Status of Nobeyama observations

Nobeyama Radio Observatory
Rin Yamada

国立天文台 野辺山宇宙電波観測所
NOBEYAMA

Self-introduction

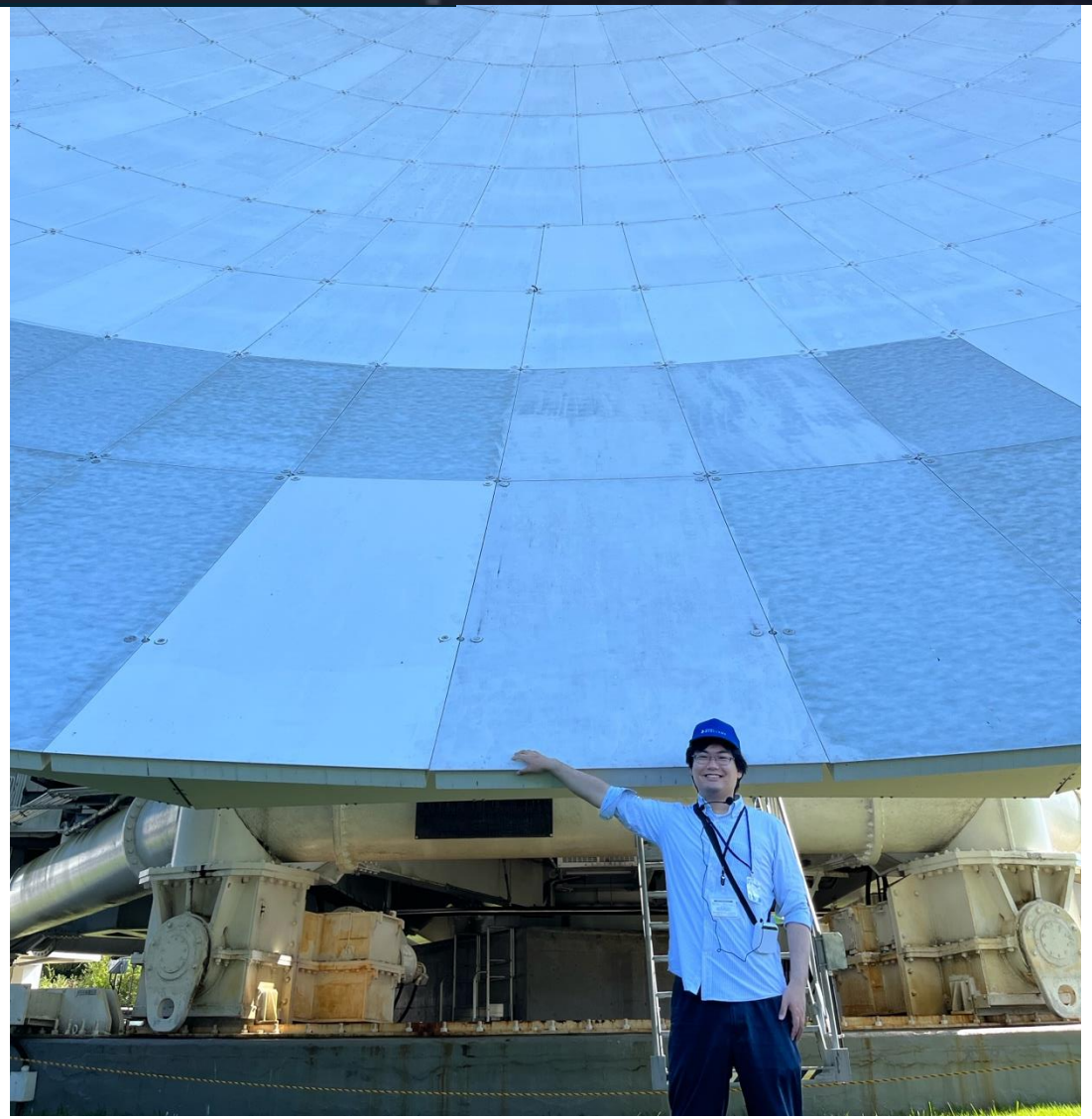
国立天文台 野辺山宇宙電波観測所
NOBEYAMA

Rin Yamada
- Aff. NAOJ/NRO

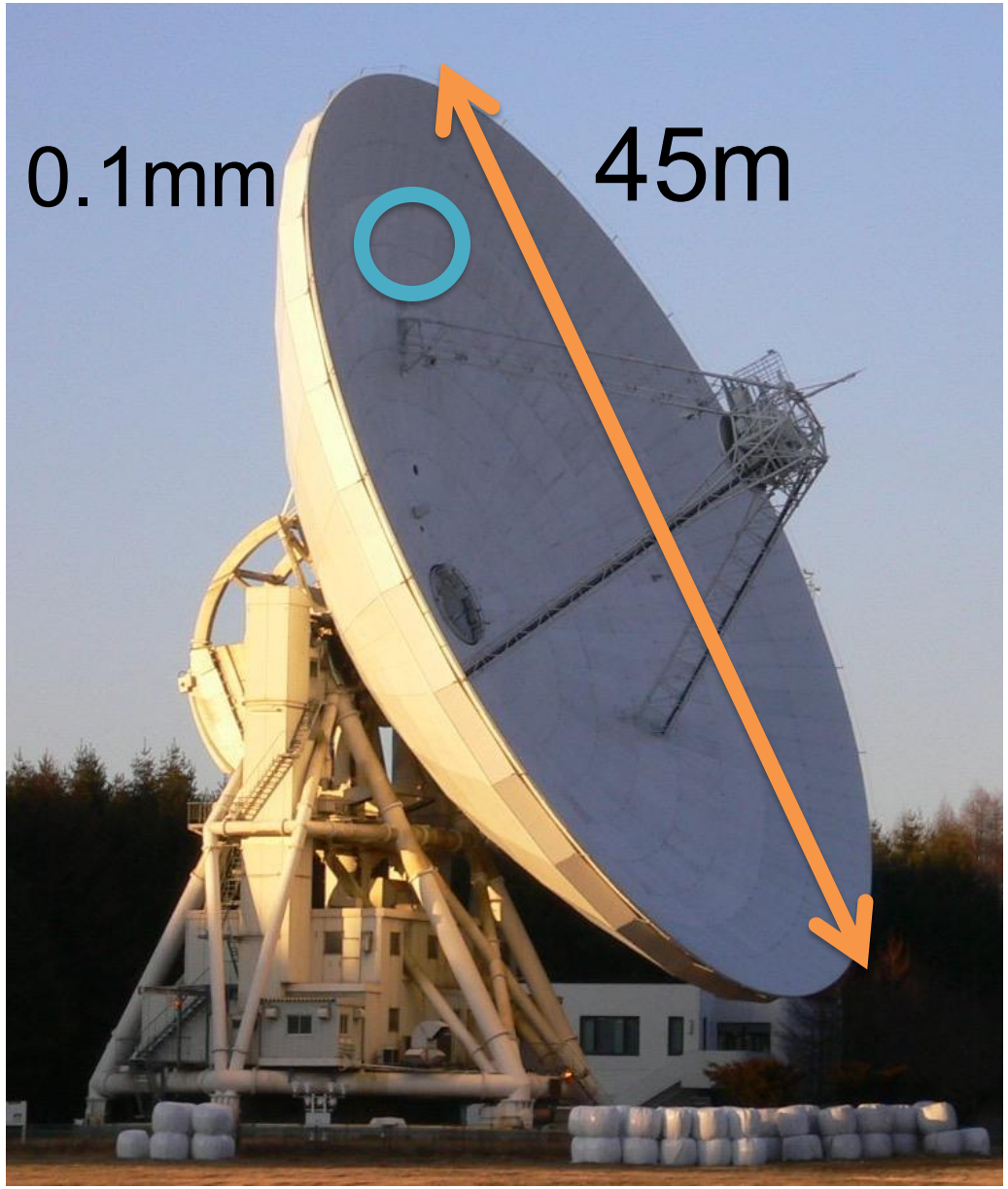
Completed Ph.D. in this march
Nagoya-Univ.

CSV, Science promotion manager

Works:
- High-mass star formation
- Evolution of ISM
- molecular cloud formation
- ISM in low-metal galaxies
- Development of telescope controlling system



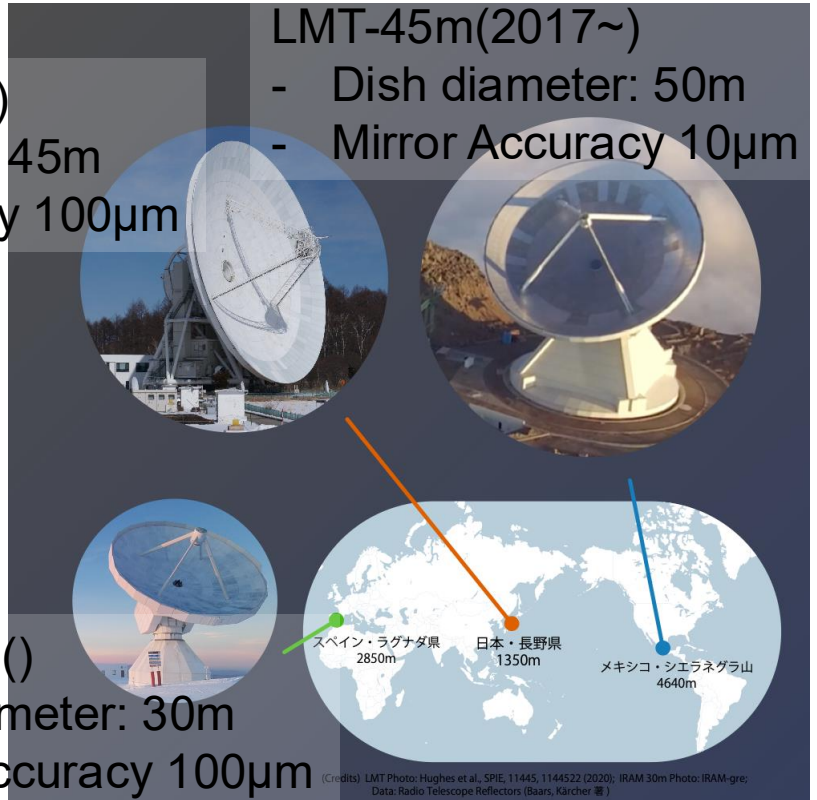
The 45m telescope



- First large millimeter dish on the Earth
  - Master collimeter
  - Homorogous structures
  - Largest until the construction of LMT(2017)
  - IEEE Milestone (2017)

NRO-45m(1982~)
- Dish diameter: 45m
- Mirror Accuracy 100μm

LMT-45m(2017~)
- Dish diameter: 50m
- Mirror Accuracy 10μm



Still one of the largest mm telescopes

IRAM-30m ()
- Dish diameter: 30m
- Mirror Accuracy 100μm

Before straggling on competitive proposals…

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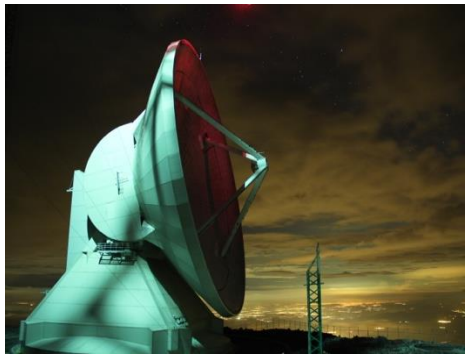
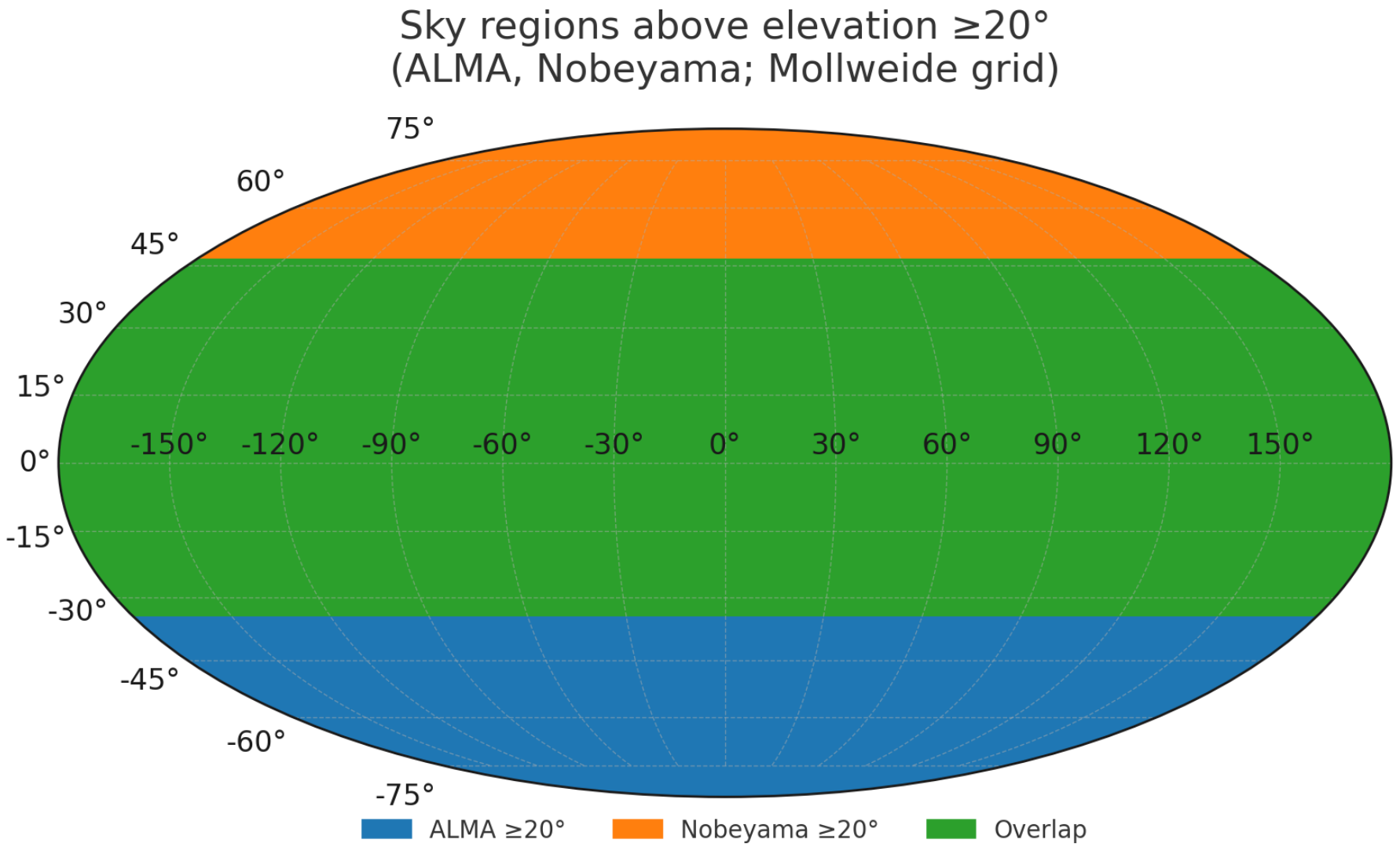
	ALMA ACA	JCMT	LMT	NRO
				
Freq.	**35~950 GHz**	**86~690 GHz**	**86~263 GHz**	**22~116 GHz**
Longest baseline	**~49m**	**15m**	**50m**	**45m**

Powerful in submm obs.

limited access

At 22~116 GHz, NRO-45m has a comparable resolution with ALMA ACA!!

Before straggling on competitive proposals…



Before straggling on competitive proposals…

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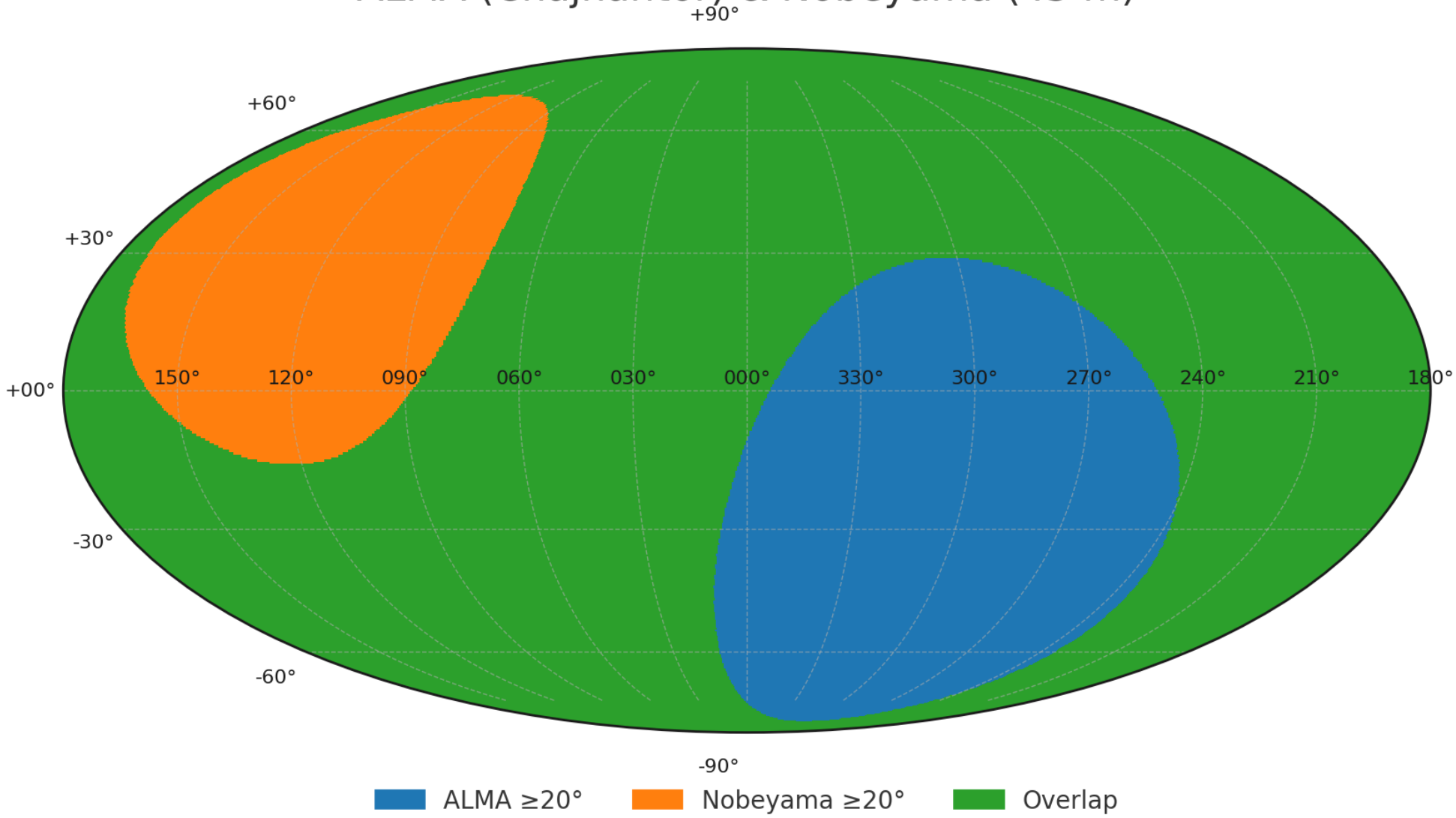

Before straggling on competitive proposals…

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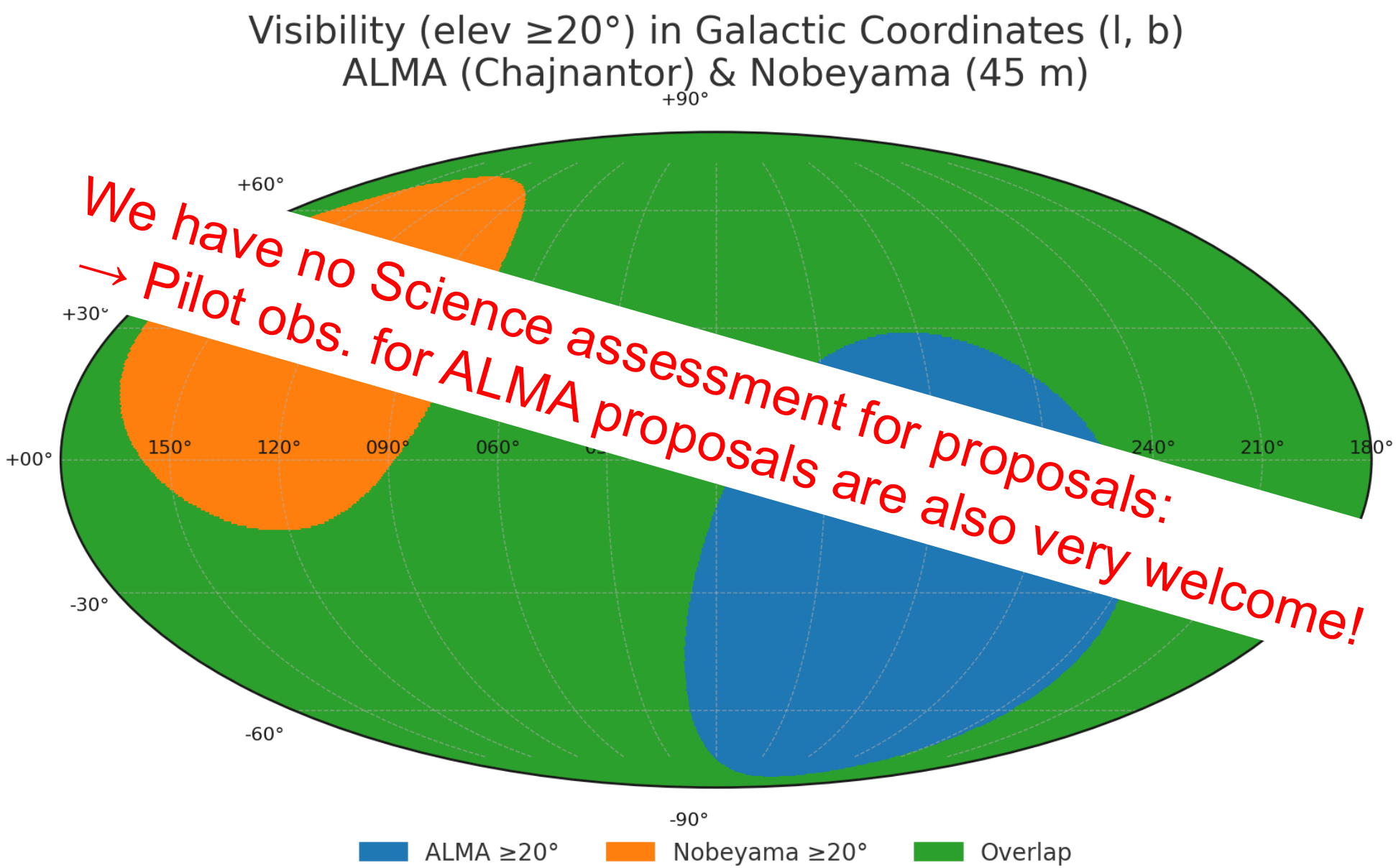
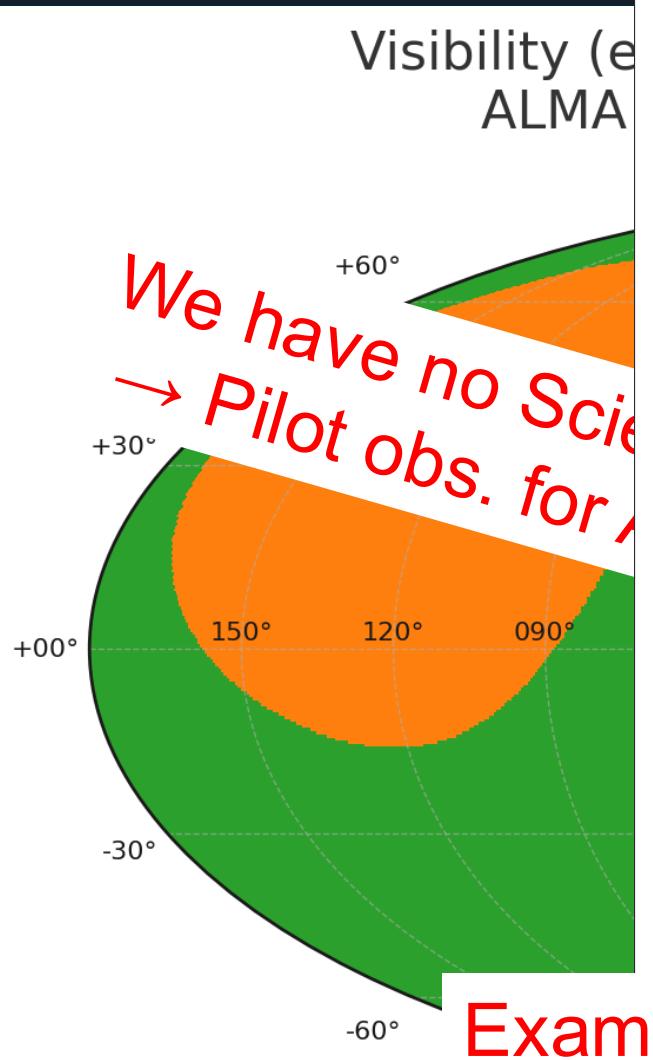


Before straggling on con



The Astrophysical Journal, 990:221 (8pp), 2025 September 10 https://doi.org/10.3847/1538-4357/adfc56

Spatially and Dynamically Extended Molecular Gas in Stephan's Quintet Revealed by ALMA CO(1–0) Total Power Mapping

Fumiya Maeda[1], Shinya Komugi[2], Kazuyuki Muraoka[3], Misaki Yamamoto[3], Fumi Egusa[4], Kouji Ohta[5], Yoshihisa Asada[6], Asao Habe[7], Bunyo Hatsukade[8,9,10], Hiroyuki Kaneko[11], Masato I. N. Kobayashi[12], Kotaro Kohno[4,13], Ayu Konishi[3], Ren Matsusaka[4], Kana Morokuma-Matsui[4], Kouichiro Nakanishi[8,9], Tomoka Tosaki[14], and Akiyoshi Tsujita[4]

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[2] Division of Liberal Arts, Kogakuin University, 2665-1 Nakano-cho, Hachioji, Tokyo 192-0015, Japan
[3] Department of Physics, Graduate School of Science, Osaka Metropolitan University, 3-3-138 Sugimoto, Sumiyoshi-ku, Osaka 558-8585, Japan
[4] Institute of Astronomy, Graduate School of Science, The University of Tokyo, 2-21-1 Osawa, Mitaka, Tokyo 181-0015, Japan
[5] Department of Astronomy, Kyoto University, Kitashirakawa-Oiwake-Cho, Sakyo-ku, Kyoto 606-8502, Japan
[6] Waseda Research Institute for Science and Engineering, Faculty of Science and Engineering, Waseda University, 3-4-1 Okubo, Shinjuku, Tokyo 169-8555, Japan
[7] Faculty of Science, Hokkaido University, Kita 10 Nishi 9, Kitaku, Sapporo 060-0810, Japan
[8] National Astronomical Observatory of Japan, 2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan
[9] Graduate Institute for Advanced Studies, SOKENDAI, Osawa, Mitaka, Tokyo 181-8588, Japan
[10] Department of Astronomy, Graduate School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 133-0033, Japan
[11] Collage of Creative Studies, Niigata University, 8050 Ikarashi 2-no-cho, Nishi-ku, Niigata 950-2181, Japan
[12] I. Physikalisches Institut, Universität zu Köln, Zülpicher Str. 77, D-50937 Köln, Germany
[13] Research Center for the Early Universe, Graduate School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan
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Received 2025 June 25; revised 2025 August 15; accepted 2025 August 15; published 2025 September 10

Abstract

We present Atacama Large Millimeter/submillimeter Array Total Power CO(1–0) mapping of Stephan's Quintet (SQ), a prototypical compact galaxy group, with a uniform noise level at a spatial scale of ∼25 kpc. These observations provide the first complete view of molecular gas across the whole system. Molecular gas is found to spread over a wide area (∼120 × 80 kpc), mainly over the two main member galaxies (NGC 7318B and 7319), but also in the shocked ridges between these galaxies, the tidal tail, and also in intergalactic regions north of the tail. The total CO(1–0) luminosity is $(2.47 \pm 0.12) \times 10^9$ K km s^{-1} pc^2, corresponding to a molecular gas mass of $(1.07 \pm 0.05) \times 10^{10}\,M_\odot$ assuming the Galactic CO-to-H_2 conversion factor. The global star formation efficiency of SQ is estimated at 0.29–0.70 Gyr^{-1}, comparable to or lower than that of nearby star-forming galaxies. Molecular gas spans a velocity range of ∼1300 km s^{-1}, which can be divided into three components (low, mid, and high). The low- and mid-velocity components, linked to NGC 7318B and the ridge, show relatively active star formation. While previous studies suggested in situ molecular gas formation in the tail, our data suggest an additional contribution from gas stripped from NGC 7319.

Unified Astronomy Thesaurus concepts: Hickson compact group (729); Molecular gas (1073); Star formation (1569); Galaxy interactions (600)

Example of Nobeyama pilot Obs. → ALMA proposals

Table of Contents

国立天文台 野辺山宇宙電波観測所
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- This report:
  - 1. Charged telescope time statistics
  - 2. Instrument status
  - 3. Development activities
  - 4. Publication status
- Nishimura-san's presentation
  - Money
  - Outreach
  - Future prospect


Credit: NAOJ

1. Observing Time Status

- Charged Telescope Time
  - 10,000 yen/hour (30,000 yen/hour for international purchase)
  - What will be charged:
    - Use of 45m for observation
  - What will income be used for:
    - annual operation cost (electricity and/or maintenance)
    - repair cost of (future) large breakdown and My salary^^

	Deadlines	Periods	Charged	Scientific Assessment
Regular	B (2025/8/1) C (2025/12/1)	11/1 – 3/31 2/1 – 3/31	Yes Yes	No No
Development	A (2025/6/1)	9/1 – 10/31	Yes	No
CSV contributions	B(2025/8/1)	9/1 – 10/31	No	No
Tutorial	A (2025/6/1)	9/1 – 10/31	Yes	No
Student	B (2025/8/1)	11/1 – 3/31	No	Yes

1. Observing Time Status

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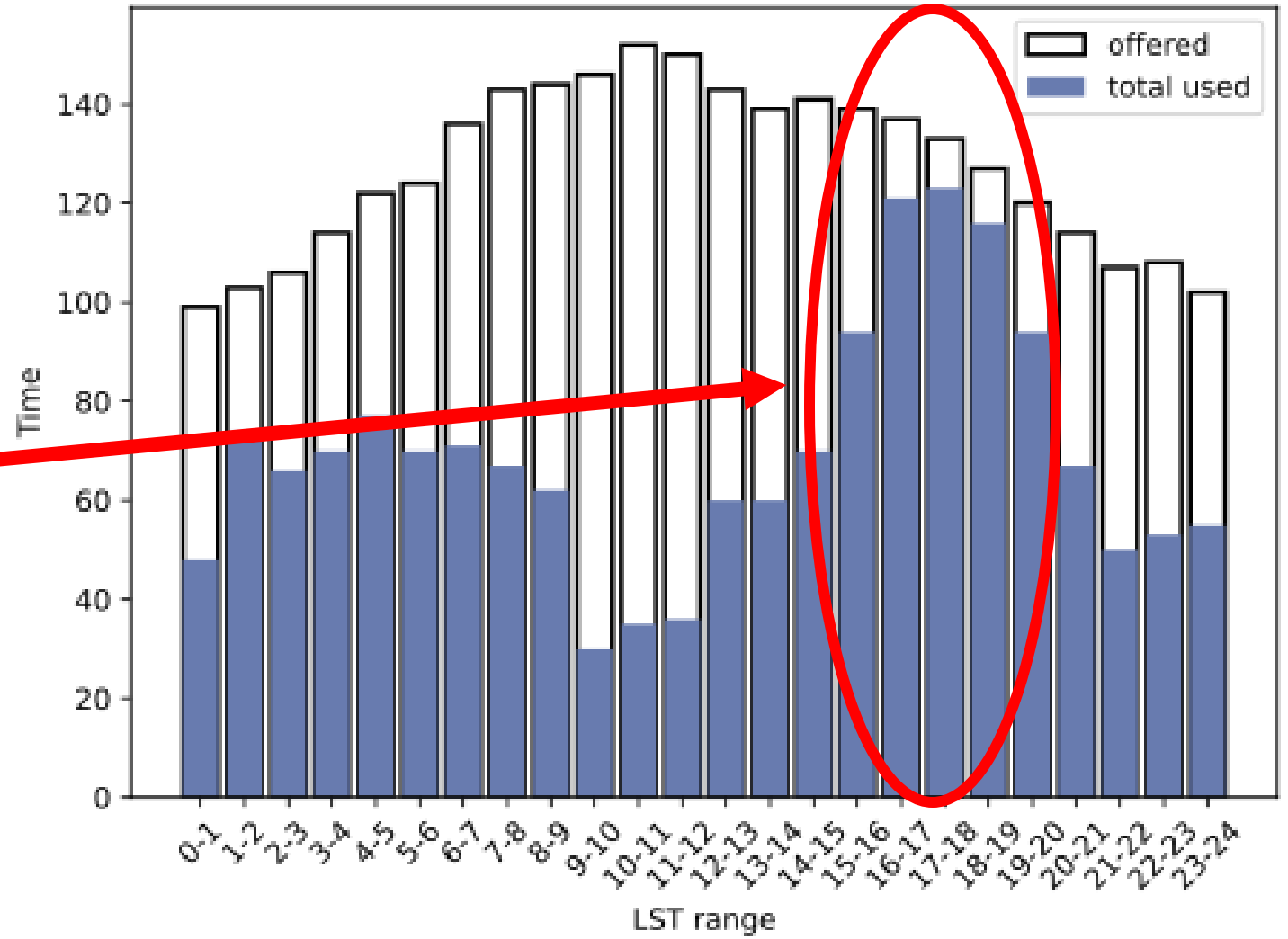
- 4th year of Charged Telescope Time
- Statistics 2025
  - Totally 51 proposals, 1666 hours were allocated.
  - (Last year: 52 proposals with 1603 hours requests)
  - Thank you very much for your contribution!

Galactic center time



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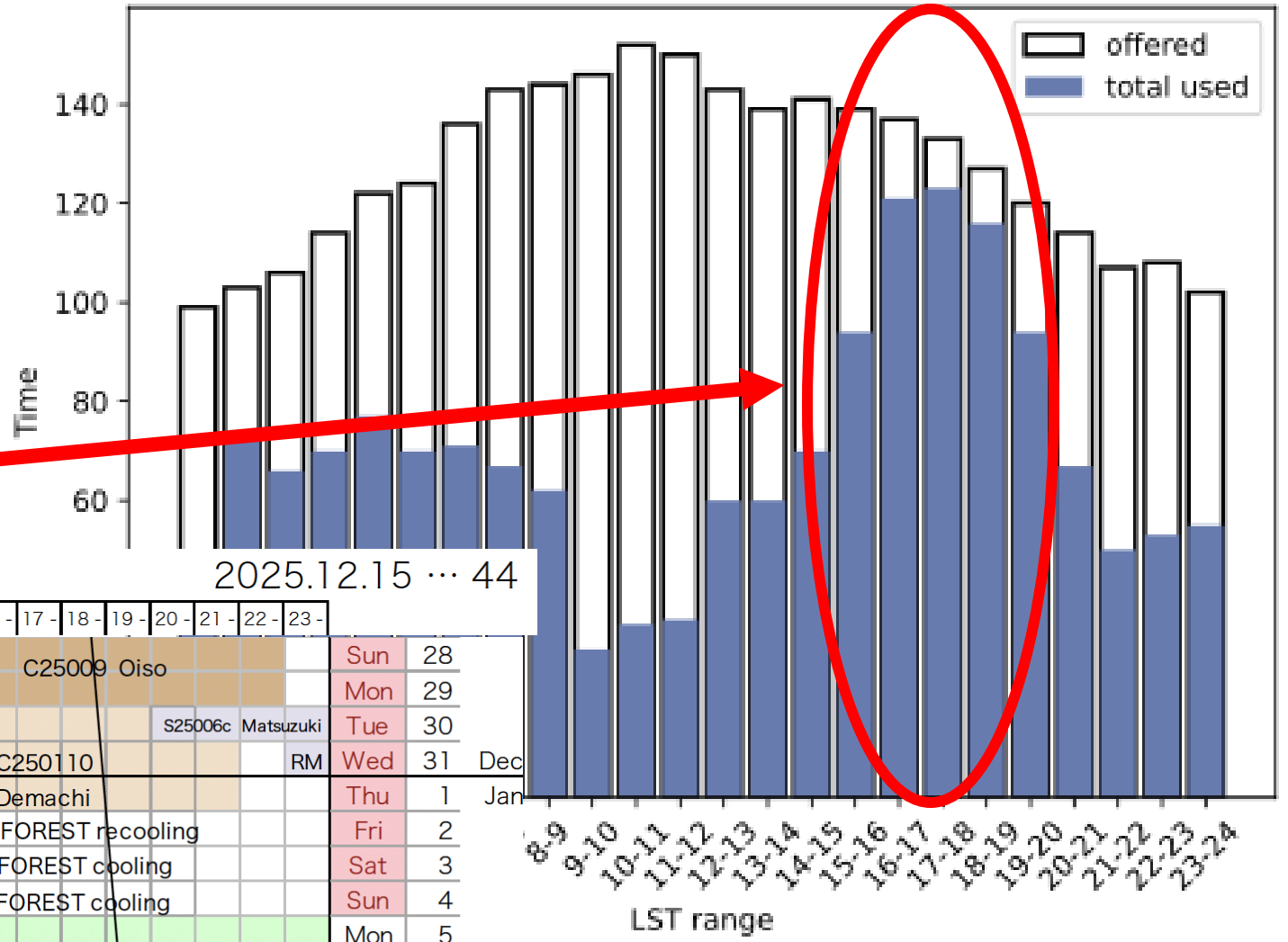
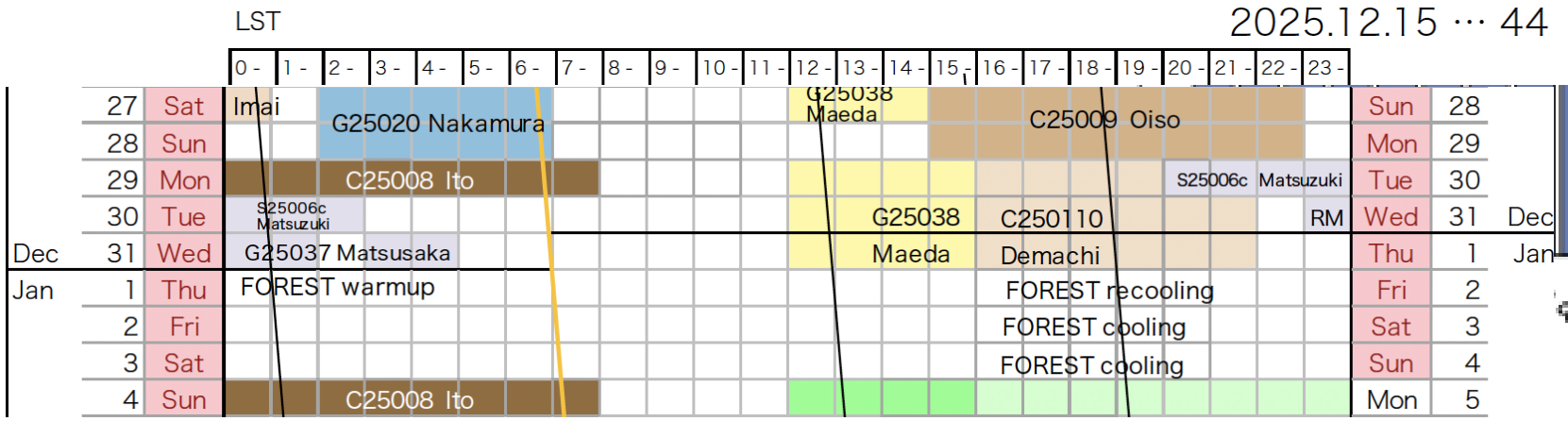


Galactic center time



New year holiday season observations!

1. Observing Time Status

- 4th year of Charged Telescope Time
- Statistics 2025
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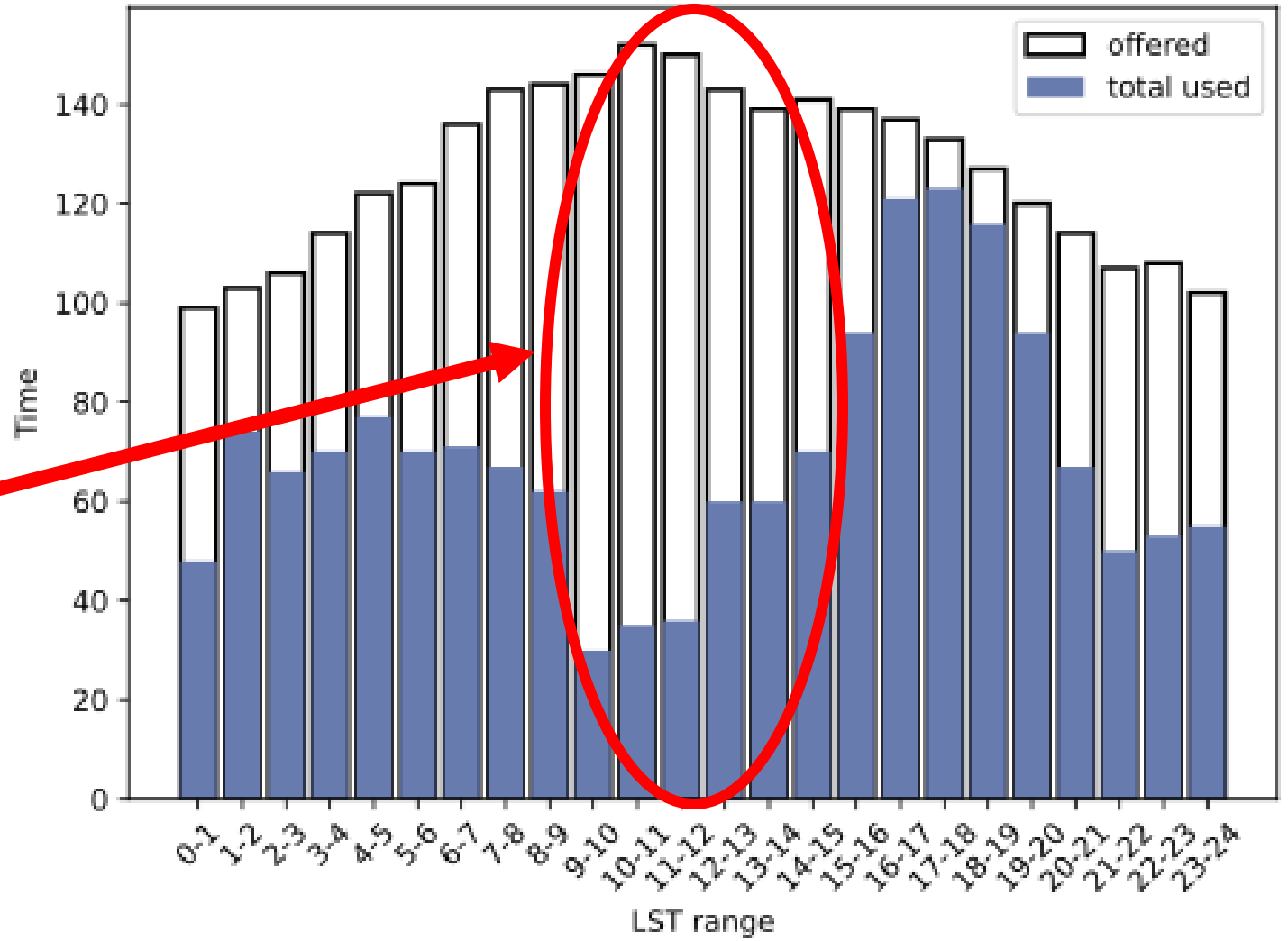
External Galaxy time



1. Student Time (free-of-sharge)

- System
  - Up to 100 hours (24 hours * 4 days)
  - Scientifically reviewed by part of JSAC members
- 2025 status
  - 11 proposals submitted, total 475 hours requested
  - Score of some proposals was reduced by the excess of page number of the Scientific Justification. Please check the role of the proposal submission
- High-scored proposals
  - Even highest scored proposals allocate rate is not 100%

⇦Maximum allocation for each LST range is limited to 4 hrs

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Rate	Request	Alloc.
4.80	39	28
3.72	36	16
3.70	40	24
3.50	40	14
3.10	38	0
2.94	45	0
2.80	70	0
2.60	53	0
2.46	15	0
2.34	31	16
2.00	68	0

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- System
  - Up to 100 hours (24 hours * 4 days)
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- 2025 status
  - 11 proposals submitted, total 475 hours requested
  - Score of some proposals was reduced by the excess of page number of the Scientific Justification.
    Please check the role of the proposal submission
- Low-scored proposals allocated
  - Allocated the time if the requested LST range
    is not requested by other higher-ranked proposals

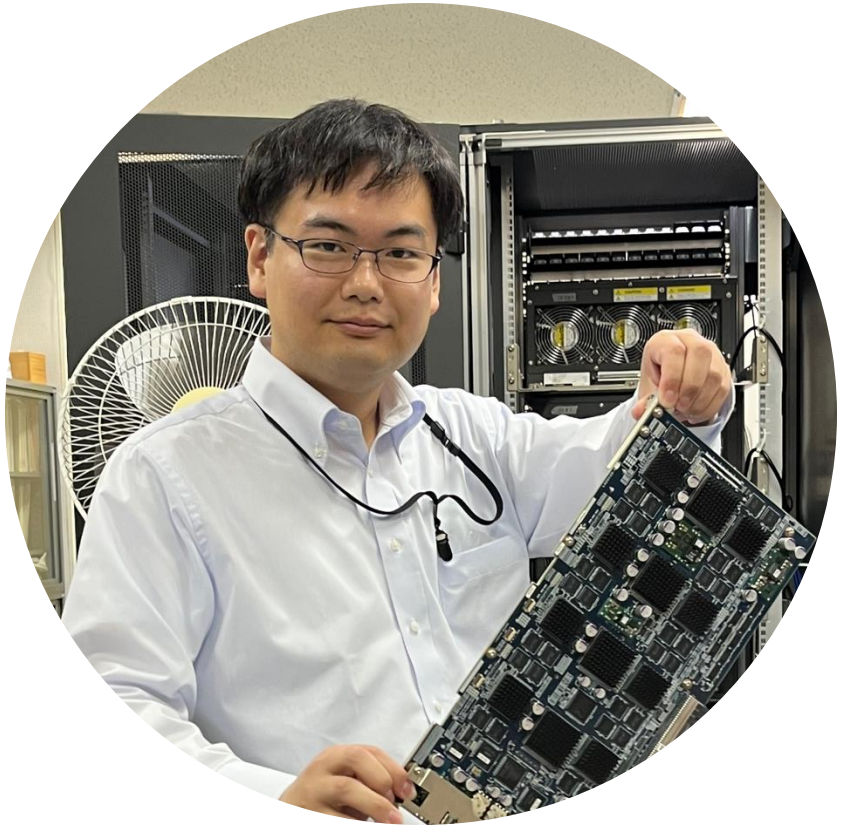
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Rate	Request	Alloc.
4.80	39	28
3.72	36	16
3.70	40	24
3.50	40	14
3.10	38	0
2.94	45	0
2.80	70	0
2.60	53	0
2.46	15	0
2.34	31	16
2.00	68	0

2. Instrument status—Break & Repair

SAM45 boards break (10/27–11/1)

- Started from the breakdown of one DFP board
- Reboots in troubleshooting finished off another almost-broken boards
- Finally, we replaced one CIP and mother boards
- Troubleshooting tools from ALMA and knowledge accumulation helped a lot for the quick repair!



H40 compressor

- Break down and replaced to spare machine

2. Instrument status—New Receiver Open

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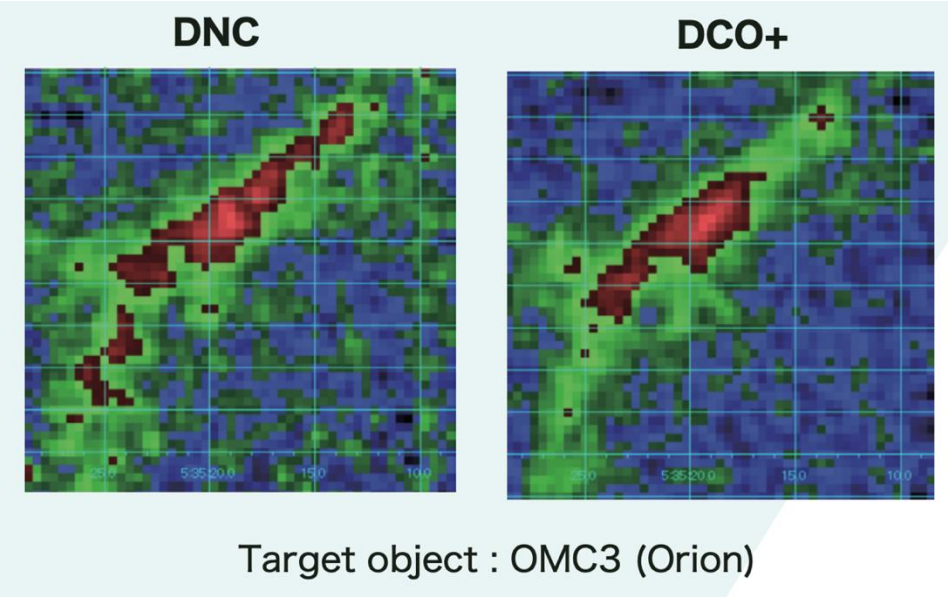
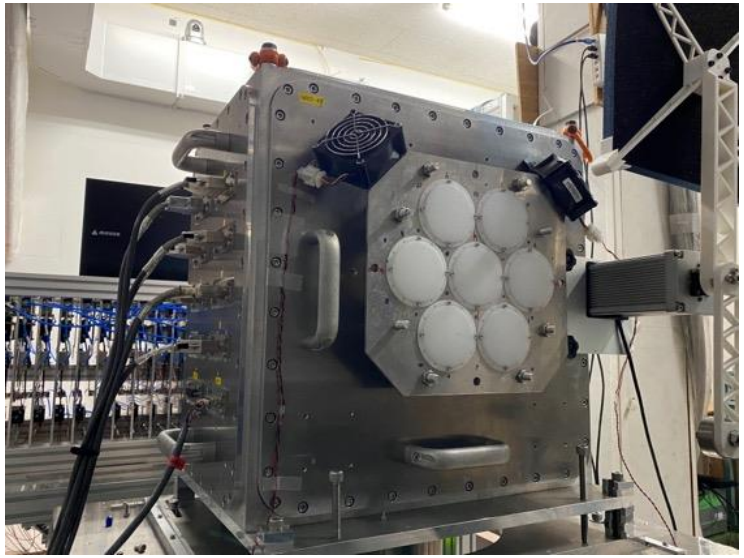
7-BEE, 70GHz band open





K. Miyato
Commissioned Graduate Student

- 7 Beam HEMT receiver, covering 70~115 GHz
- Aims
  - Deuterium compounds
  - Large scale CO mapping
  - Ancestor of FOREST
- Status
  - Final CSV in progress
  - Full band will be opened from 2026 season

2. Instrument status—New Receiver Open

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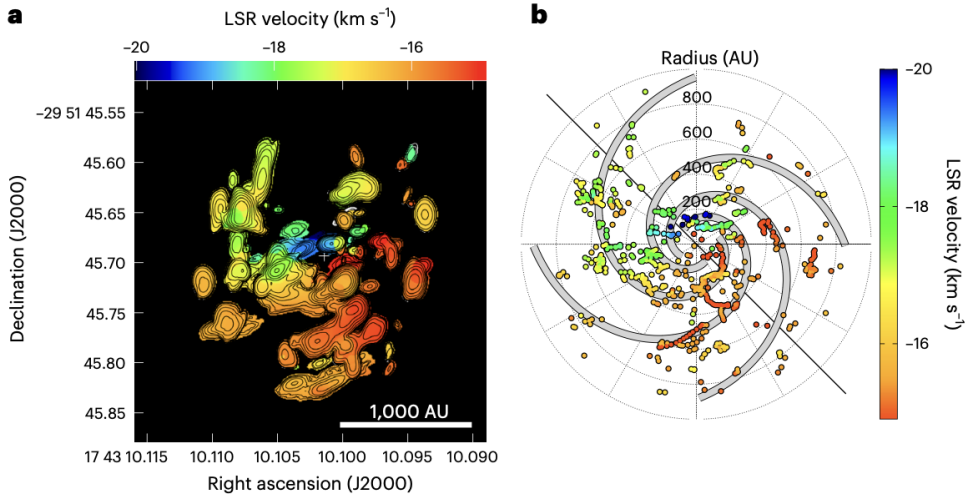
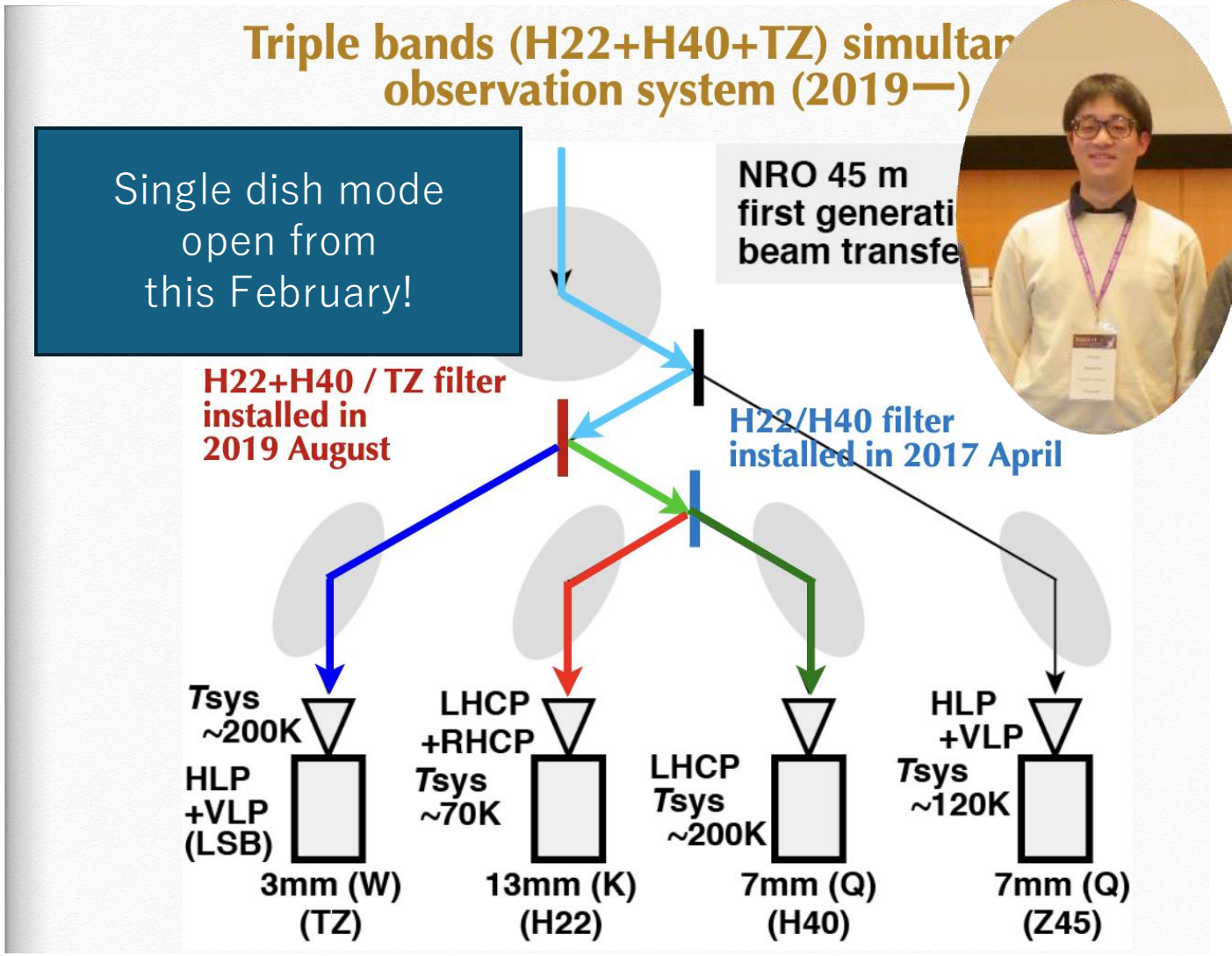
HINOTORI-single dish mode

- Simultaneous 22/40/86 GHz
  - Frequency separation filters
- Aims
  - Maser monitoring
  - Blackhole imaging via VLBI
- Status
  - Triple bands single-dish mode open
  - Double(22/40) VLBI success



Kisuke Nakashima
Commissioned Graduate Student



3. Development activities–Dev. proposals

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NOBEYAMA

RX port arrangement in consultation with NRO

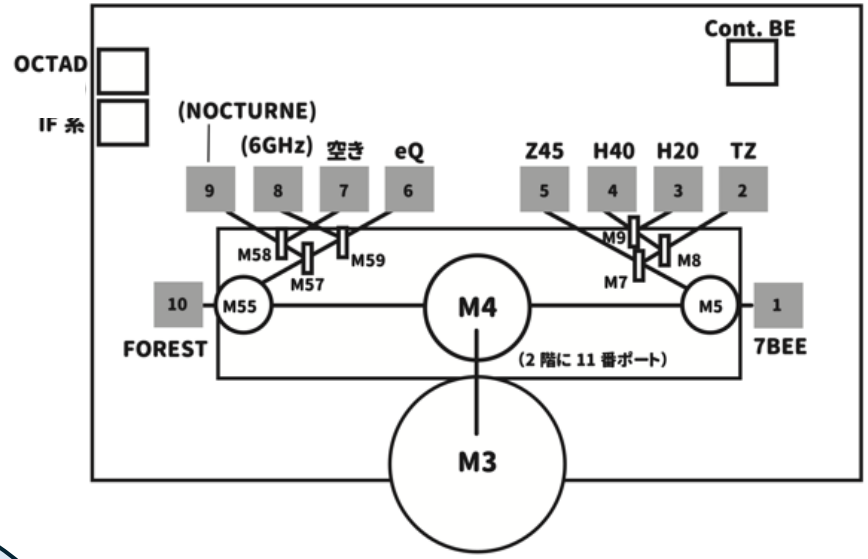
JSPS Grant Submission

Submission of Dev. proposal

Refine strategy

Success!!

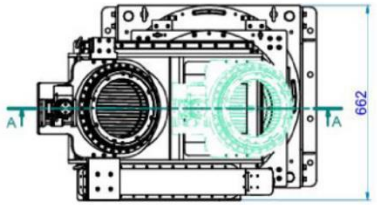
Start development

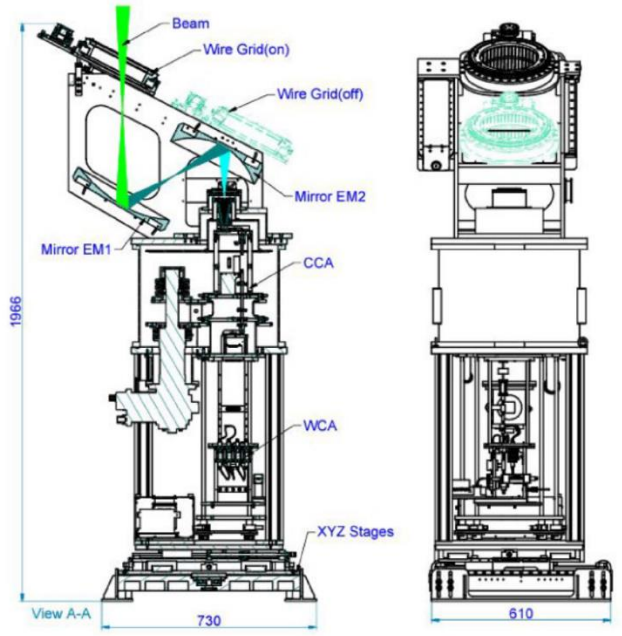


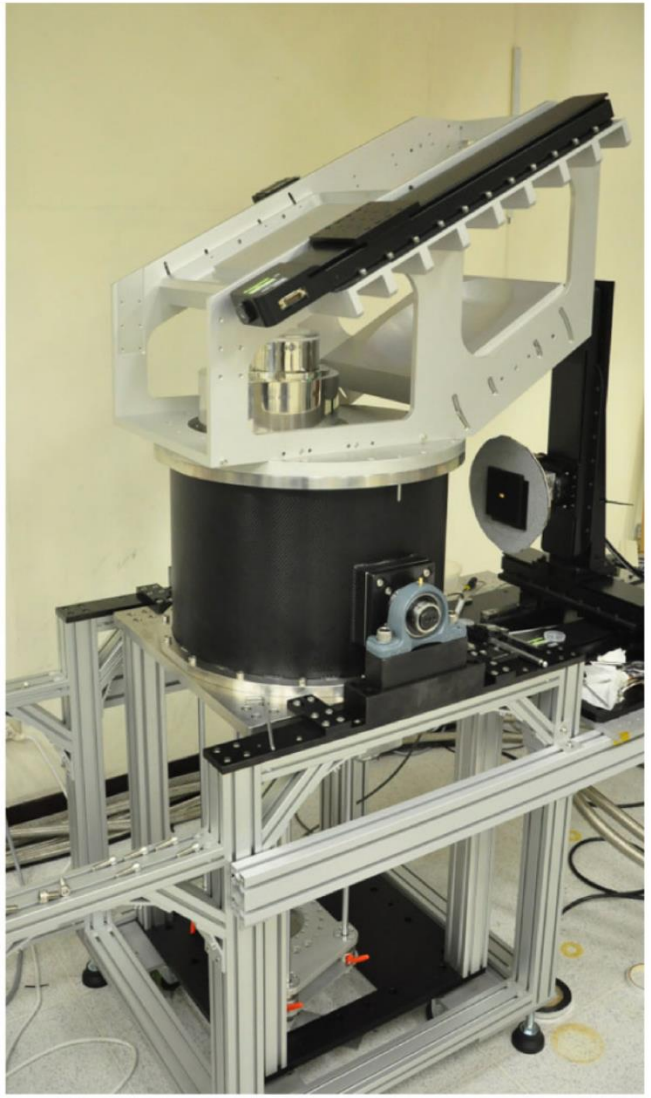
3. ASIAA-KASI-NRO contract for eQ

- Q-band dual-linear polarization receiver
  - low receiver noise (~15 K)
  - wideband (RF 30—50 GHz)

- Aims
  - Zeeman observations of
    - CCS($J_N = 4_3 – 3_2$, $J_N = 3_2 – 2_1$),
    - SO($J_N = 1_0 – 0_1$)
  - High-redshift molecular line detection
  - Astrochemistry exploration
- Status
  - CSV for the non-polarization mode finished (Nakamura+)
  - For Zeeman observation, NRO-ASIAA-KASI contract for backend dev. have been established in 2025







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Under grant application projects

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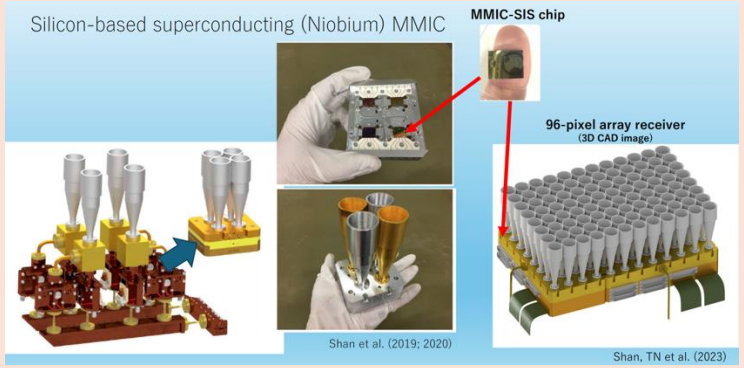
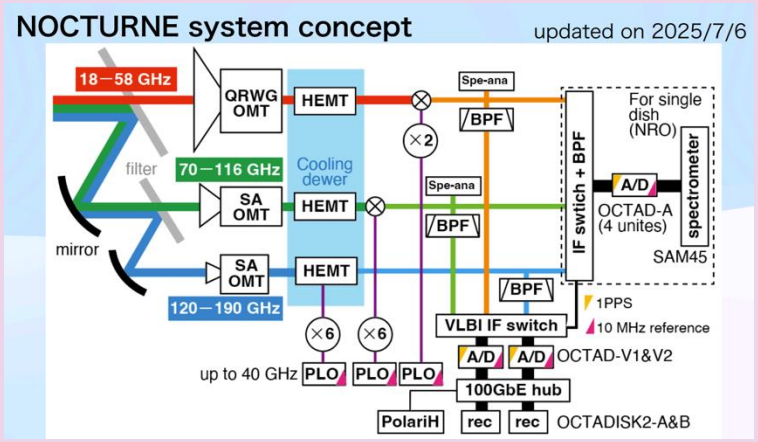
Super multi-pixel heterodyne (20 pixel)



Prof. Tac Nakajima

Suwa university of Science

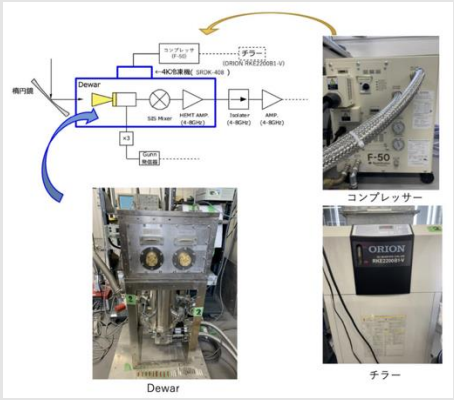
Ultra-wideband 18—190 GHz



Prof. Hiroshi Imai

Kagoshima university

200 GHz receiver



Prof. Kazuhiro Hata

Nagoya-city university

Under grant application projects

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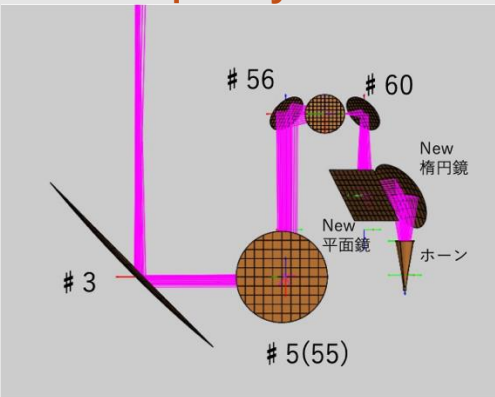
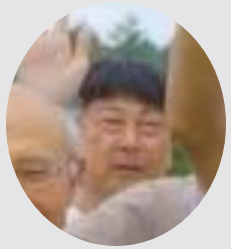
NOBEYAMA

6 GHz low frequency observation

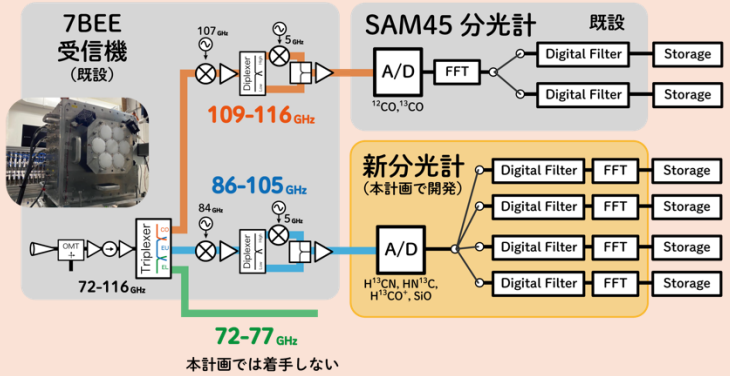




Prof. Yoshinori Yonekura

Ibaraki university

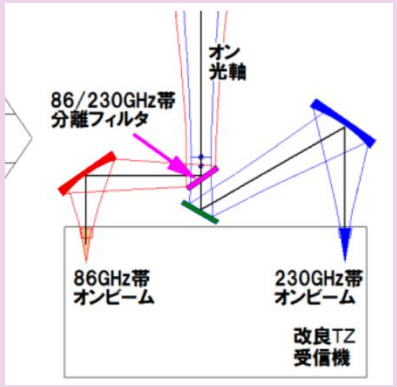
New FPGA backend



Prof. Atsushi Nishimura

NAOJ

230 GHz new receiver



?

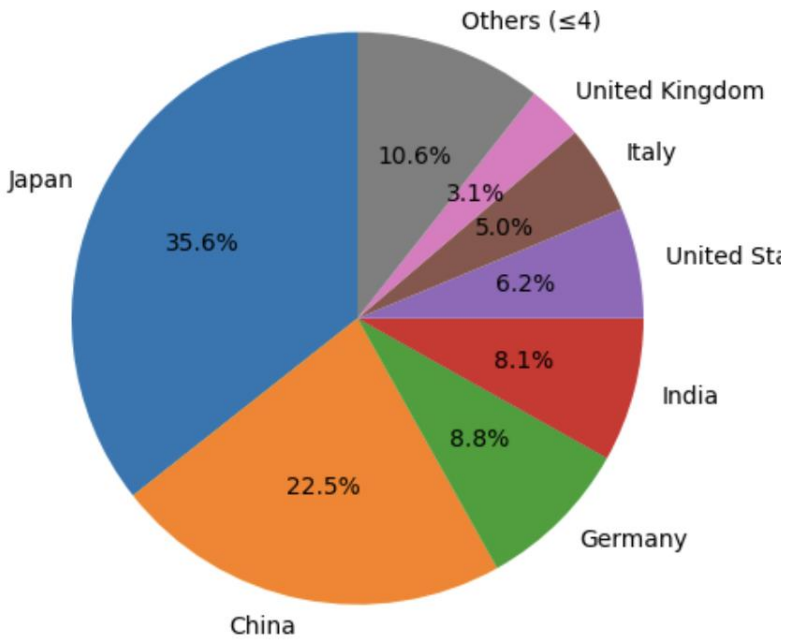
Dr. Nozomi Okada

JAXA

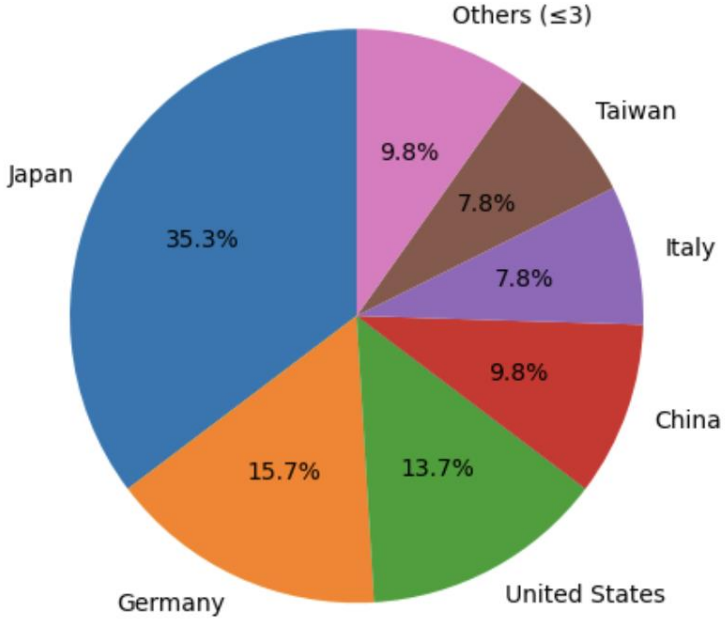
4. Publications

- Publications using NRO45m (Nov 2024 – Oct 2025):
  - 34 refereed papers
- Citation analysis of Legacy projects

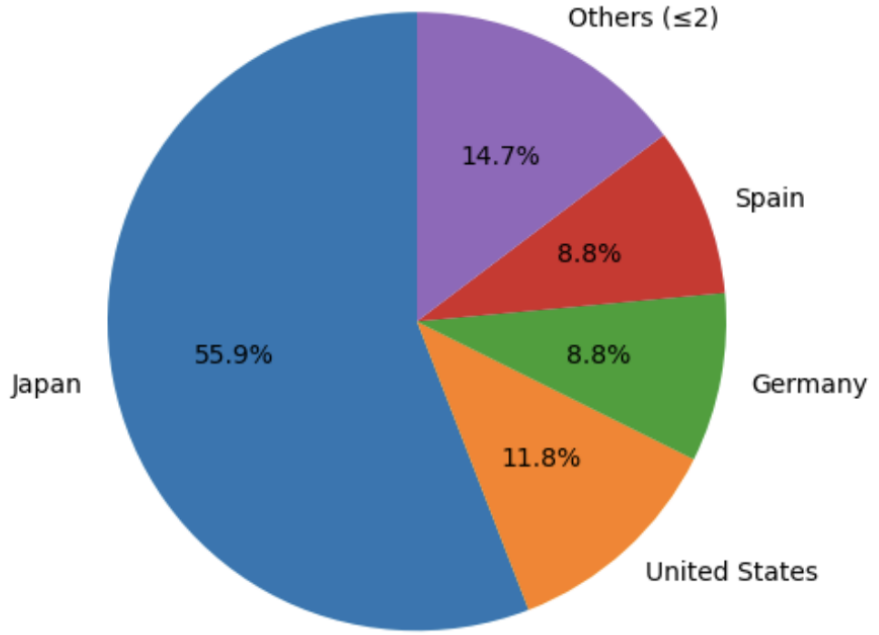
FUGIN
(Umemoto+17, 183 citations)



COMING
(Sorai+19, 56 citations)



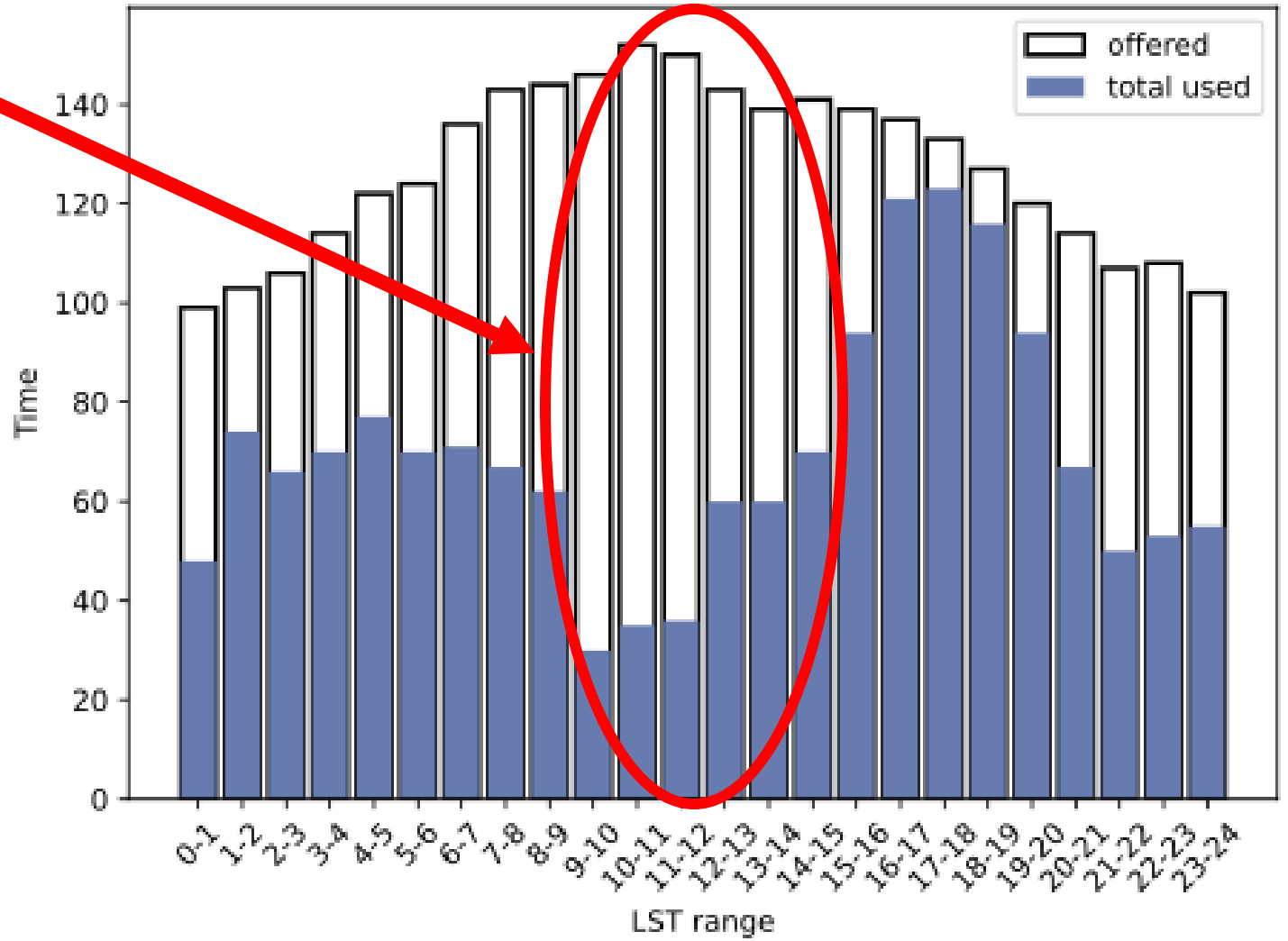
Star Formation Legacy



- Please make the press-release if you publish the 45m paper!

5. Brain storming for the future

- To increase the use of the 45m,
  External Galaxy time
- To make the 45m good telescope for galaxy observations,,,,
  - Adaptive pointing corrections
    - ex) MAO(Tamura et al,)
  - Baseline correction
    - Maeda-san's poster,,,,
- Is this the best solution or,
  Do you have another ideas?



Summary

- 45m telescope is in stable operation
- 7 BEE and HINOTORI single dish opened
- Multiple developing program is in operation