

Nobeyama Radio Observatory



Ken Tatematsu

景煙
構内歩行

Summary

- Three **Legacy** programs (FUGIN, COMING, Star Formation) have officially finished in 2017 May. **3D FITS data** will be made **public** on 2018/5/31. **Papers are coming.**
- We **started Call for Development Proposals.**
- **Target is High-Performance Telescope (> 30 papers with < \$3M operation budget)**
- We are making efforts to make 45m telescope more productive.
 - Efforts to increase the proposal number
 - Efforts to increase the refereed paper number
- We received **two Milestones**: IEEE and IECIE

Change of Director

- Masao Saito (2014 Jul-2017 Feb)
- Hideyuki Kobayashi (Acting Director 事務取扱, 2017 Mar-Jun)
- Ken Tatematsu (2017 Jul-2021 Jun)

Current achievement

- **High telescope efficiency** of the 45-m telescope (surface, FOREST, spectral window mode, etc) lead by Masao Saito, Tetsuhiro Minamidani
- **Completion of three legacy programs** (FUGIN, Star Formation, COMING) in 2017 May
- **It is a time to output outstanding scientific results!**

Legacy Programs

- Three legacy programs **officially ended at the end of 2017 May** (practically terminated in 2017 March because of the master collimator failure)
- A total of ~3000 hrs were allocated, and ~2000 hrs were useful.
- We help the **Legacy Review** on Sep 26-27 (Fujisawa [chair], Arimoto, Inutsuka, Takakuwa, Komugi, Oka)
- We have confirmed that all projects **release 3D FITS by 2018 May 31.**

^{12}CO , ^{13}CO , C^{18}O

- 1st quad.: $l = 10^\circ - 50^\circ$, $|b| \leq 1^\circ$

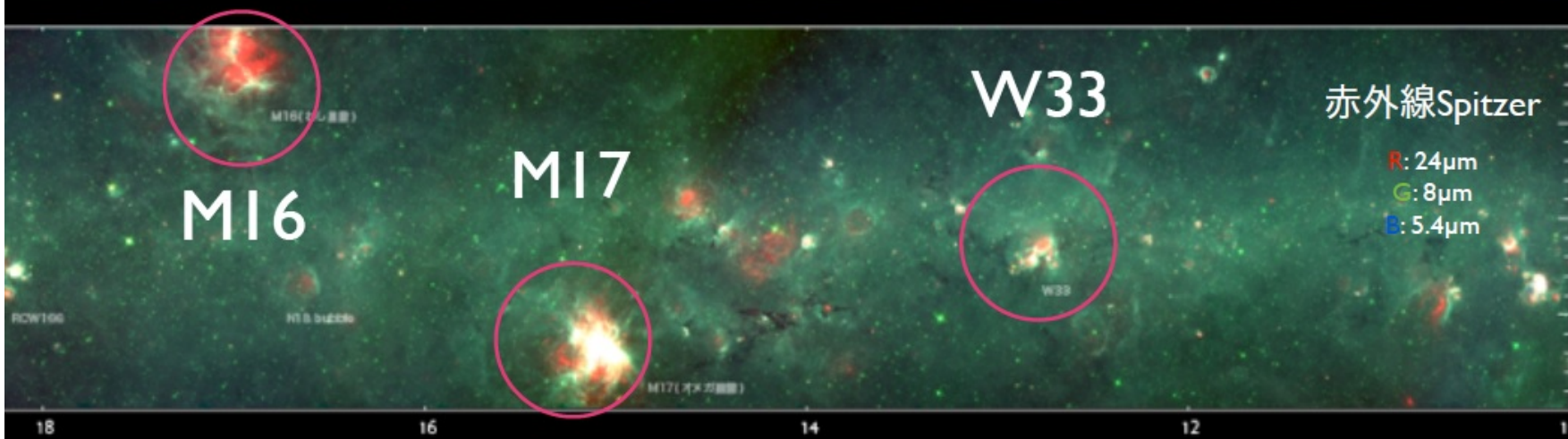
- 3rd quad:

$l = 198^\circ - 209^\circ, 213^\circ - 218^\circ, 232^\circ - 235^\circ$, $b = 0^\circ - 1^\circ$

$l = 198^\circ - 204^\circ, 208^\circ - 214^\circ, 217^\circ - 236^\circ$, $b = -1^\circ - 0^\circ$

可視光

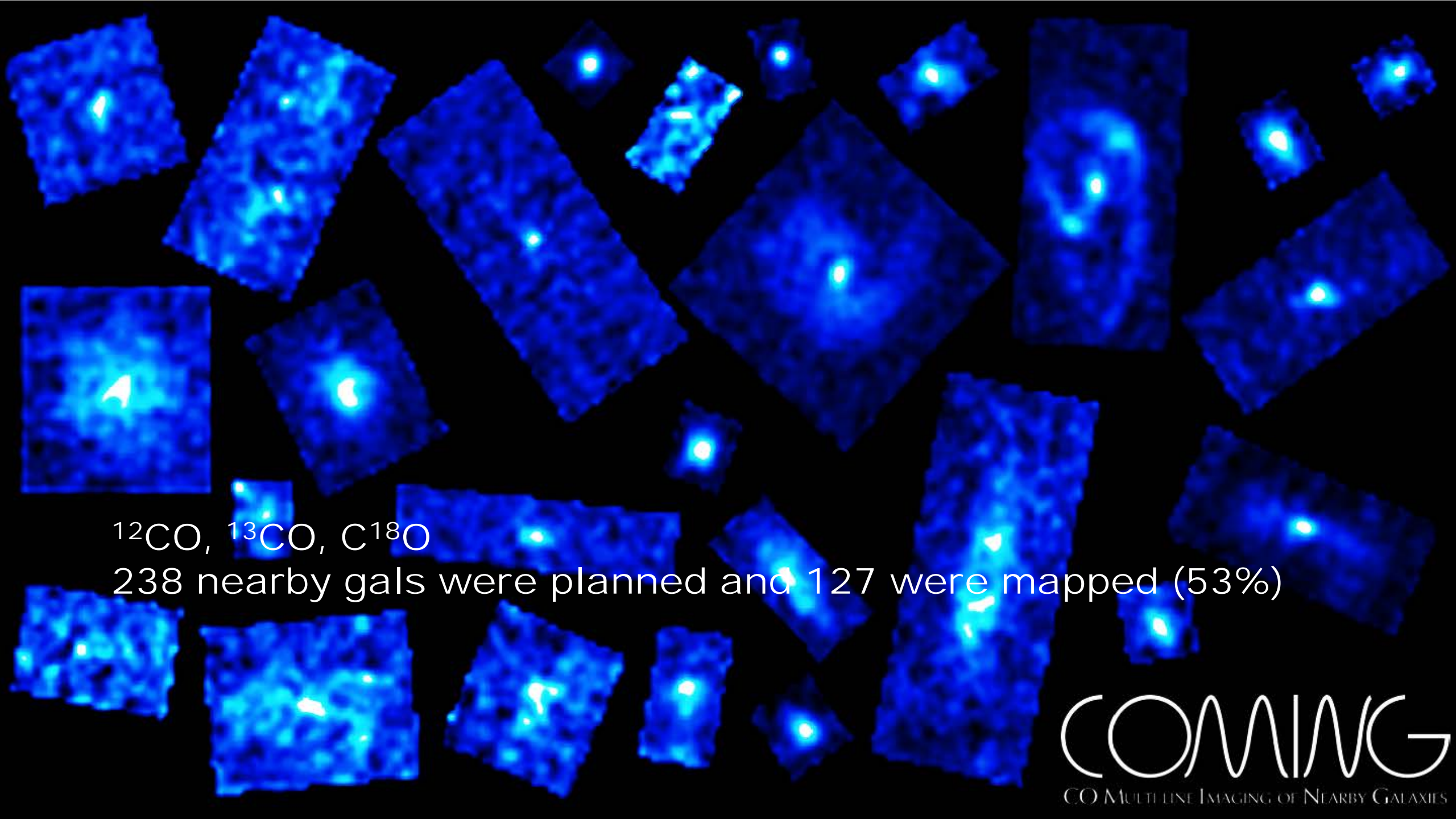
Image: Axel Mellinger



国立天文台 野辺山宇宙電波観測所

NOBEYAMA

FOREST

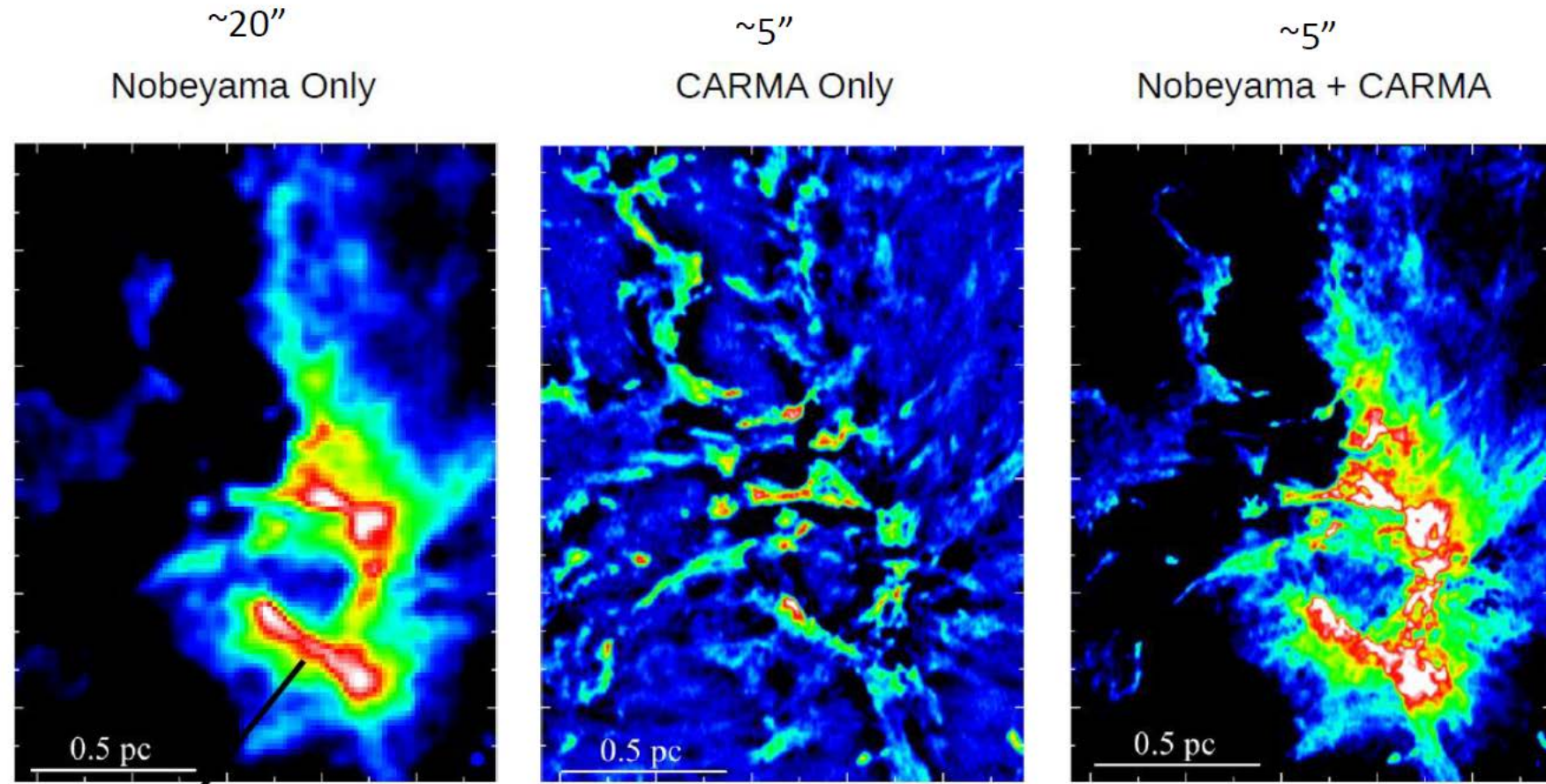


^{12}CO , ^{13}CO , C^{18}O

238 nearby gals were planned and 127 were mapped (53%)

COMING
CO MULTILINE IMAGING OF NEARBY GALAXIES

Star Formation (Ori A $2-3 \text{ sq deg}$, M17 1 sq deg , Aquila 1 sq deg ; ^{12}CO , ^{13}CO , C^{18}O , N_2H^+ , CCS)



Orion Bar

Final combined map is more than 3 times of this image.

Status of Legacy papers

- FUGIN (PI=Umemoto): published=2 (Yamagishi+, Umemoto+), accepted=2 (Kohno, Nishimura), submitted=4 (Torii+, Torii+, Fujita+, Kuriki+), total # =15-17 from Review presentation
- COMING (PI=Sorai): published=2 (Muraoka+, Hatakeyama+), total # planned=22 from Review presentation
- Star Formation(PI=Nakamura): published=0, total # planned=20-30 from Review presentation
- Total published=4, accepted=2, submitted=4, total # planned>55

PASJ Special Issue: Legacy and FOREST

- Recommended by the Legacy Review
- Submission recommended by 2018/08/01
- Acceptance deadline 2018/12/01
- Electrical version is published one by one after acceptance
- Print version 2019/03/25

- On the other hand, some reviewer suggest submitting to not only PASJ but also to Nature or Science etc depending on the impact of results.

Effort to reduce the operation budget

- From this fiscal year, we introduced **Call for Development Proposals**, so that Nobeyama developments concentrate on open-use capability enhancement only. Furthermore, we request that **PI is asked to prepare the necessary development budgeting**. This fiscal year, we accepted three out of 11 proposals (Taiwan Band1 RX ,three frequency simultaneous observation with HINOTORI, FMLO)
- We continue slimming down, started by Masao Saito. On the other hand, we wish to **secure the minimum resource for open use operation**.

45m Hardware

- Master collimator broken 2017 mid March, reinstalled in 2017 August, commissioned, and now in use.
- FOREST
 - Spectral window mode (4 lines with 4 beams in 2 polarizations etc)
 - On-On obs ==> receiver TZ decommissioned
 - wider band in LSB : 4-8GHz --> 4-8GHz, 7-11GHz
- Z45 for the open use
- Telescope repainted (FY2016, 2017)
- Renewal of millimeter calibration system (FY2016)
- Renewal of RX selection mirrors

45m Software

- New observing table software “**nobs**” (Python based) replaced “zobs” (Java based) to allow “FOREST spectrum window mode”
- Increase of **remote operation** sites (Kagoshima, Taiwan ASIAA)
- Nobeyama 45m Science **Data Archive** opened in August
<https://nobeyama-archive.nao.ac.jp/user/index.html>
- 45m/ASTE data reduction with **CASA**; test for pipeline

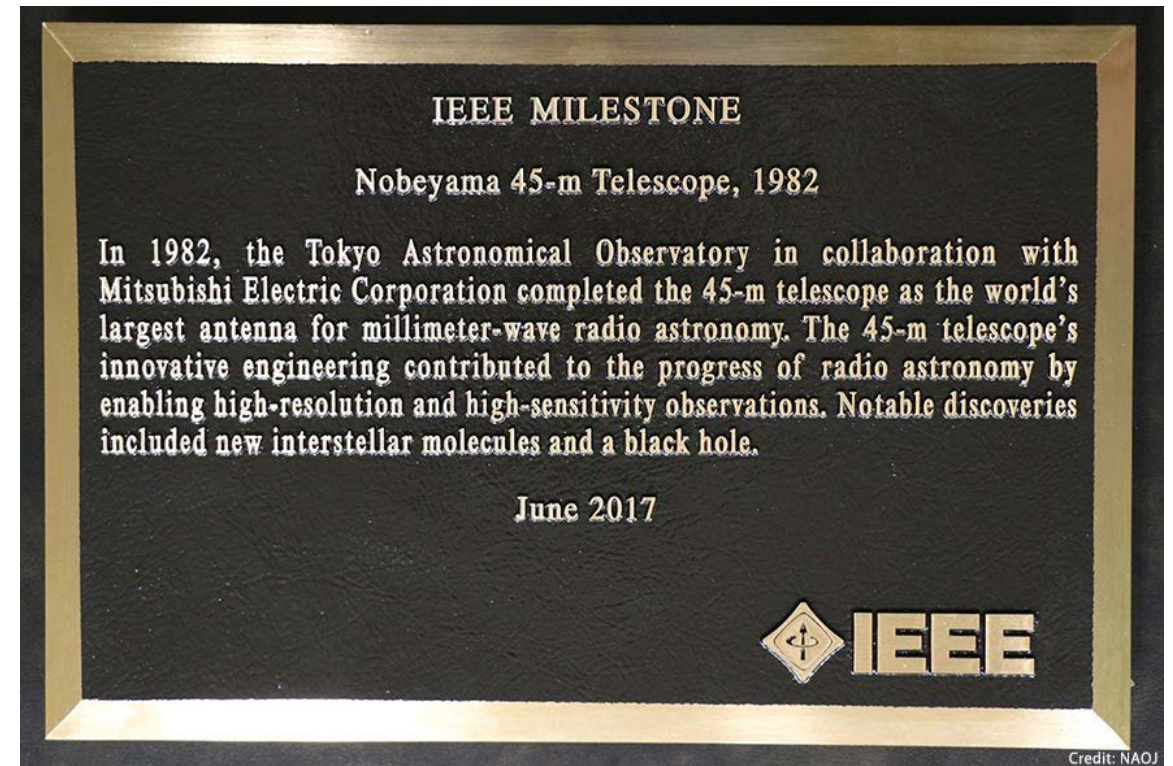
Nobeyama Solar Polarimeters

- Stable observations, but 2 GHz observation continues to be affected by interference.
- Accident in June
 - Safety was reconsidered
 - Installed a stable work stage
 - Safety rule: maintenance work by two or more persons, hardhat, etc
 - Repair was suspended before installation of the new stage, and 9.5 GHz data had a problem during this period.



Milestones

- IEEE Milestone
 - 2017 Jun 14 @ Tokyo
 - 2017 Jun 16 @ Nobeyama



- **IEICE (The Institute of Electronics, Information and Communication) Milestone** 電子情報通信学会マイルストーン



Public Outreach

- Opening of **NINS Exhibition Room** 2017 Apr 29
- We re-use the Nobeyama Millimeter Array control building for explanation of five NINS institutes. It has 4D2U theater.

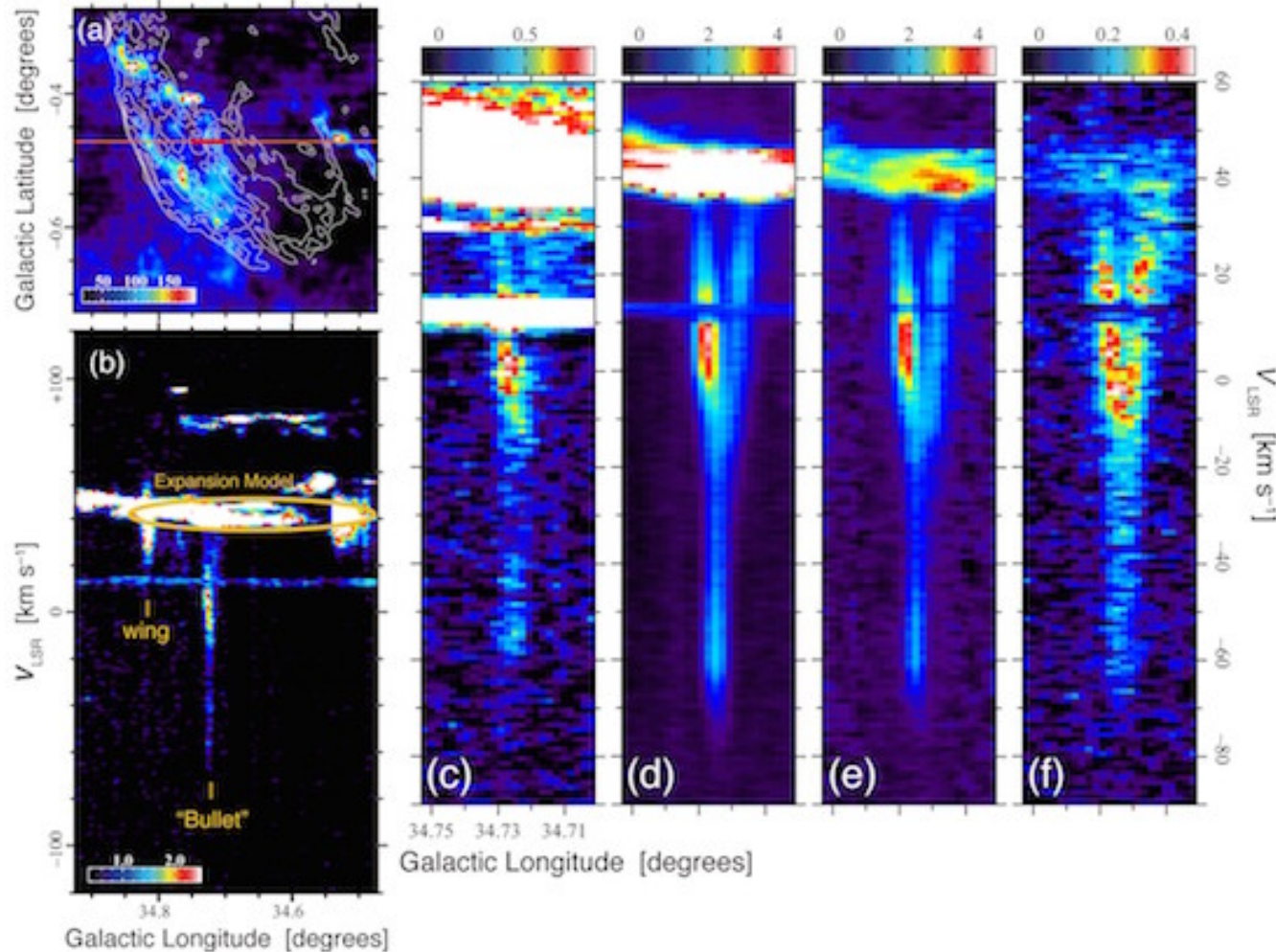


Public Outreach: Releases

- 2017 Jan 16 Stray-dog Black Hole by Tomoharu Oka
- 2017 Feb 28 Simultaneous observation of diffuse and dense gas Muraoka, COMING
- 2017 Sep 5 Galaxy Merging Kaneko COMING
- 2017 Sep 11 COMING Sorai
- 2017 Nov 17 Quiet Sun is unchanged

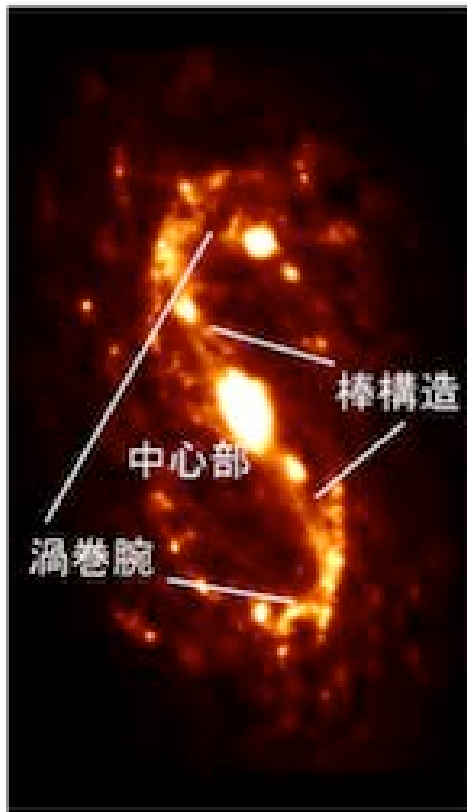
2017 Jan 16 Stray-dog Black Hole by Tomoharu Oka

天の川を撃ち抜く超音速の『弾丸』を発見
～正体は「野良ブラックホール」か？～

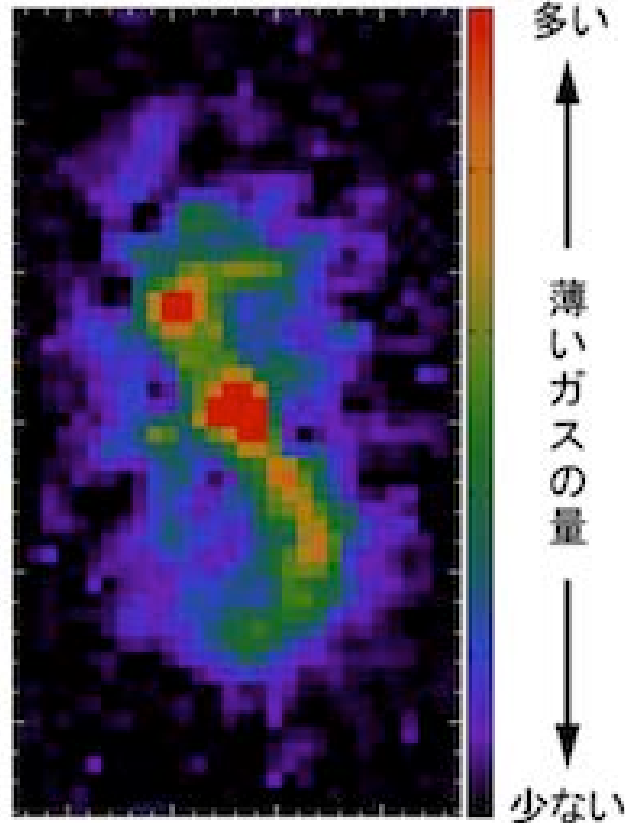


2017 Feb 28 Simultaneous observation of diffuse and dense gas Muraoka, COMING

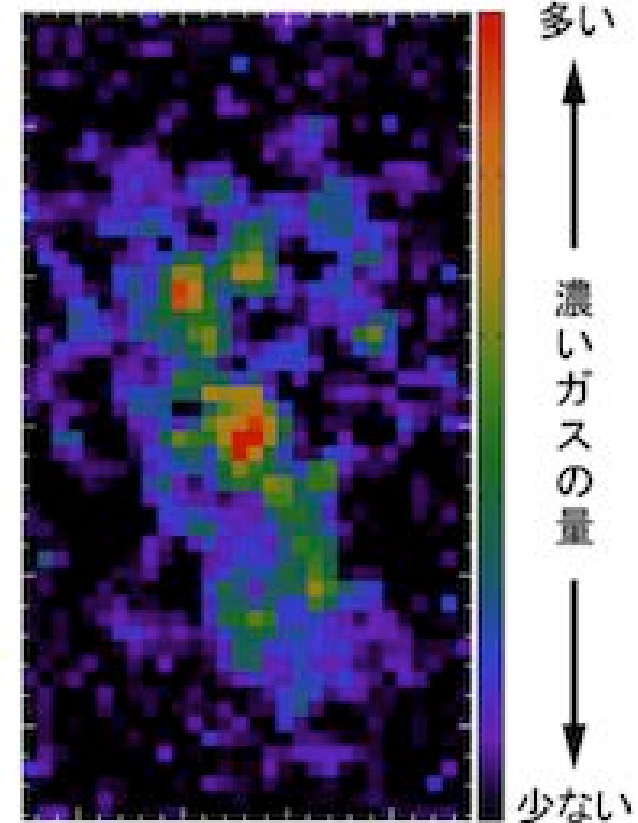
赤外線画像



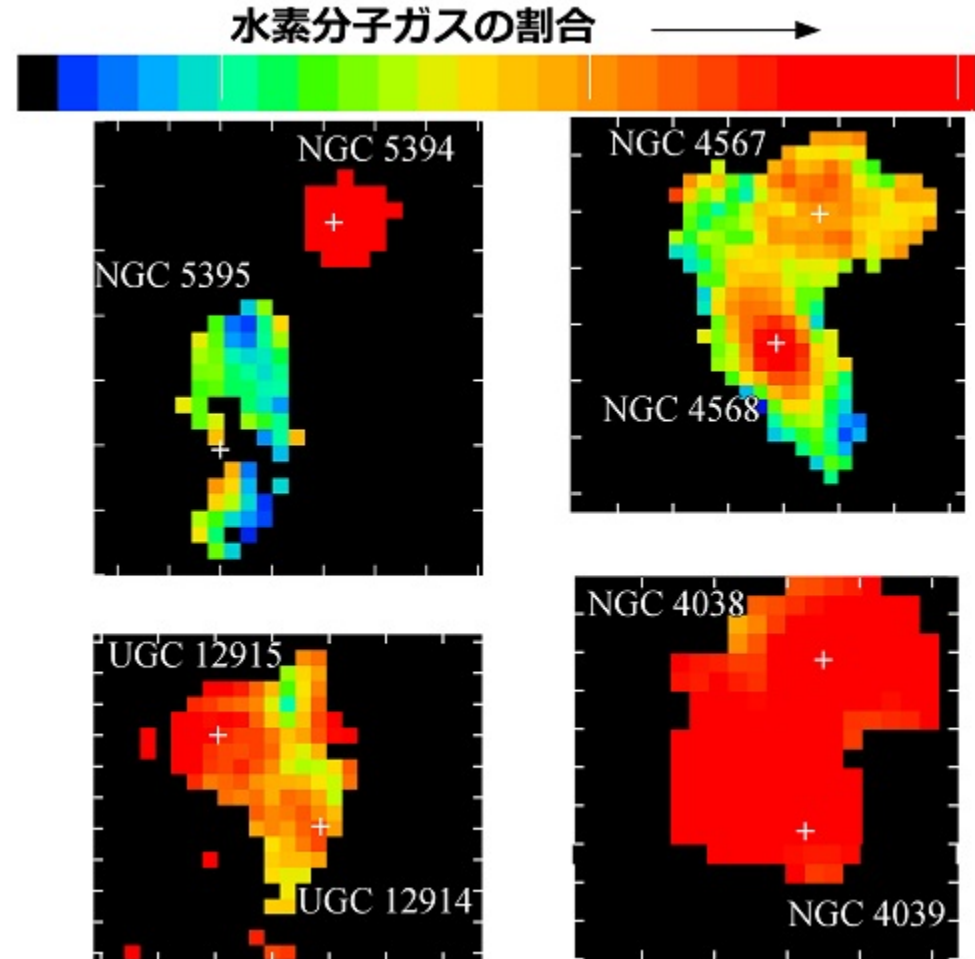
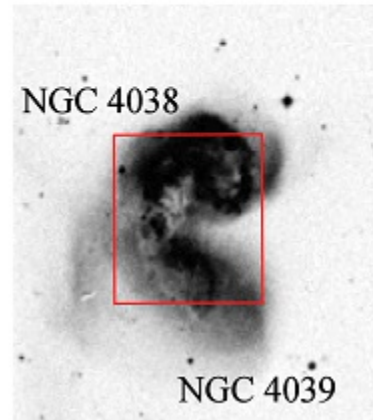
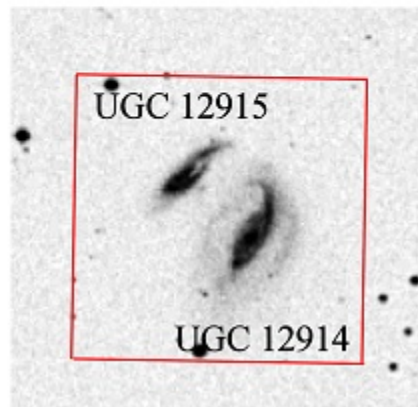
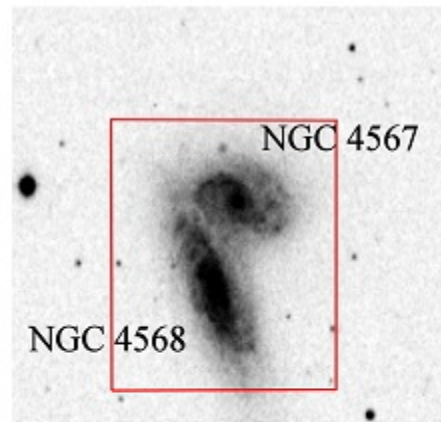
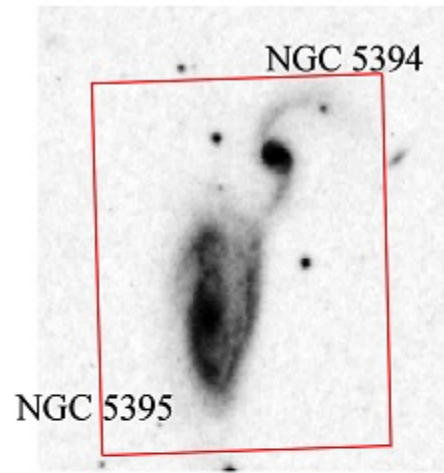
「薄いガス」の分布



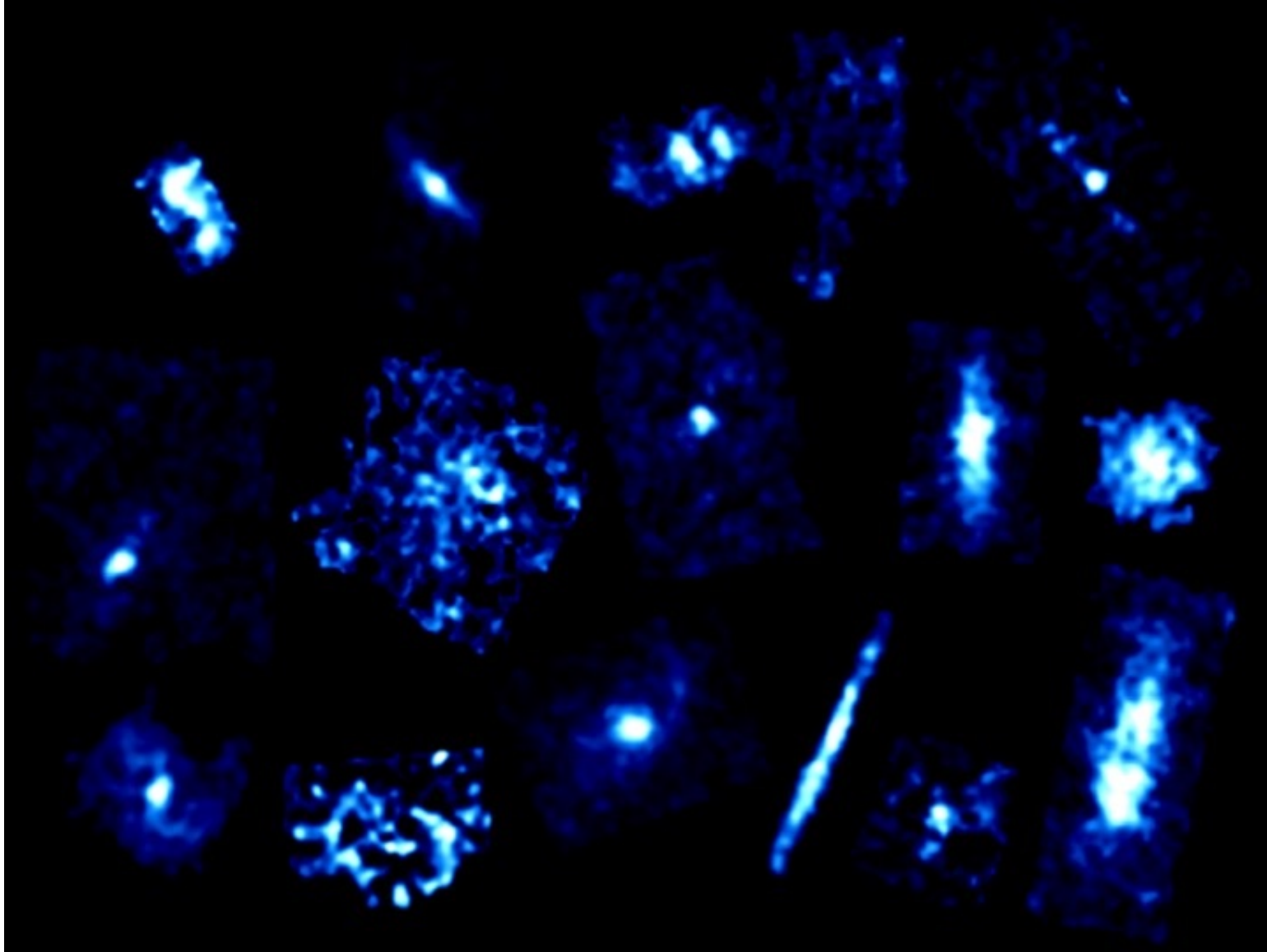
「濃いガス」の分布



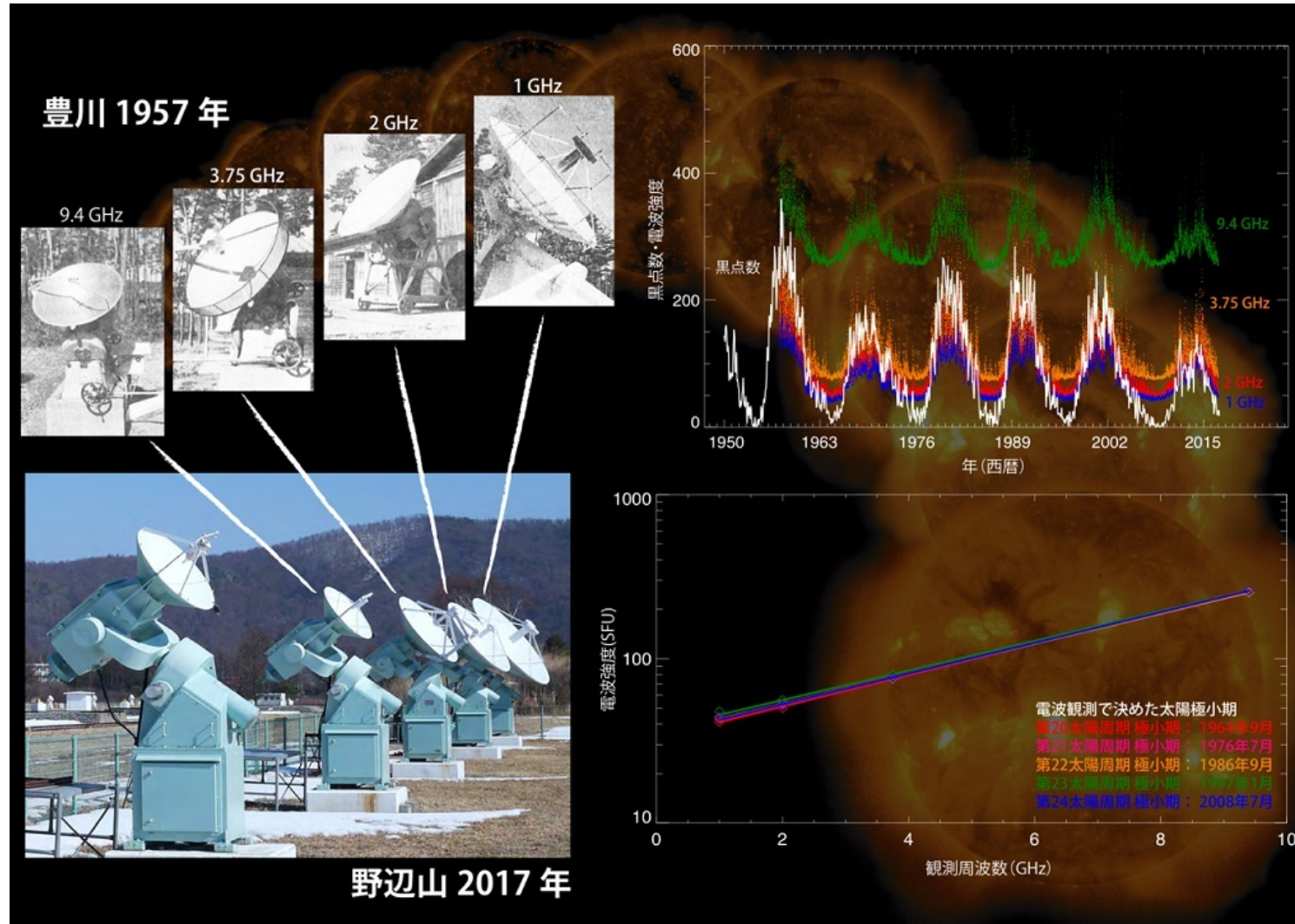
2017 Sep 5 Galaxy Merging Kaneko COMING



2017 Sep 11 COMING Sorai



2017 Nov 17 Quiet Sun is unchanged



Public Outreach: Local Community

- Nagano-ken is Uchuu-ken stamp rally 長野県は宇宙県
スタンプラリー 2017 Jul 22-Aug 31



- Hosizorano-machi Aozorano-machi Zenkokutaikai in
Minamimaki 星空の街 あおぞらの街 全国大会 in 南牧村
2017 Lecture by NRO Director

第29回
星空の街*あおぞらの街 全国大会 in 信州南牧村
平成29年10月21日(土) 22日(日)
会場：八ヶ岳高原音楽堂 (長野県南佐久郡南牧村大字海ノ口2244-1)
主催：環境省、長野県、「星空の街・あおぞらの街」全国協議会 主管：南牧村

- 地元感謝デー (天文台、信大、筑波大) 2017 Dec 9

地元感謝デー



250

YEARLY REFEREED SCIENTIFIC PUBLICATION

200

“J” MEANS PI IN JAPANESE INSTITUTION OR PI JAPANESE NATIONAL

150

100

50

0

2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

ALMA (whole)

SUBARU

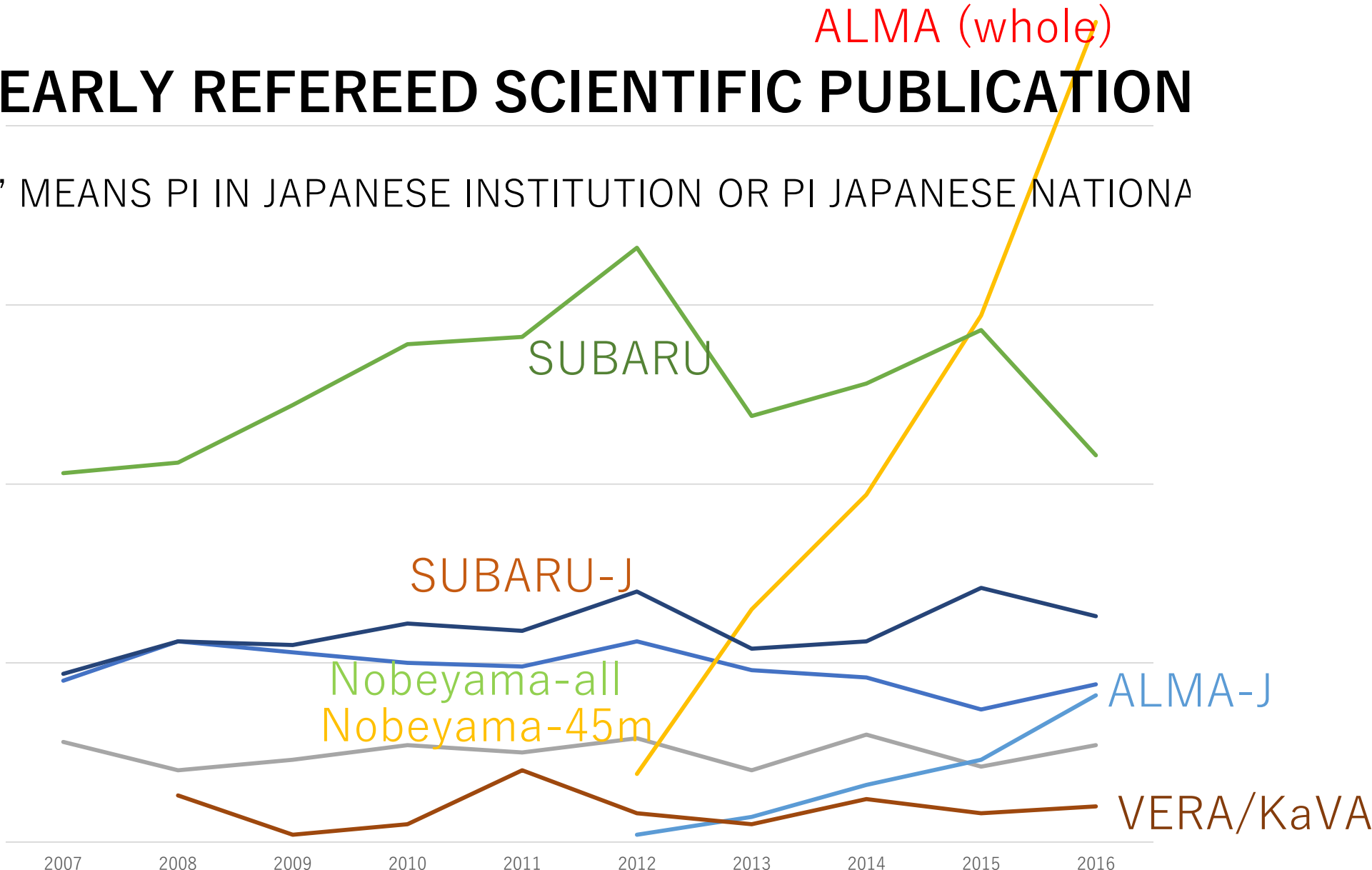
SUBARU-J

Nobeyama-all

Nobeyama-45m

ALMA-J

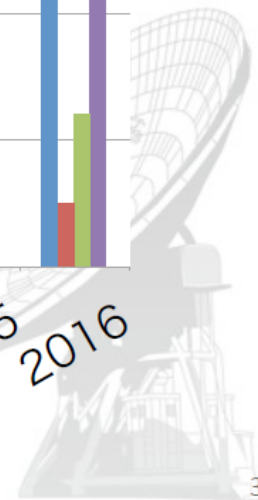
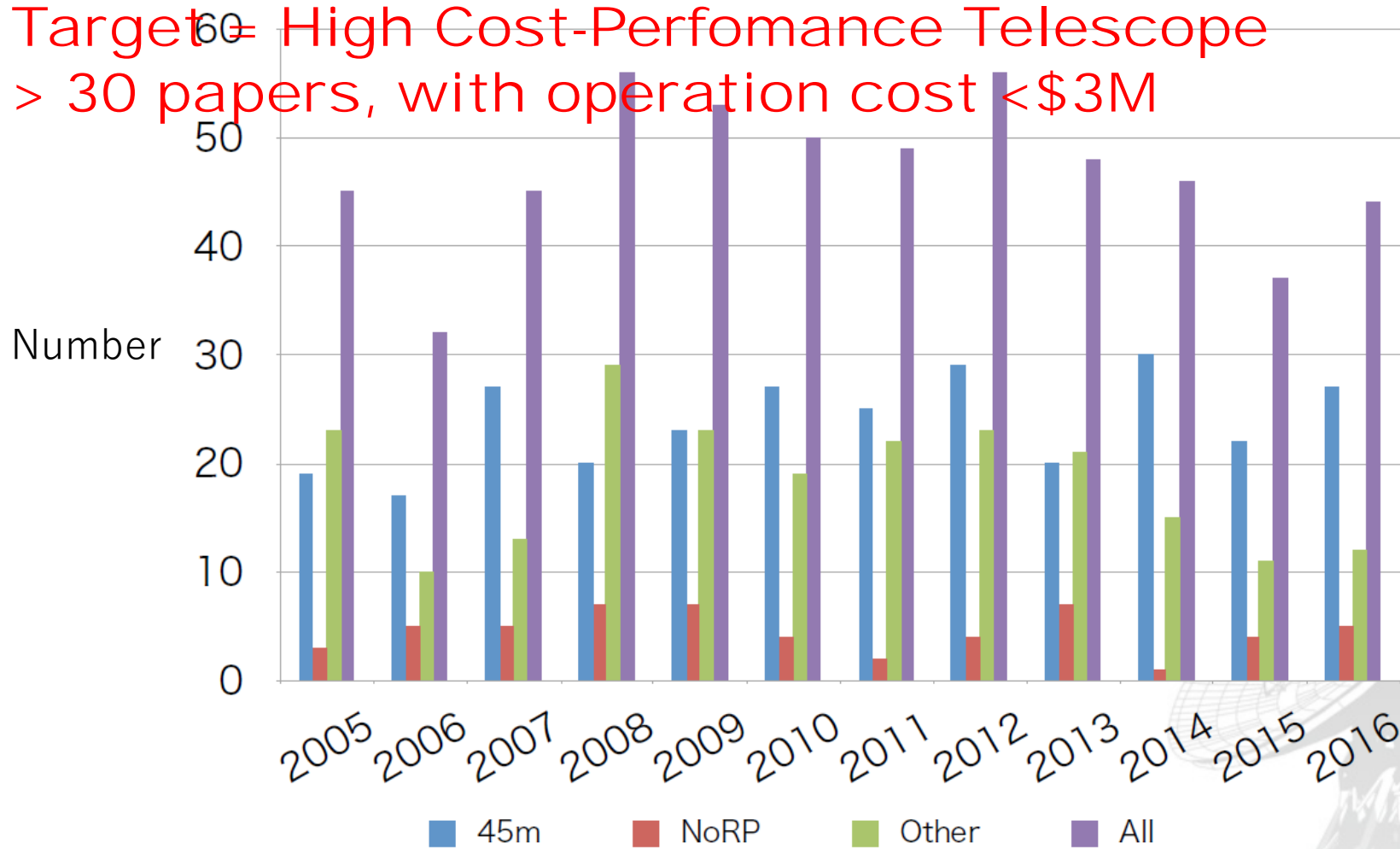
VERA/KaVA



Publication Status

Refereed papers(2005-2016)

Target = High Cost-Performance Telescope
> 30 papers, with operation cost < \$3M



Call for Proposals

- Effort in Call for Proposals

- We only had **one deadline** for regular programs for 2016-2017, but resume to have **two deadlines** for 2017-2018.
- For many years, we had only one deadline for short programs, but started to have **two deadlines from this season 2017-2018**.
- **By using personal network**, we made our effort to increase proposal from foreign countries.

Call for Proposals

- Status of 2017A
 - # proposals for 2016A was 35, but we received 46 proposals for semester 2017A.
 - # proposals from foreign countries for 2016A was 5, but we received 12 for 2017A
 - # proposals from China mainland have been zero there years, but we received 6 proposals (2 was accepted).
- Status of 2017B
 - #regular = 20 (#foreign = 8!!!, Chine=3, US=2, Taiwan/UK/Australia=1)
 - #short=5 (#foreign=0)
- We continue to make effort to increase the open use time (currently ~ 3000 hr/y)

Refereed publication from 45m telescope within one year

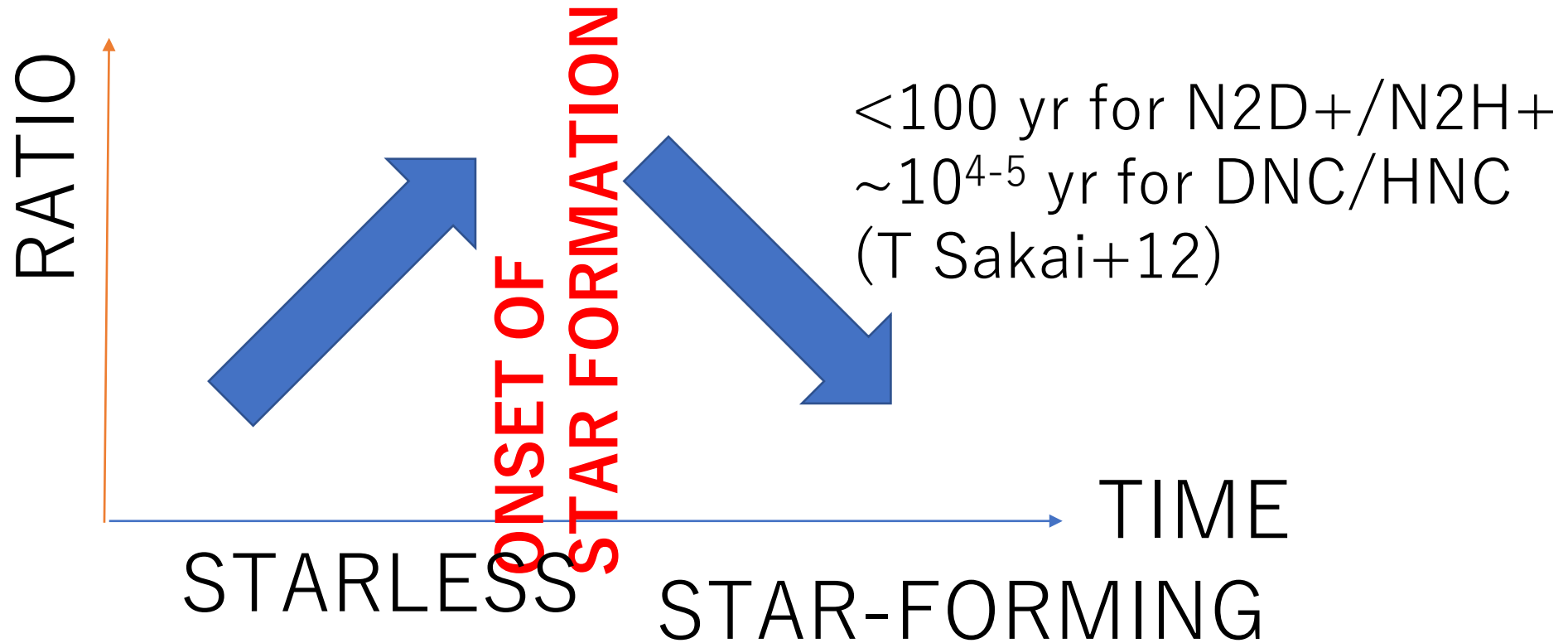
- 2016.11-2017.10 34
 - 2016.11-2016.12 7
 - 2017.1-10 26

- 2017.1-2017.12.19 29

Importance of the 45-m telescope

- ALMA will need good molecular-line tracers to see the densest cold ISM, but depletion of molecules onto dust should be serious.
- N_2D^+ , N_2H^+ (relatively) free from depletion will be very powerful tools.
- D/H such as $\text{N}_2\text{D}^+/\text{N}_2\text{H}^+$, DNC/HNC is being confirmed to be good signpost of the onset of star formation in cold cores.
- 70-GHz (B2) , 140-GHz (B4), 200-GHz (B6) are important for deuterated molecules. 45-m has receiver T70 for 70 GHz.
- Now, ALMA-EU and ALMA-NA is proposing B2 receiver development.

$\text{N}_2\text{D}^+/\text{N}_2\text{H}^+$ or DNC/HNC
in cold (10-20 K) cloud cores



Nobeyama as ALMA Pathfinder

- **Nobeyama Large Program** (PI=Tatematsu, # of col ~ 200, 350 hr over 2 yr) will pick up **cores very close to star formation** using **deuterated molecules** for Planck cold clumps. Started on 2017 Dec 8. This will provide good targets for ALMA.
- NRO Director strongly **wishes to continue open use operation of 45m at least 10 years** from now, by achieving the high cost-performance telescope, although NAOJ top management is asking to stop it by 2022 March.

Problems

- No assistants for Dec 28-Jan 3. We started GTO rather than internal programs. Legacy finished.
- Dec 29-Jan 3 needs to be filled with observatory PI or expert.
- This time, large (PI=Tatematsu) have assigned time on Dec 24, 25, Dec30-31, Jan 1-3.
- Can Large and GTO (from development program) be asked to have expert users OK for Dec 29-Jan 3, and Golden Week?

Grade A for 45m telescope?

- Professor Satoshi Yamamoto suggested Grade A (guarantee rms noise level) one year ago
- It may continue very long time, taking into account 45m situation (pointing due to winds)
- Re-allocation: Cancelled observing time due to unexpected instrumentation/telescope failure will be re-allocated. Observing time surrendered to backup programs due to bad weather also will be compensated.
- Grade A (more generous weather compensation)? 15-20%? Excluding Large programs?

Thank you!