ESTEMA, HINOTORI and FLASHING

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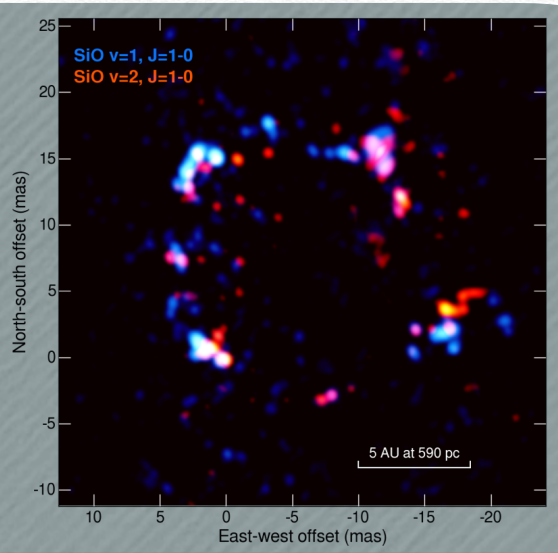
On behalf of ESTEMA / HINOTORI / FLASHING Teams

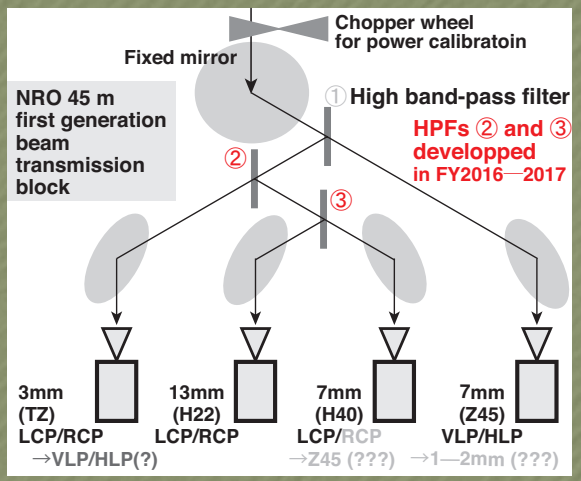
ESTEMA

EAVN Synthesis of Stellar Maser Animations



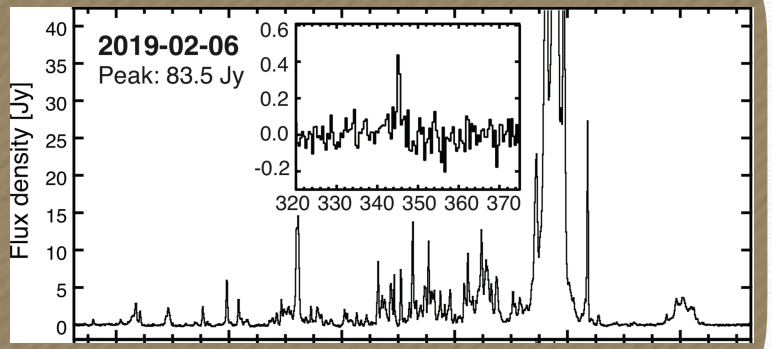
HINOTORI

Hybrid Integration Project in Nobeyama, Triple-band Oriented



FLASHING

Finest Legacy Acquisitions of SiO-H_2O-maser Ignitions by Nobeyama Generation



ESTEMA EAVN Synthesis of Stellar Maser Animations

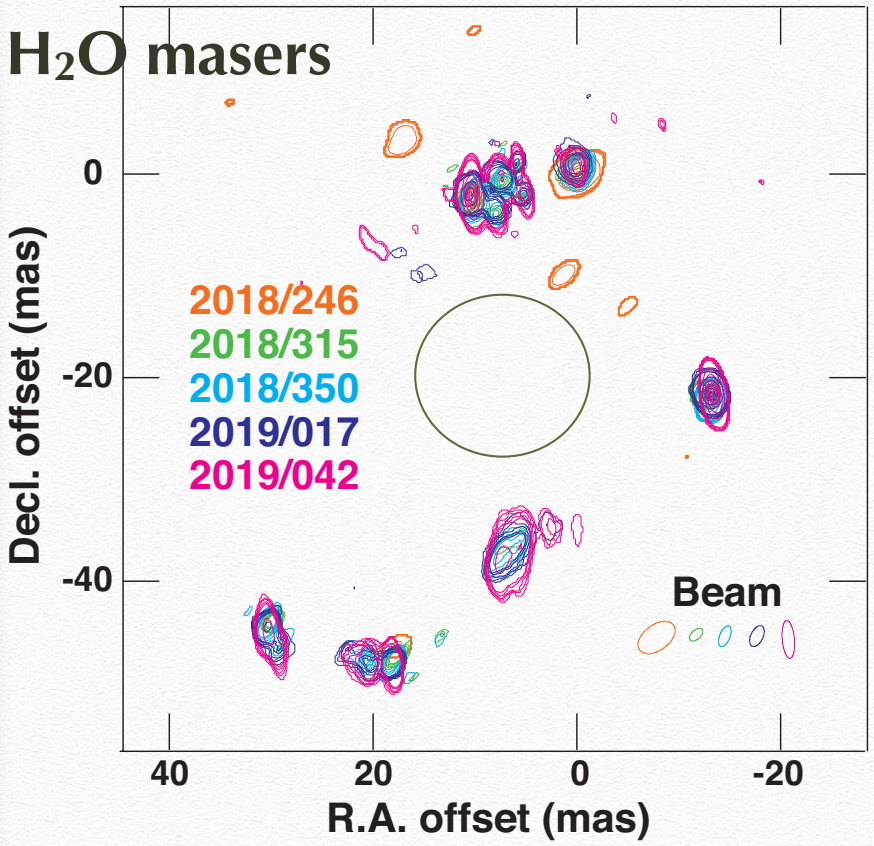
Biweekly/monthly
monitoring with VLBA
during 1996—2002
SiO v=1 J=1→0 only

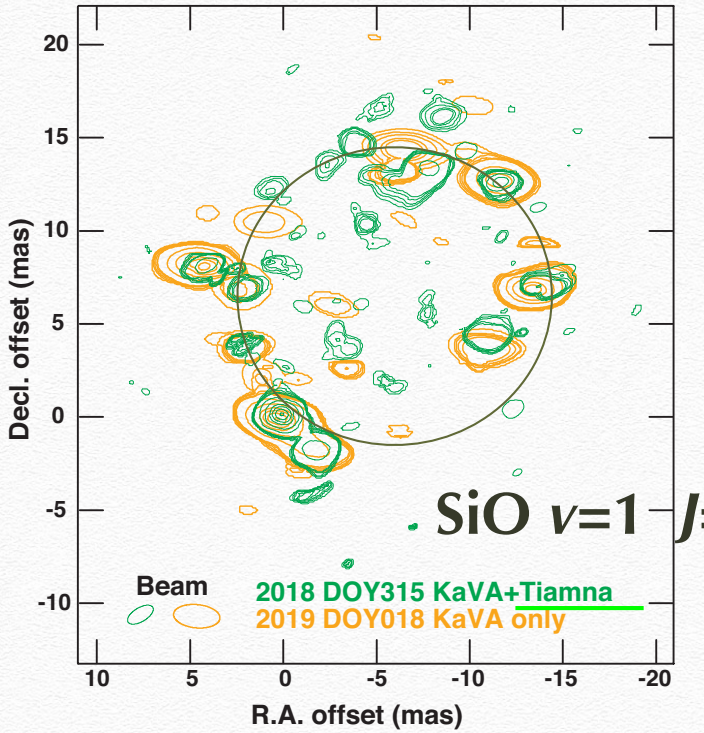
⇩

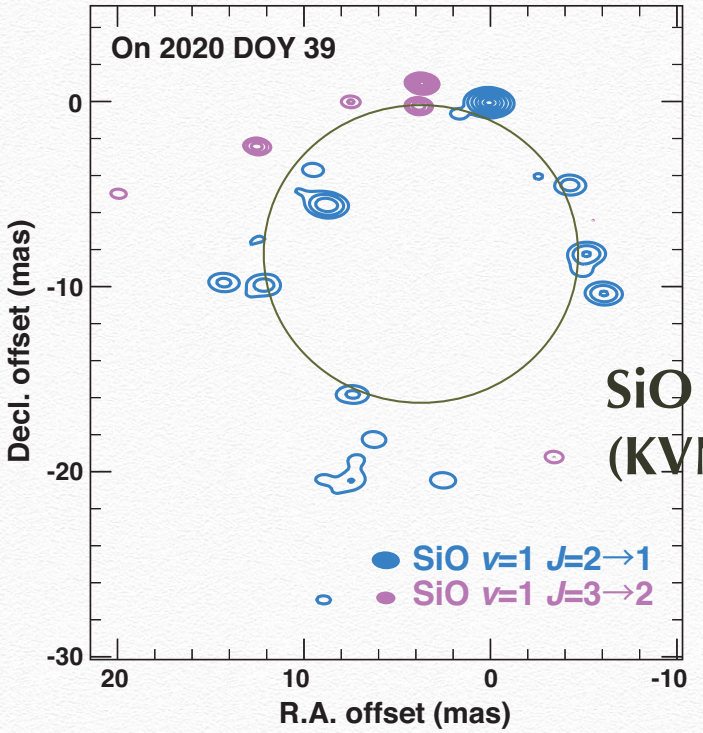
Intensive monitoring
with KaVA/EAVN
H_2O
SiO v=0,1/2/3 J=1→0
^{29}SiO v=1 J=1→0
SiO v=1 J=2→1, 3→2

BX Cam, NML Cyg
(o Cet, U Her, IRC-10151, Y Cas)

BX Cam masers taken in ESTEMA

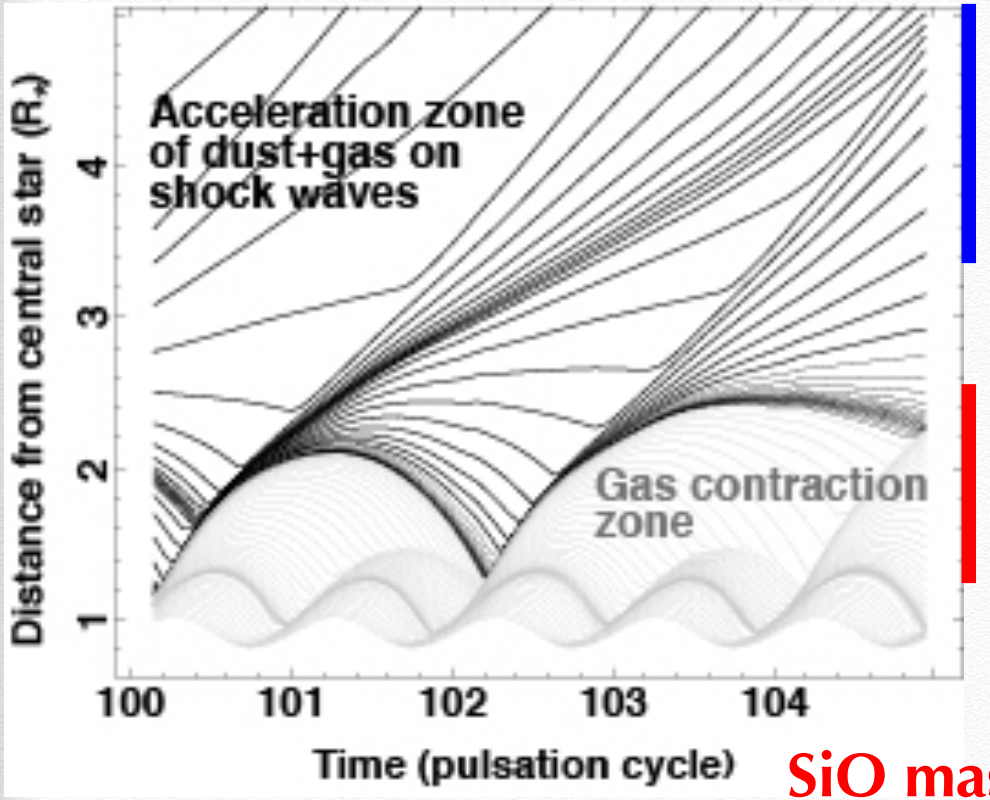






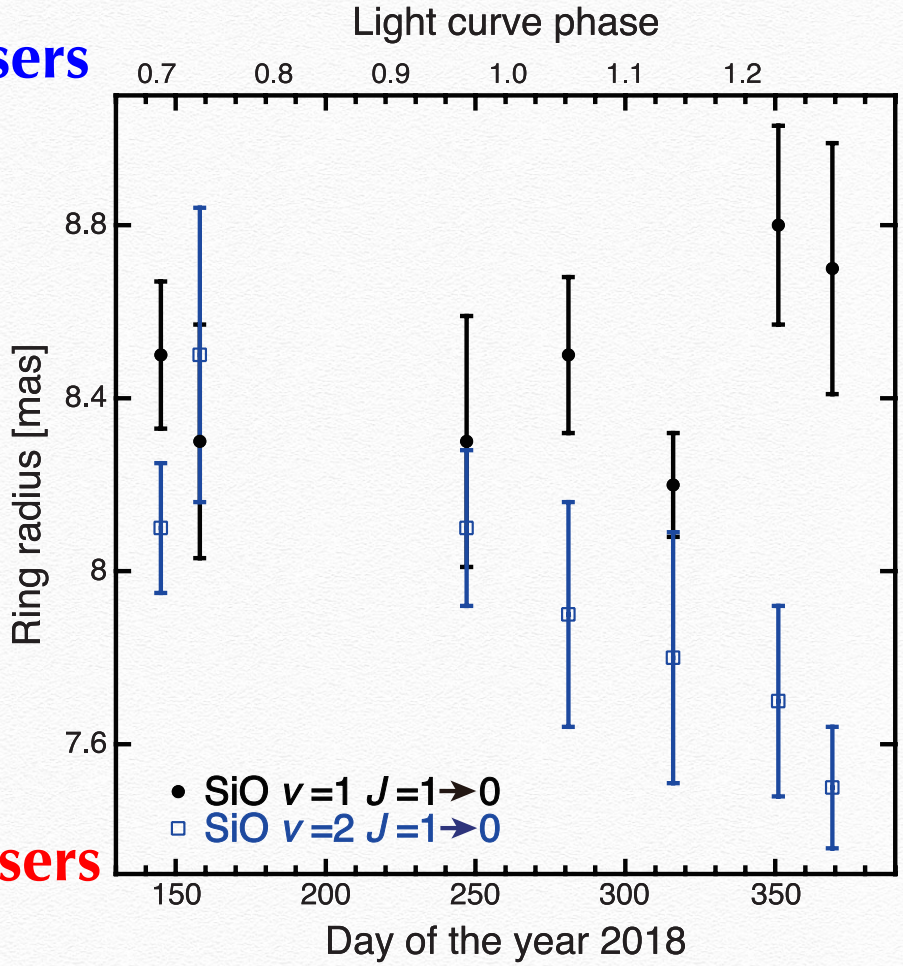
Similar ring sizes of
SiO J=2→1 and 1→0 transitions
(c.f. Soria-Ruiz et al. 2004)

SiO maser time variation in BX Cam



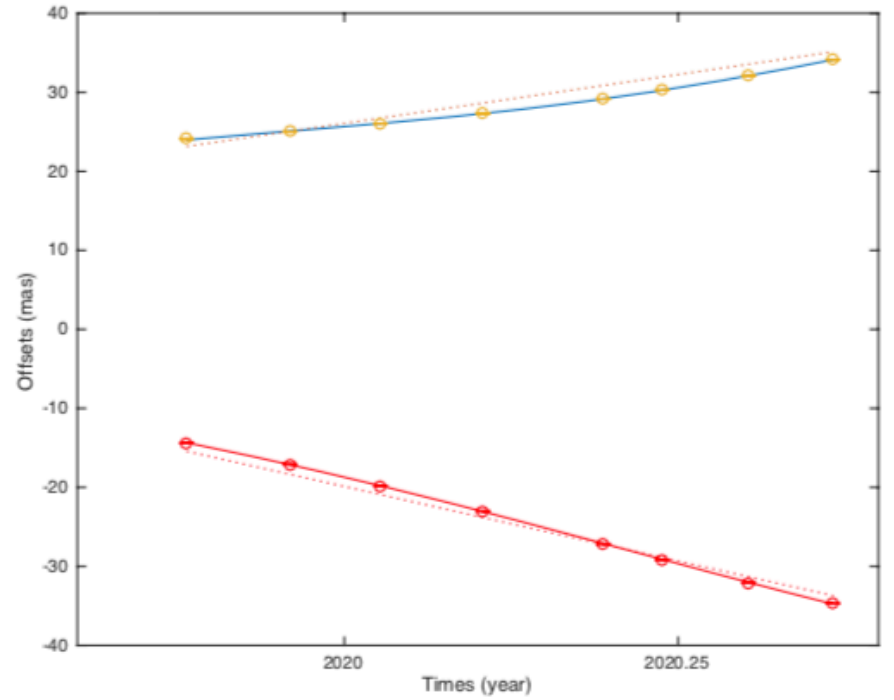
H_2O masers

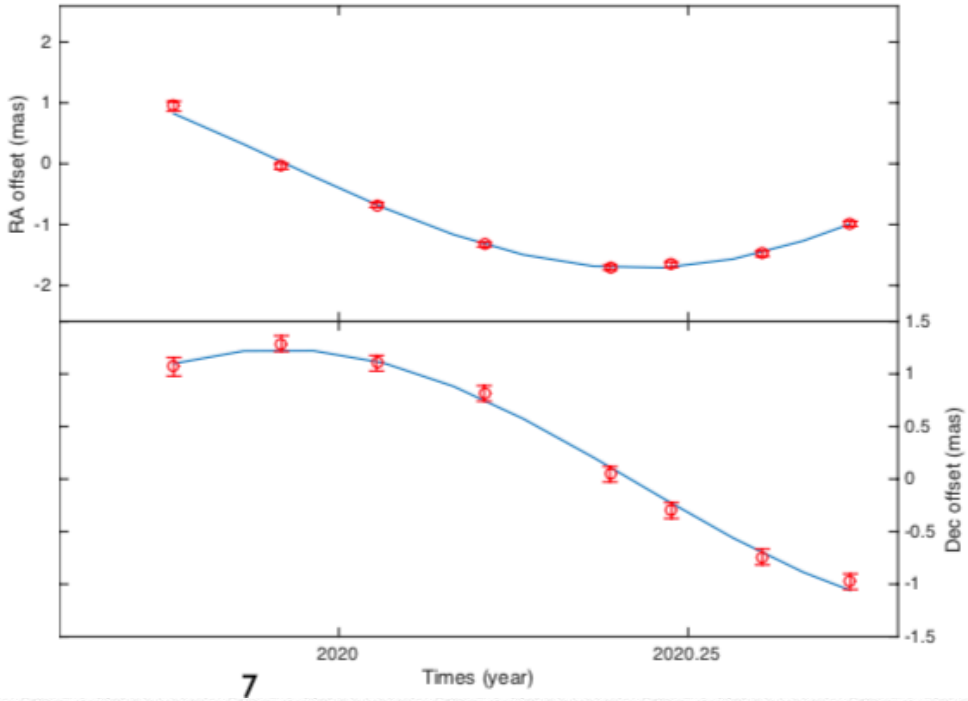
SiO masers



Höfner et al. (2003)

H_2O maser annual parallax yielded with VERA dual beams

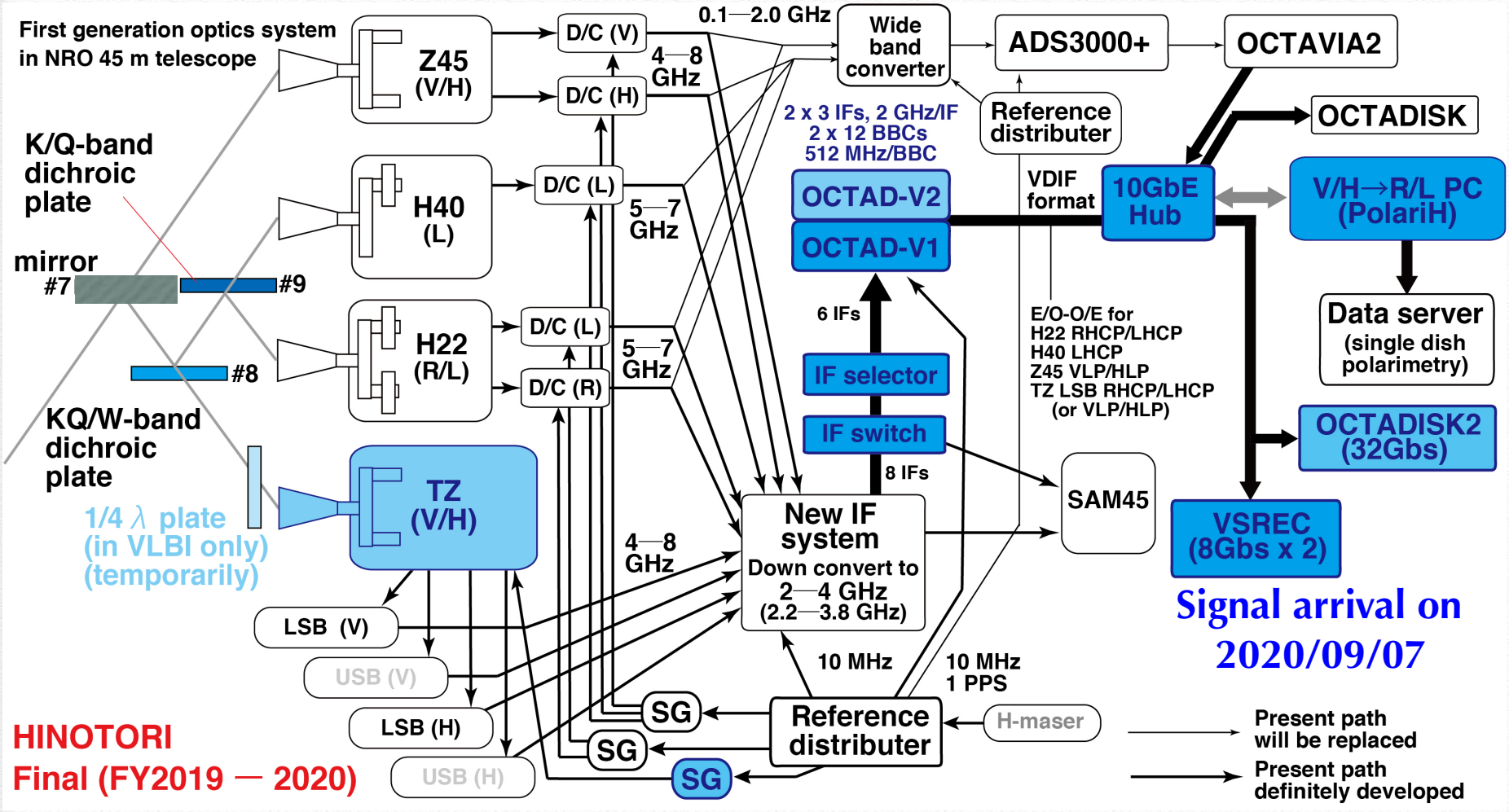




π=1.73±0.06 mas
(ESTEMA, preliminary)

π=1.73±0.03 mas
(Matsuno et al. 2020)

HINOTORI system in the 45 m telescope



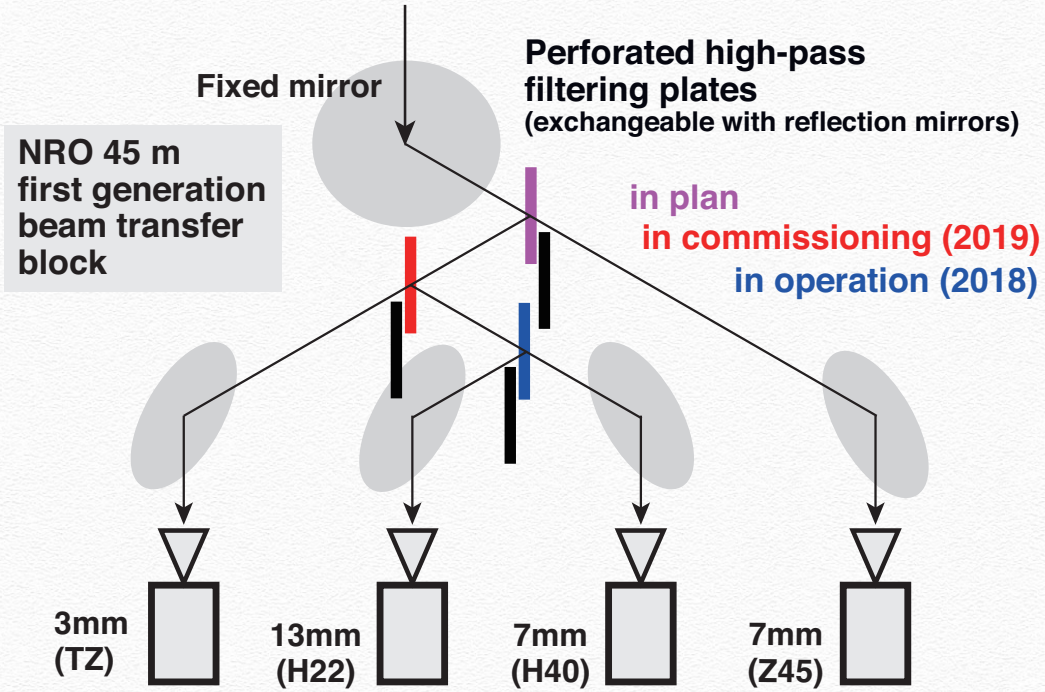
Remaining (main) items:

VLBI operation test, real-time spectroscopy with PolariH

Polarization conversion of TZ output signals (PolariH, OCTAD, post-corr)

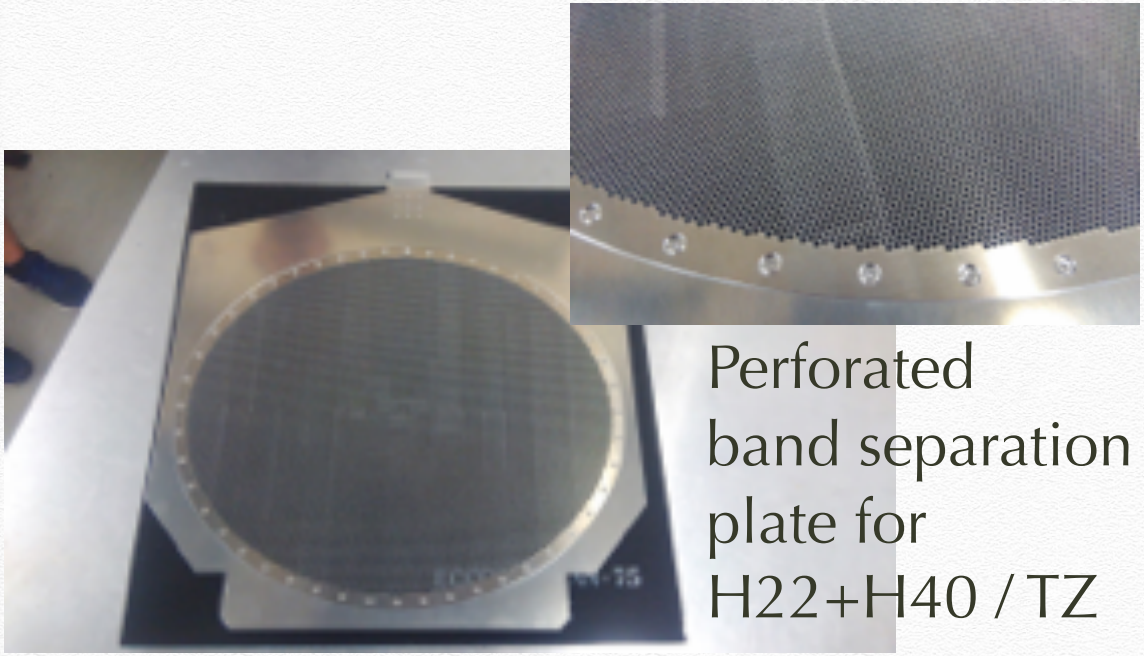
Installation of a new perforated band separation plate for Z45+H22

Concept of a triple-band observation system



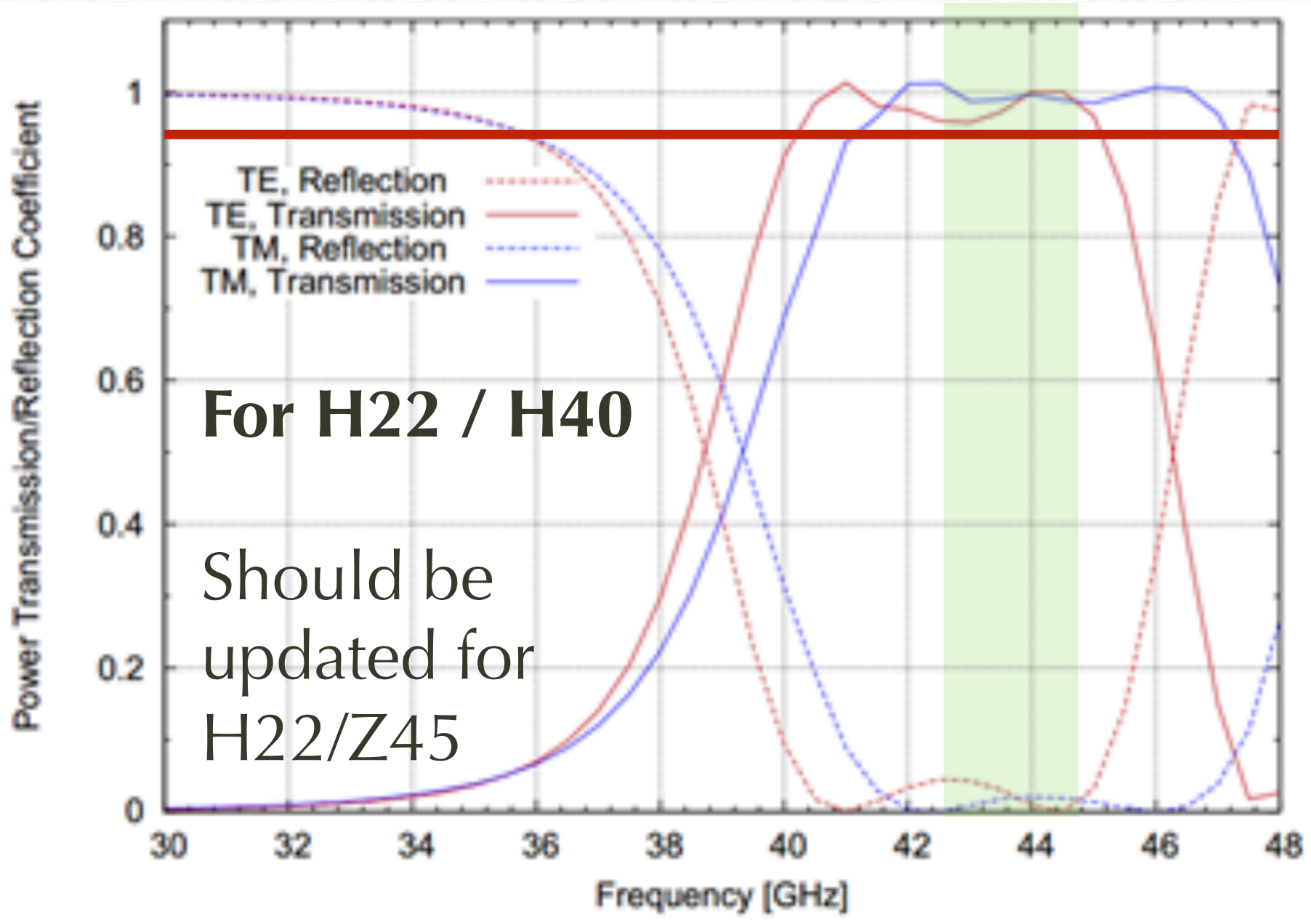
Designing and H22/H40 measurement (Okada et al. 2020)

Beam squint within 3″ for TZ (Tsutusmi et al. Ms. thesis)



Perforated band separation plate for H22+H40 / TZ

Expected performances



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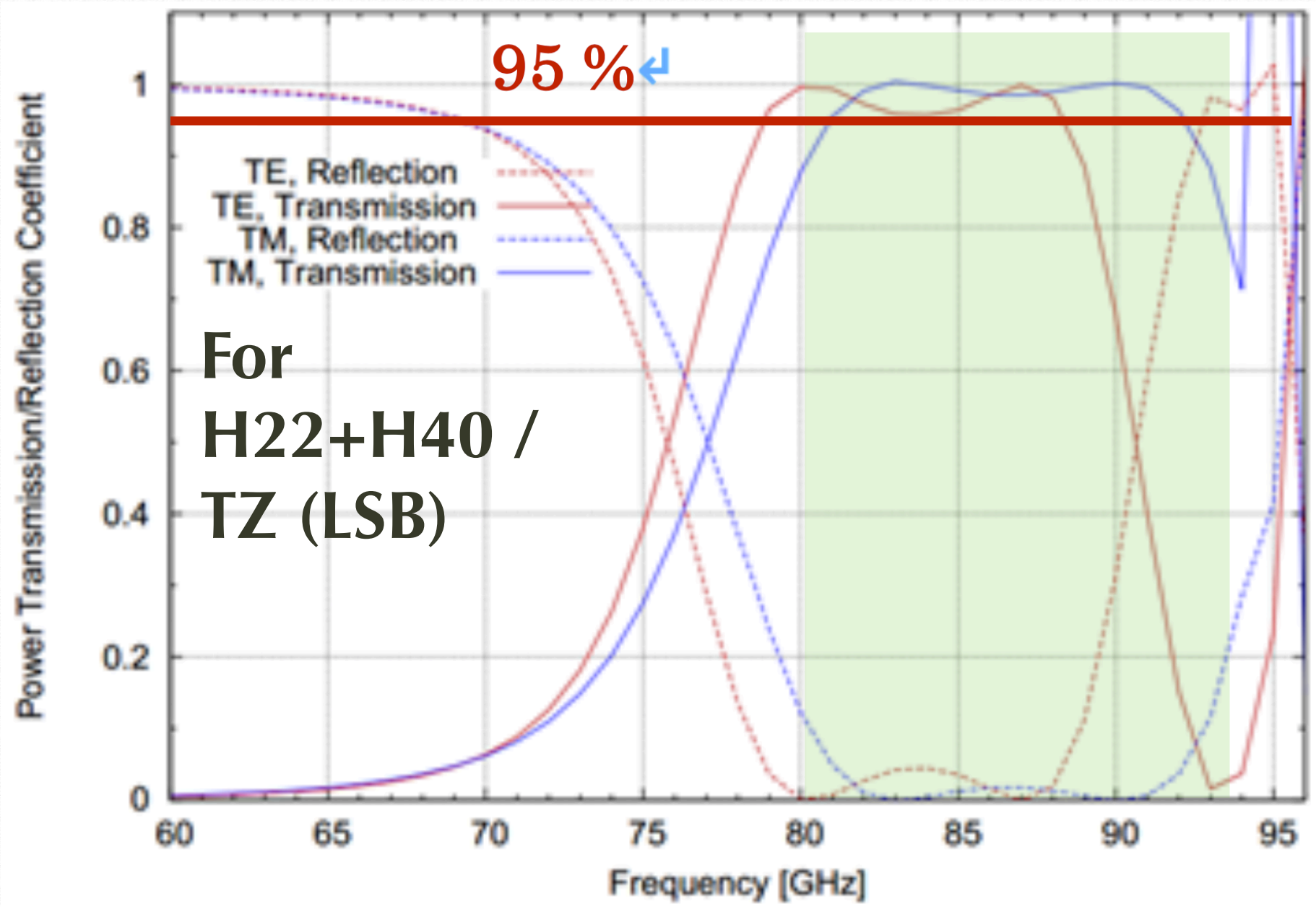


Early science in H22/H40 simultaneous single-dish observations (since 2018 Dec.)

FLASHING

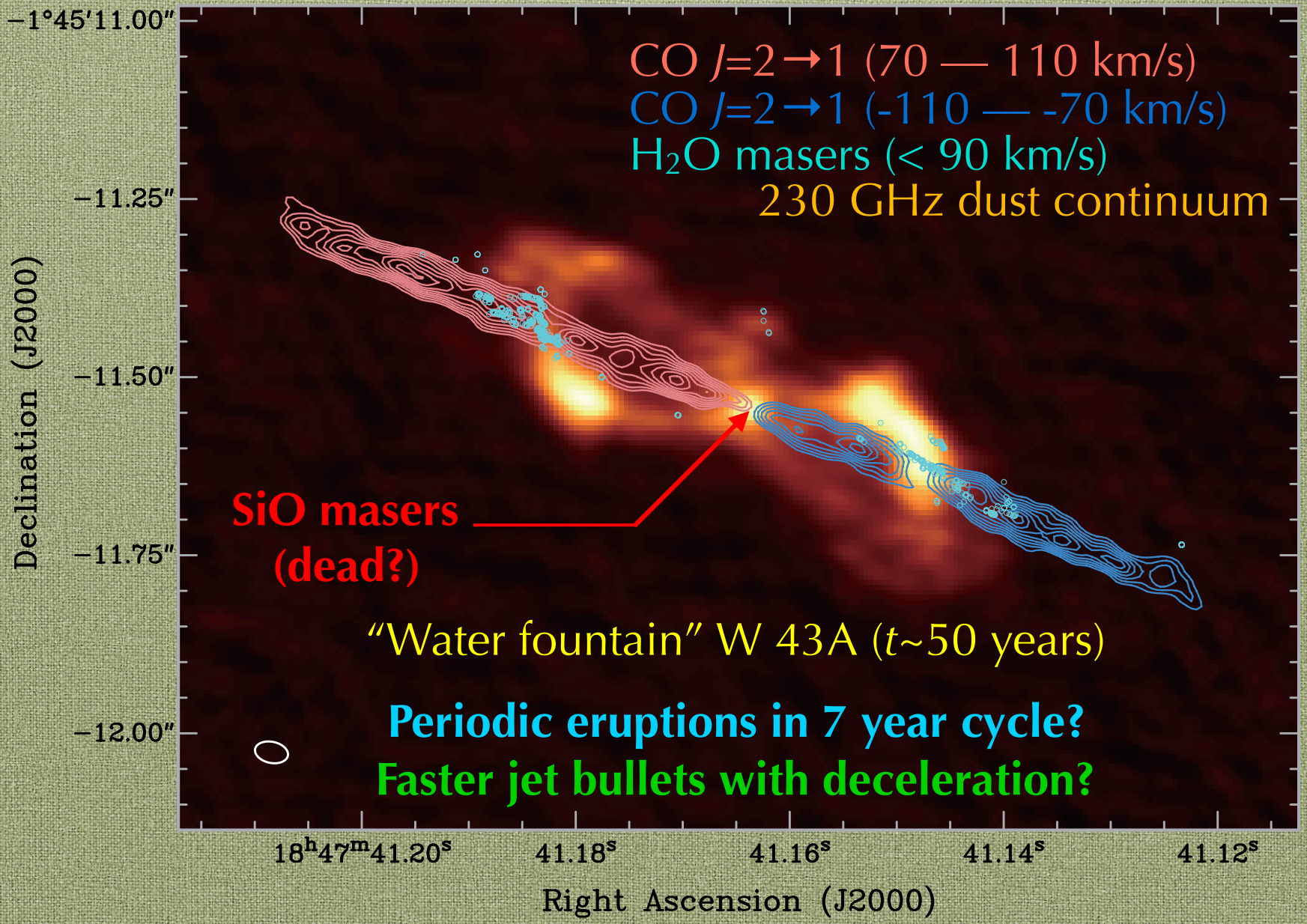
(Finest Legacy Acquisitions of SiO- and H_2O-maser Ignitions by Nobeyama Generation)

(Not GTO)

working in (very sparse) time domain astronomy

Up to 16 spectral windows with SAM45

Fast bipolar jets from dying stars

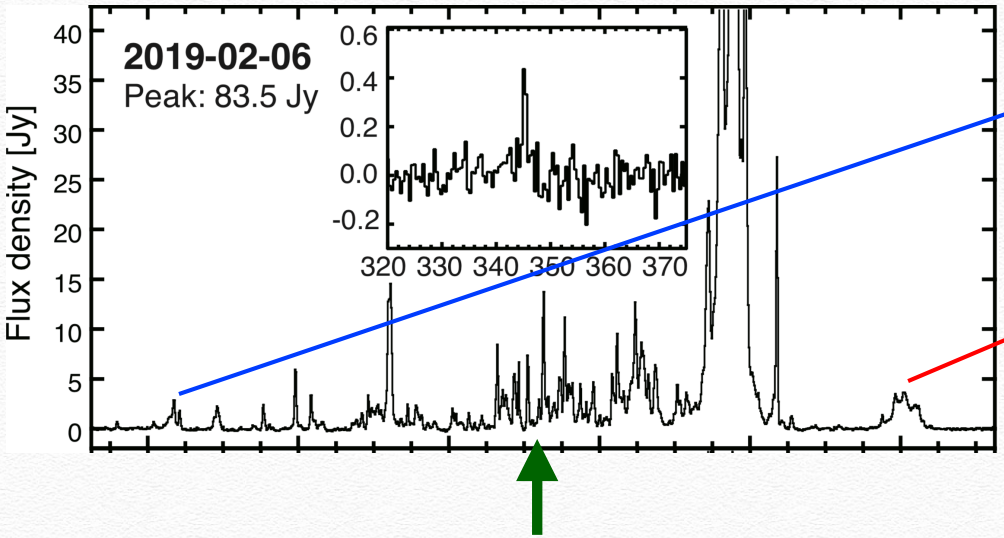


With ALMA+VLBA (Tafoya et al. 2020)

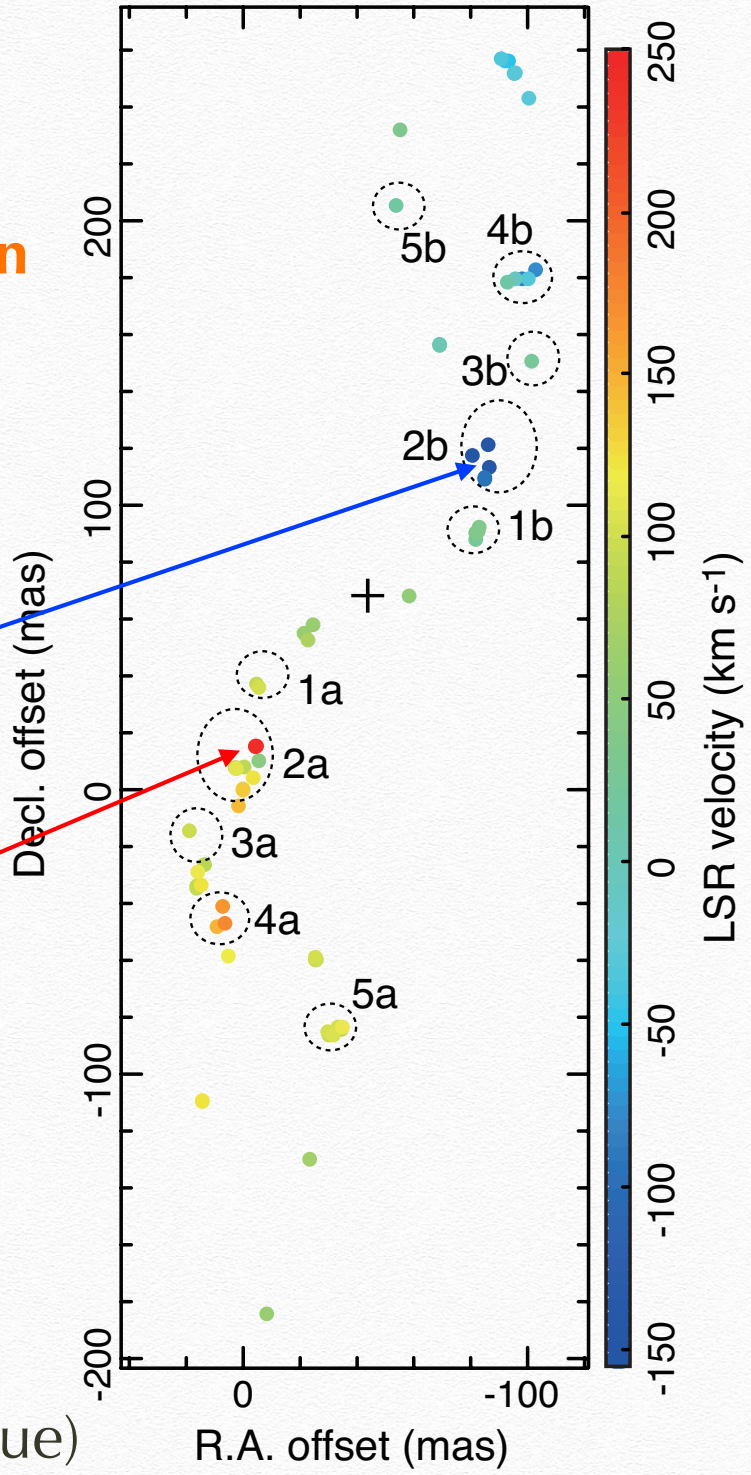
Ignitions of the highest velocity H_2O maser components

Highest velocity jet before deceleration
Point symmetric pattern of maser distribution

IRAS 18286-0959

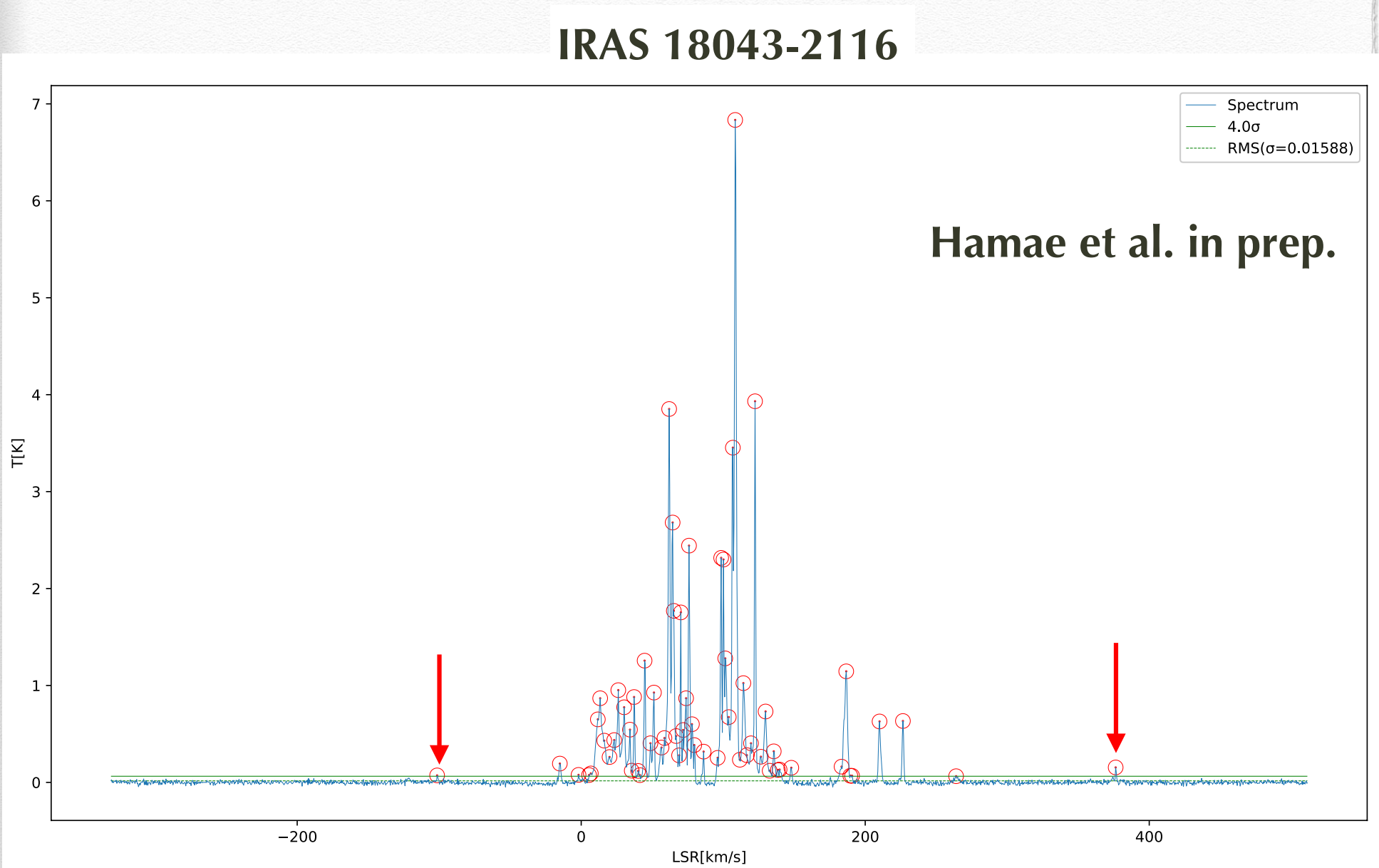


Mapped with KaVA
(KVN and VERA Combined Array)
on 2019 March 6



Imai et al. (2020, PASJ VERA Special Issue)

Catching the second case of the record-breaking highest-velocity maser components

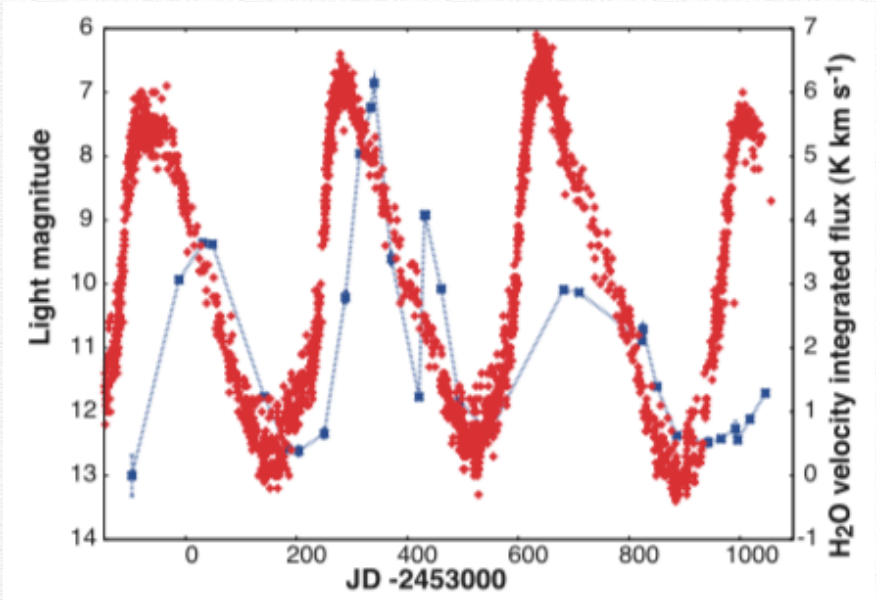


Most intensive monitoring of masers in pointing sources

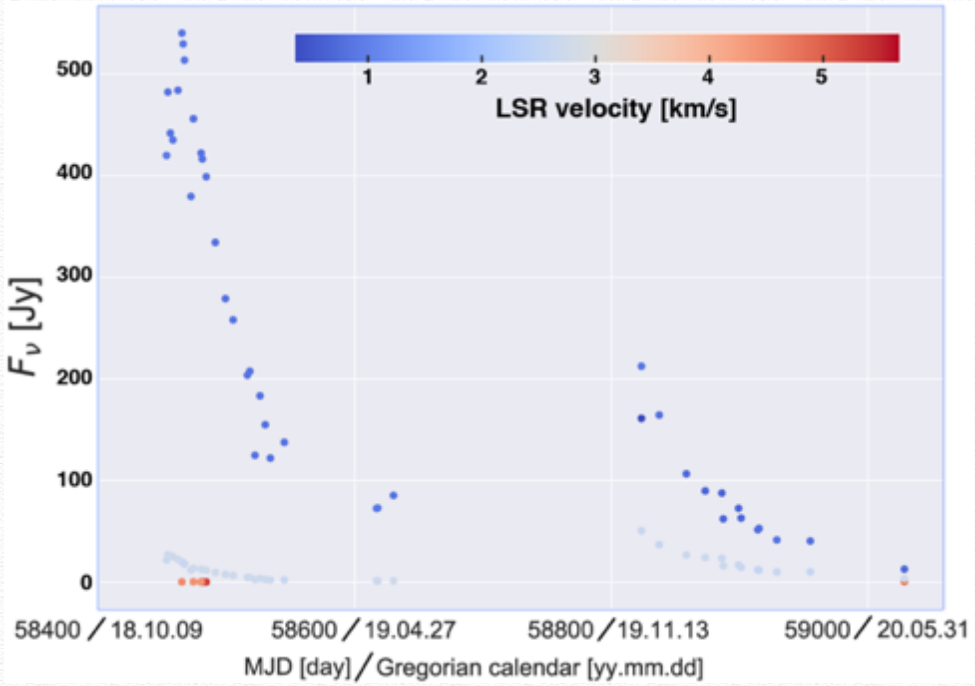
S CrB (P~360 d)

pointing source

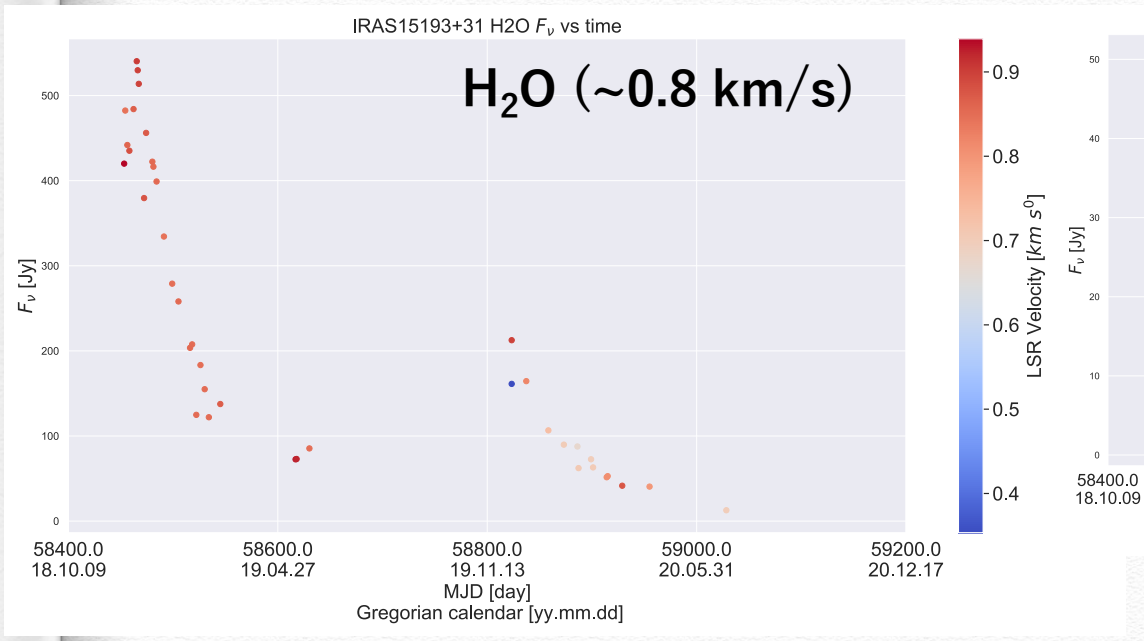
FLASHING (2018—2020

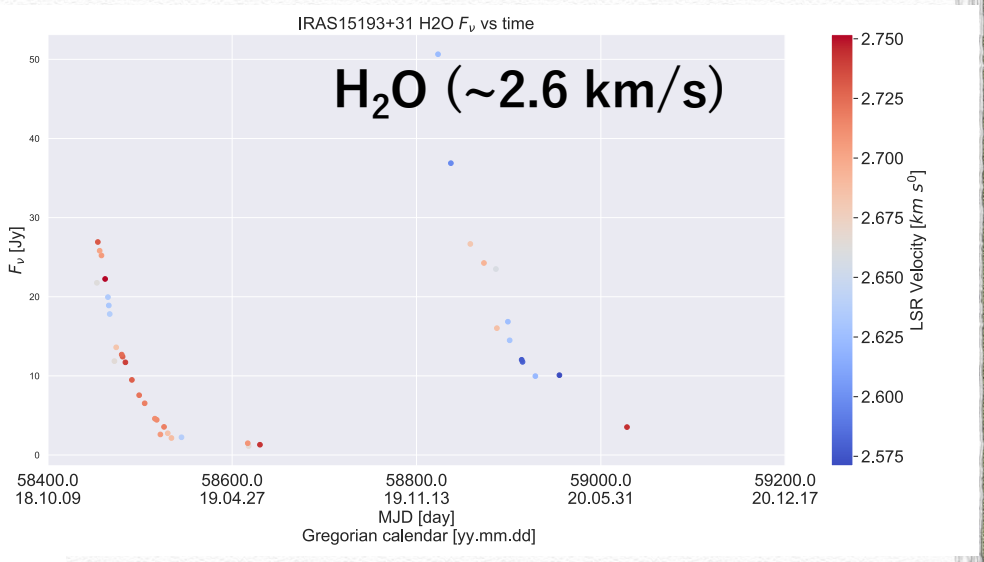


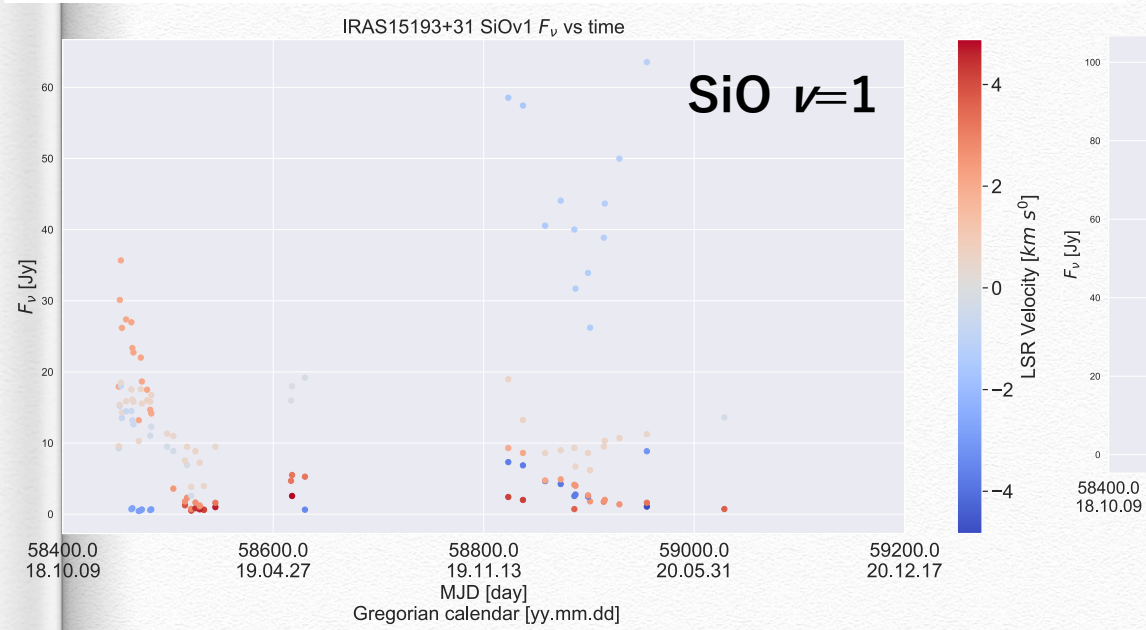
Shintani et al., PASJ, 60, 1077 (2008)

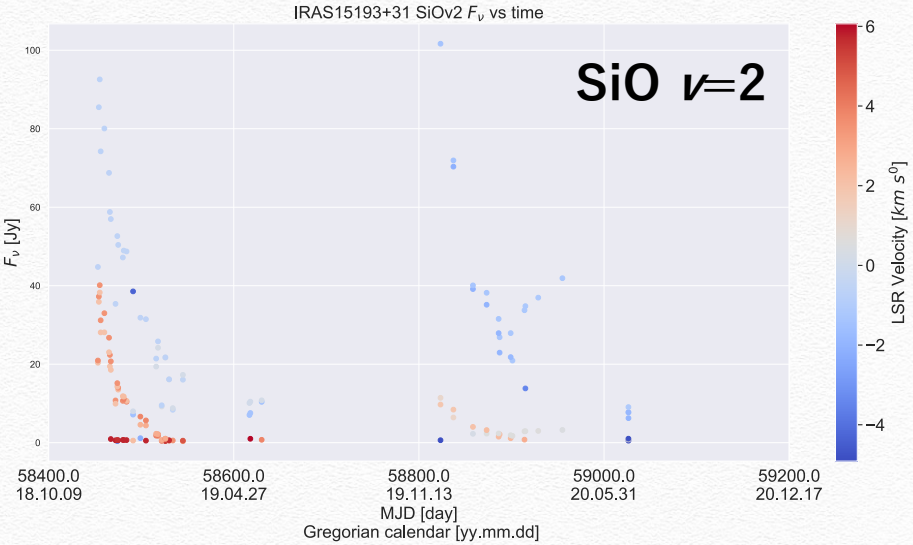


No phase lag between flux variations of H_2O and SiO masers



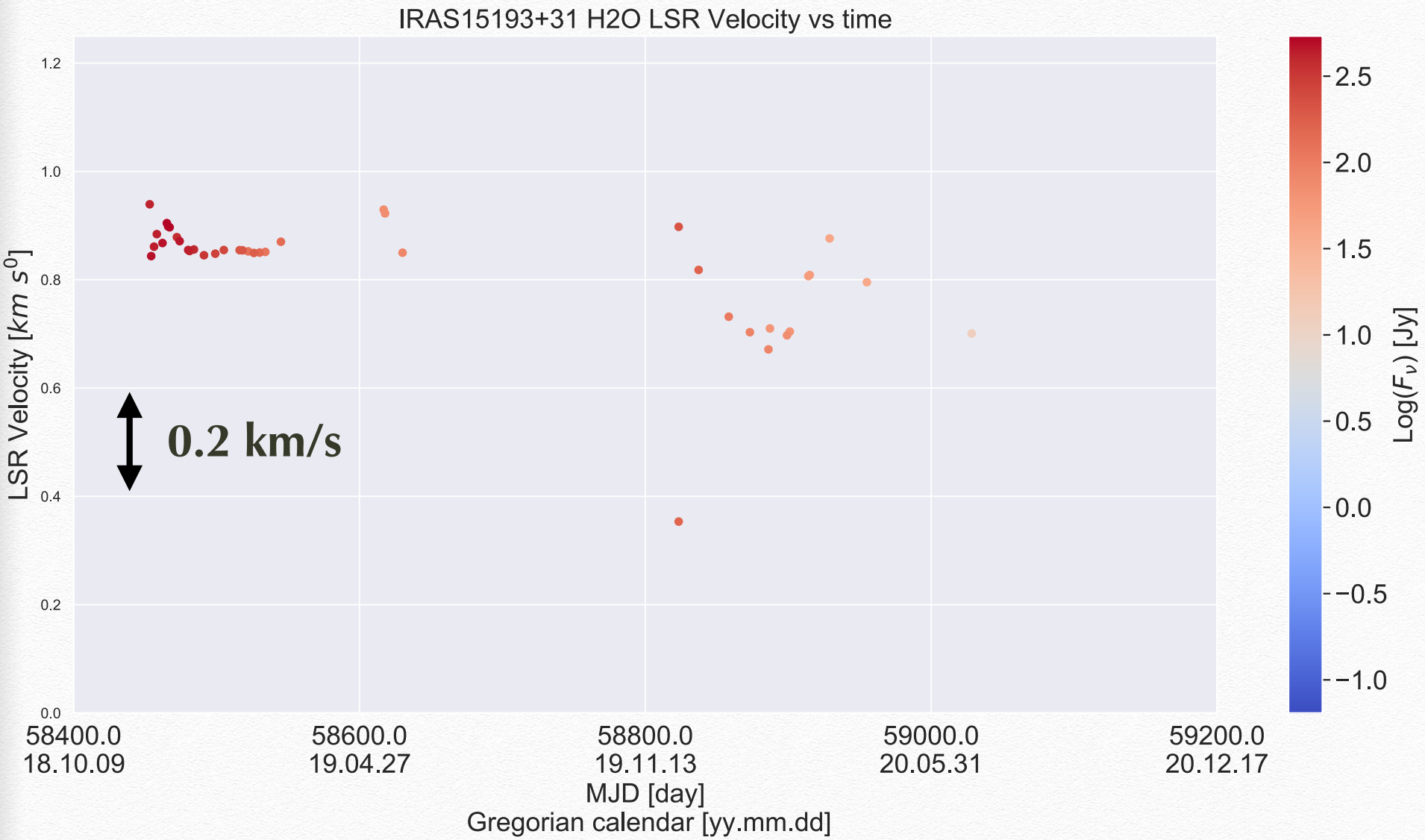




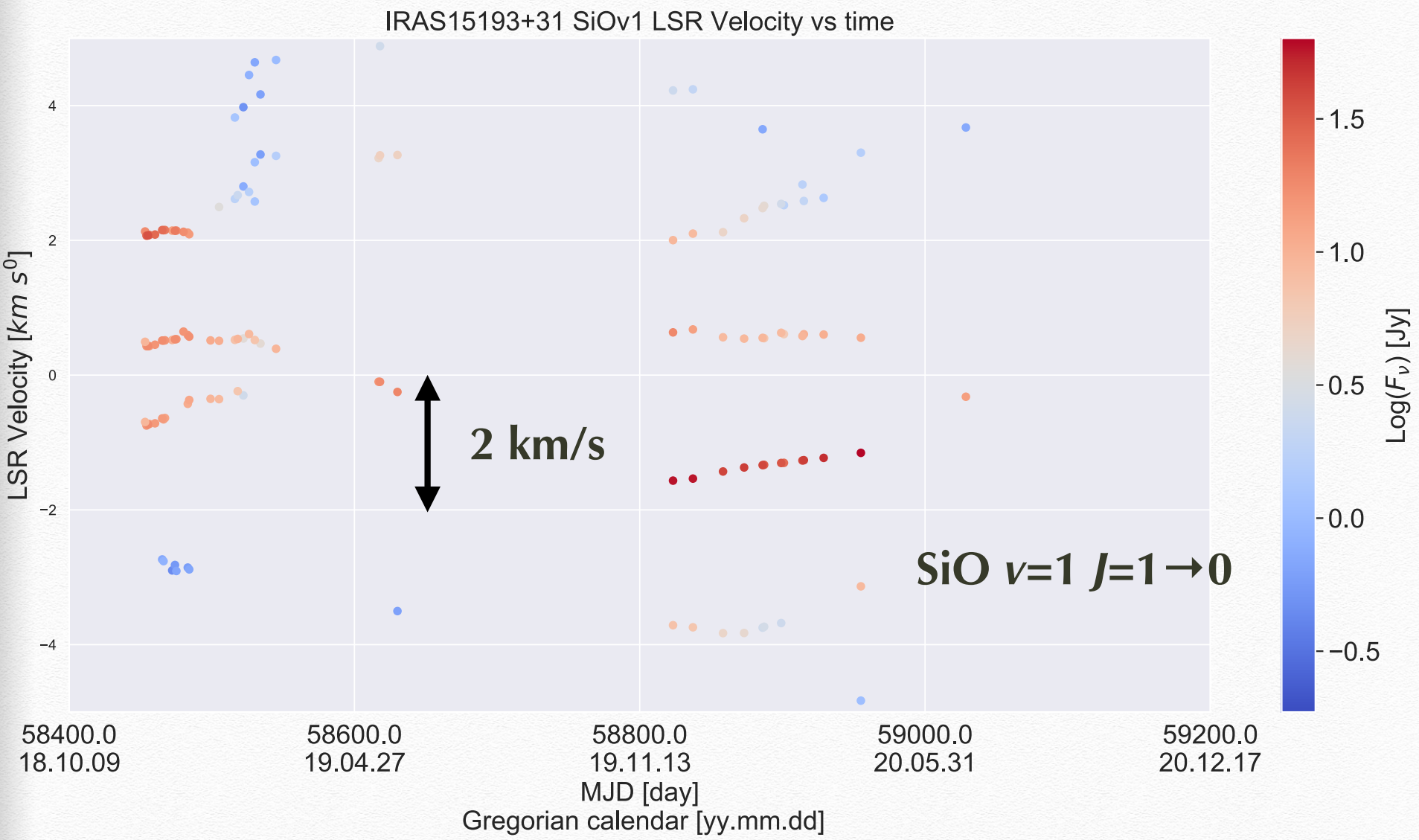


c.f. shock propagation ~30 km/s → Δt~1.6 yr@10 au

Stability of velocity field in H_2O maser region



Catching propagation of pulsation-driven shock waves?



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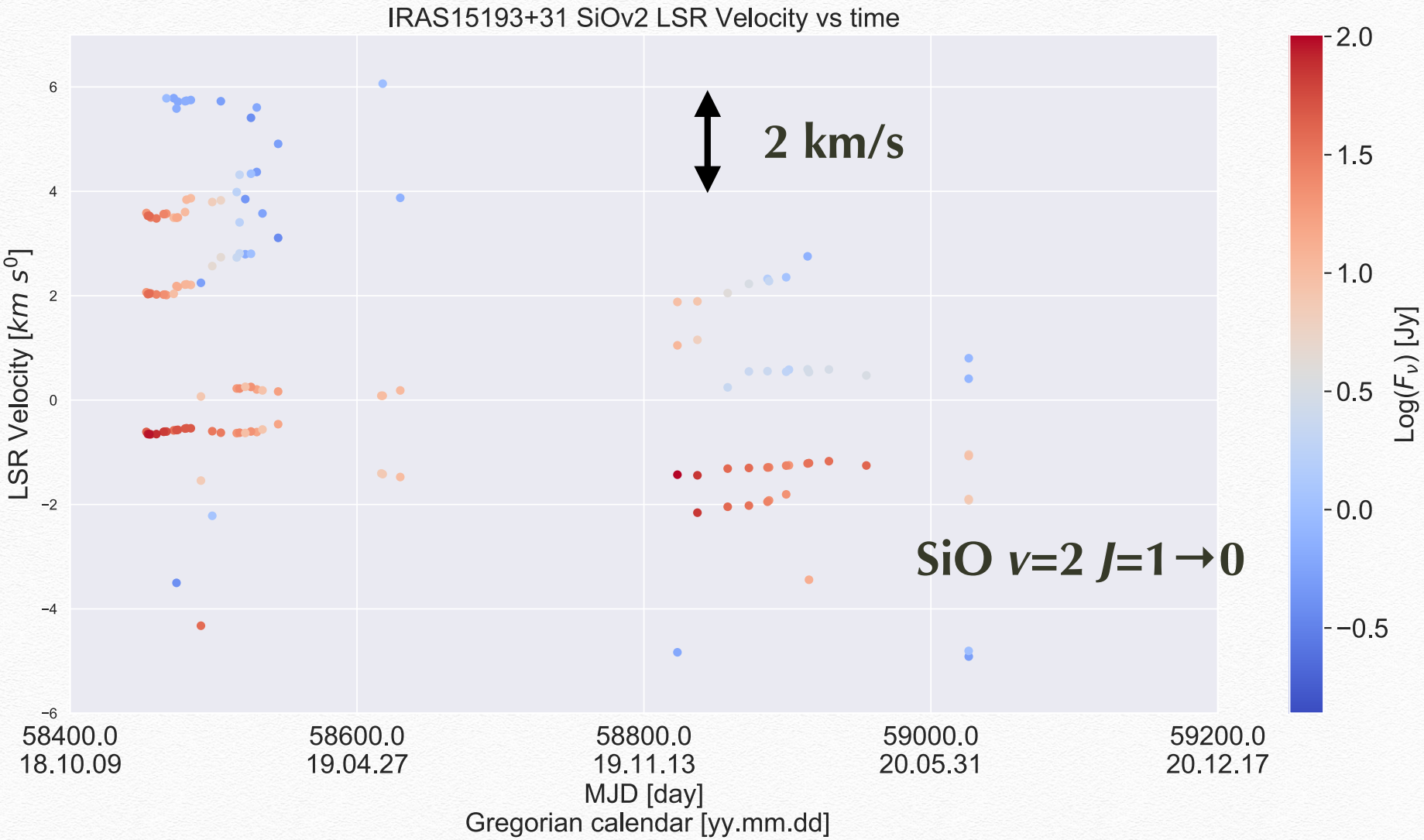

HINOTORI science cases in single-dish updated

- Remaining issues in HINOTORI for single-dish
  - Doppler tracking with TZ
  - Customized band filtering with the perforated plates
  - Efficient integration in TZ with flagging for bad pointing data

- Monitoring and surveying circumstellar H_2O, SiO, HCN masers
  - **FLASHING (towards water fountain and pointing sources)**
  - BAaDE (Bar and Asymmetric Disk Exploration) follow-up
  - Revisting **Nobeyama SiO masers in the Nuclear Disk/Bulge**
- Monitoring and surveying interstellar H_2O, SiO, CH_3OH masers
  - Chronology of massive star-forming regions
  - Integration of time-series data for deep exposure for thermal lines (e.g. SiO, NH_2D, $HC^{15}N$, SO, $H^{13}CO^+$, HCN, HCO^+)
- Deep exposure surveys of radio recombination lines
  - Seyfert galaxies hosting H_2O megamasers(?)

Acknowledgements

- Very thanks to
  - Nobeyama Radio Observatory
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