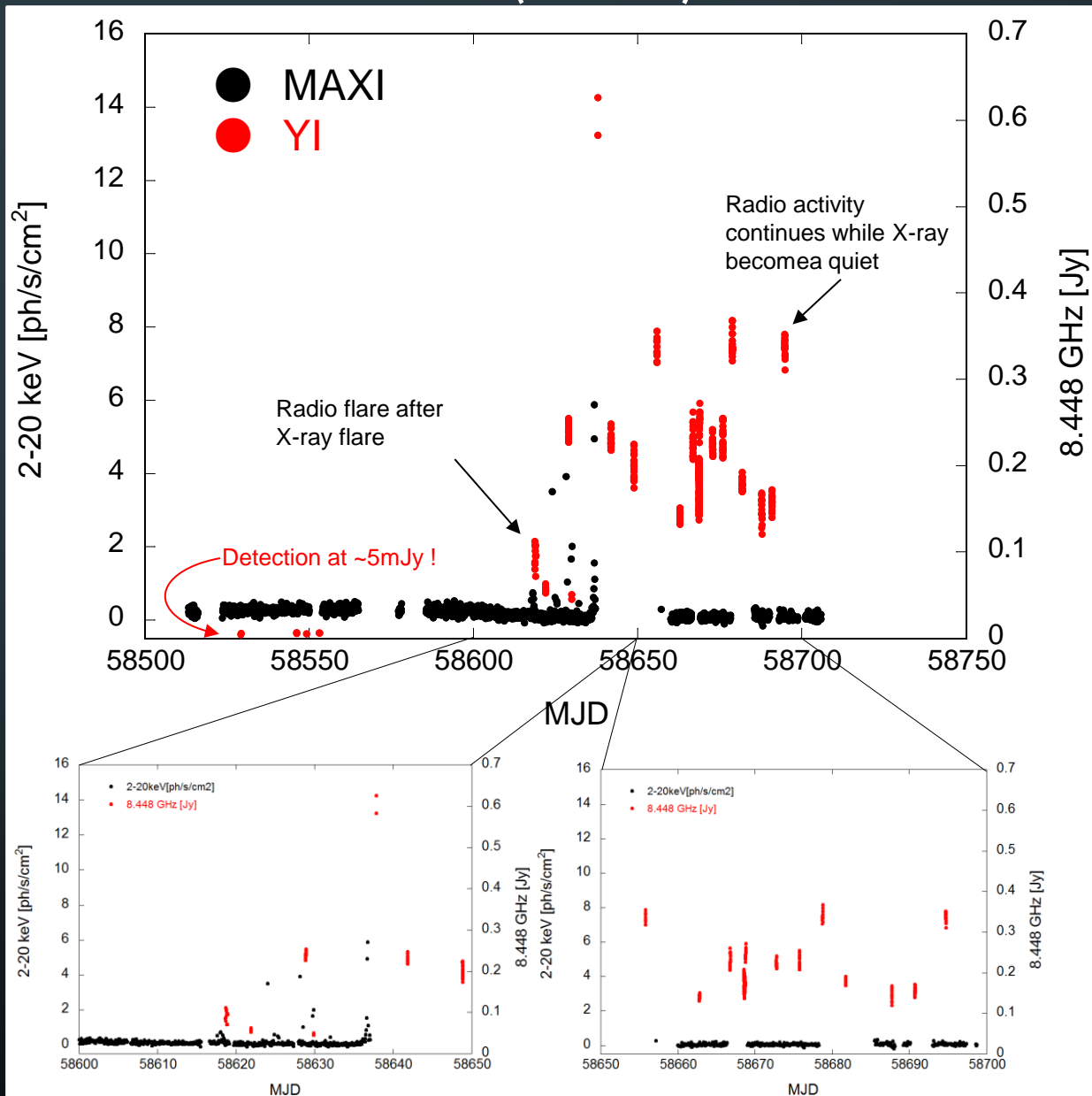
X-RAY BINARY GRS 1915+105 MONITORING BY MAXI (X-RAY) AND YAMAGUCHI INTERFEROMETER (RADIO)

- Observation

- Yamaguchi Interferometer
- 8 GHz (8192-8704 MHz)
- Sensitivity ~ 5 mJy (5sigma)
- Period 2019 Feb. to Sep.

- Results

- Radio detection at quiet phase with flux density of ~ 5 mJy
- Radio flare of ~ 100 mJy was detected after X-ray flare
- Fast variability with timescale of a few hours
- After X-ray became quiet, radio activity continues



SUMMARY

- Imaging Observation
 - C and X-bands steady observation
 - Participation to EAVN from 2020B
 - 100 hrs
- Ibaraki – Yamaguchi observation
 - Intensively doing to create a new field of VLBI
- Single-dish and short baseline interferometer
 - Ibaraki, Yamaguchi