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

- 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

<table>
<thead>
<tr>
<th>band</th>
<th># of obs.</th>
<th>Obs. time (hr)</th>
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</thead>
<tbody>
<tr>
<td>C-band</td>
<td>42</td>
<td>130</td>
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<tr>
<td>X-band</td>
<td>50</td>
<td>268</td>
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<tr>
<td>Sum</td>
<td>92</td>
<td>398</td>
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</table>
**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
IBARAKI-YAMAGUCHI-KASHIMA OBSERVATION

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
IBARAKI-YAMAGUCHI OBSERVATION

GAMMA-RAY EMITTING AGN SURVEY

• To find candidate AGNs in the field of Fermi unassociated $\gamma$-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 (→)

<table>
<thead>
<tr>
<th>2FGL name</th>
<th>Radio name</th>
<th>$F_{\nu,4}$ [mJy]</th>
<th>$F_{\nu,5}$ [mJy]</th>
<th>$uv$ [MJ]</th>
<th>$T_B &lt; 10^6\text{K}$</th>
<th>$\alpha_{1.4}$</th>
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<tr>
<td>2FGL J0226.1+0943</td>
<td>NVSS J022613+093726</td>
<td>374.6</td>
<td>64.7</td>
<td>20.5</td>
<td>16.02</td>
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<td>2FGL J0227.7+2249</td>
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<td>15.43</td>
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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 CH$_3$OH 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 ~5mJy
  - Radio flare of ~100mJy 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