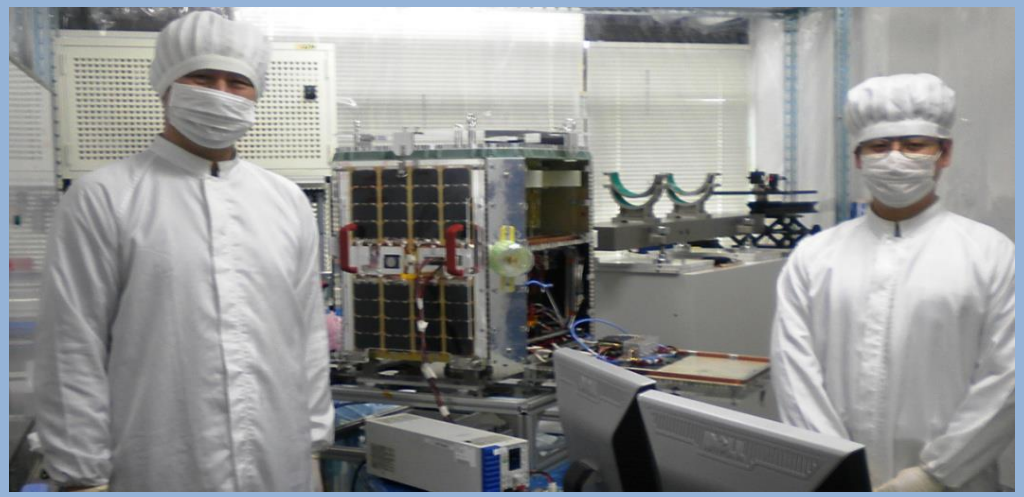
水沢でのSgr A* モニター観測

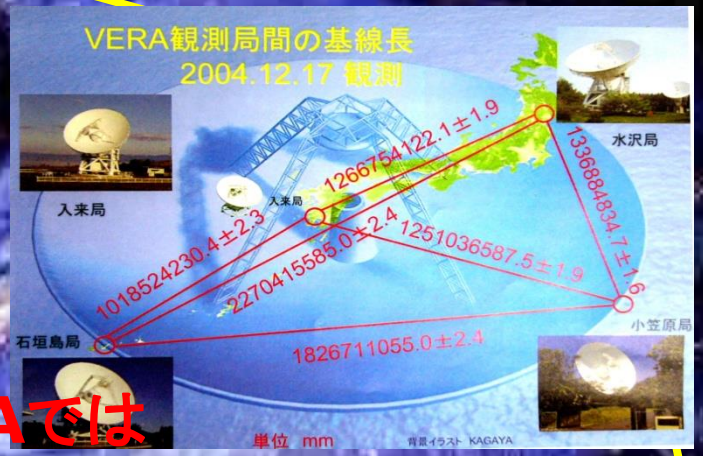
亀谷　収（国立天文台水沢VLBI観測所）



Nano-JASMINE衛星

ダウンリンク局　水沢10mアンテナ

天の川銀河で三角測量ができる範囲



銀河中心

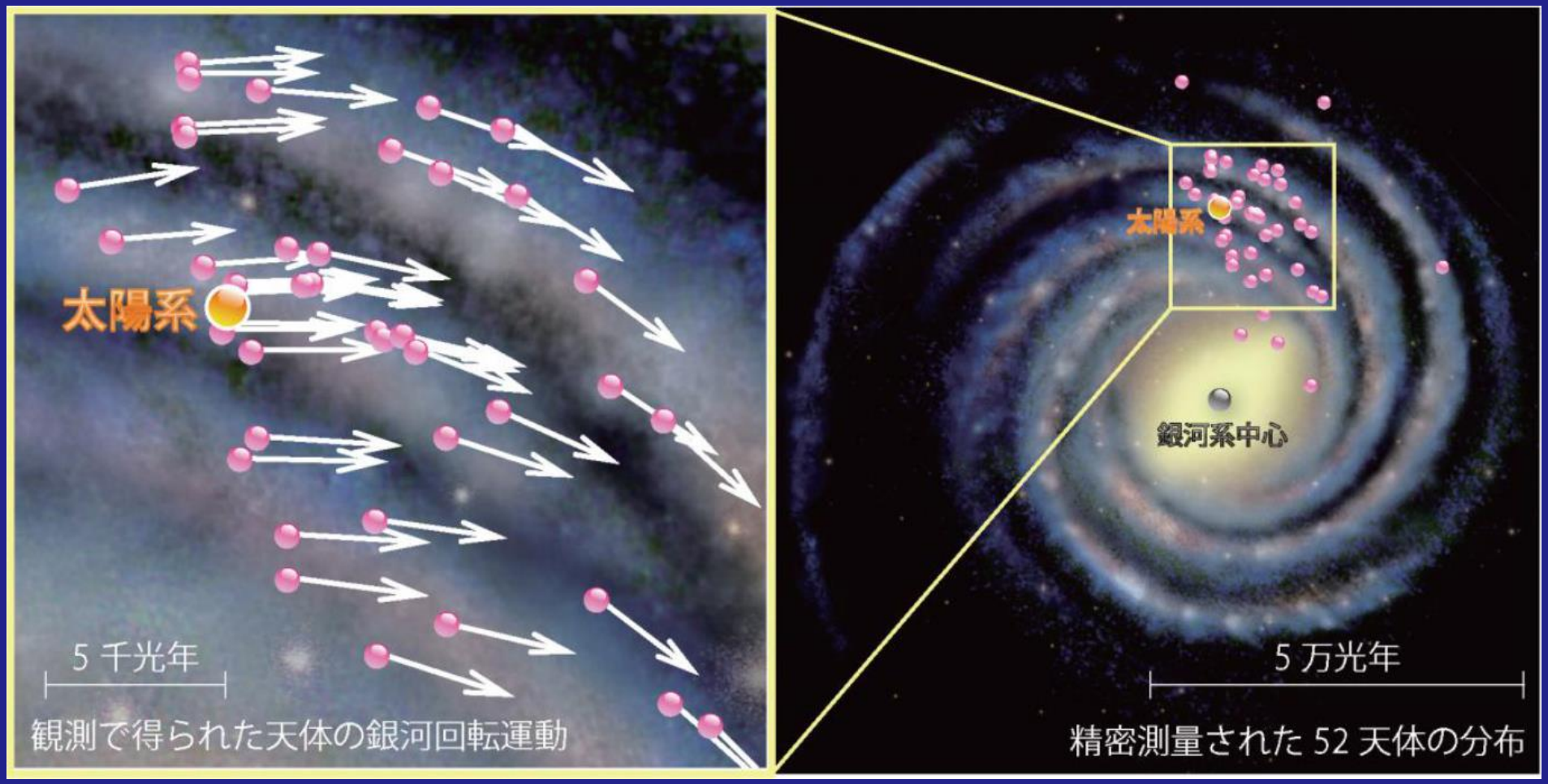
太陽

VERAでは

3万光年までの星の距離

天の川銀河の中の星の動き

VERA+VLBA



10m activity

Performance of the Mizusawa 10m telescope

- **1) Antenna & Receiver**

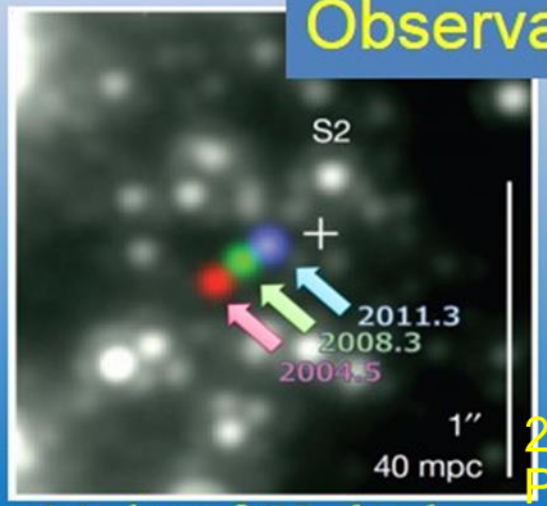
  Main reflector : 10.0m surface accuracy : 0.34mm(rms)
  S Band HPBW : 54′, aperture efficiency : 38%, Tsys:180K
  X Band HPBW : 13′, aperture efficiency : 63%, Tsys:100K
  22GHz Band HPBW : 5.2′, aperture efficiency : 36%, Tsys:130K
  43GHz Band HPBW : 2.7’, aperture efficiency : 25%, Tsys:200K

- **2) Driving ability**

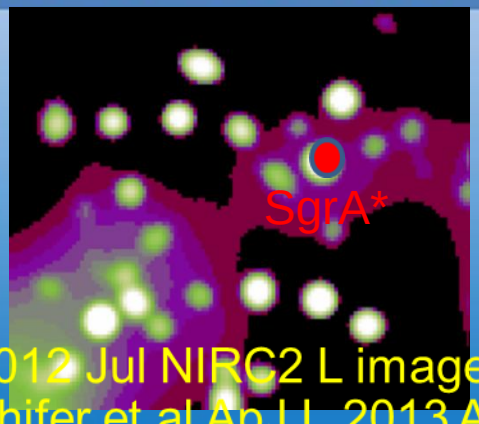
  Max. slew speed : AZ : 3.14˚/sec
  EL : 3.06˚/sec
  Max acceleration : AZ : 3.78˚/sec2
  EL : 3.71˚/sec2

VLBI Monitor of Sgr A*G2 cloud event

水沢10m 電波望遠鏡は、SgrA*G2
イベントのVLBIモニタ観測に2013年2月から2014年8月まで1年半に渡りほぼ毎日参加していた。
Recording system: VSSP32
Band Width: 32MHz
Sampling Rate: 128Mbps
Observation Start: Feb 11, 2013

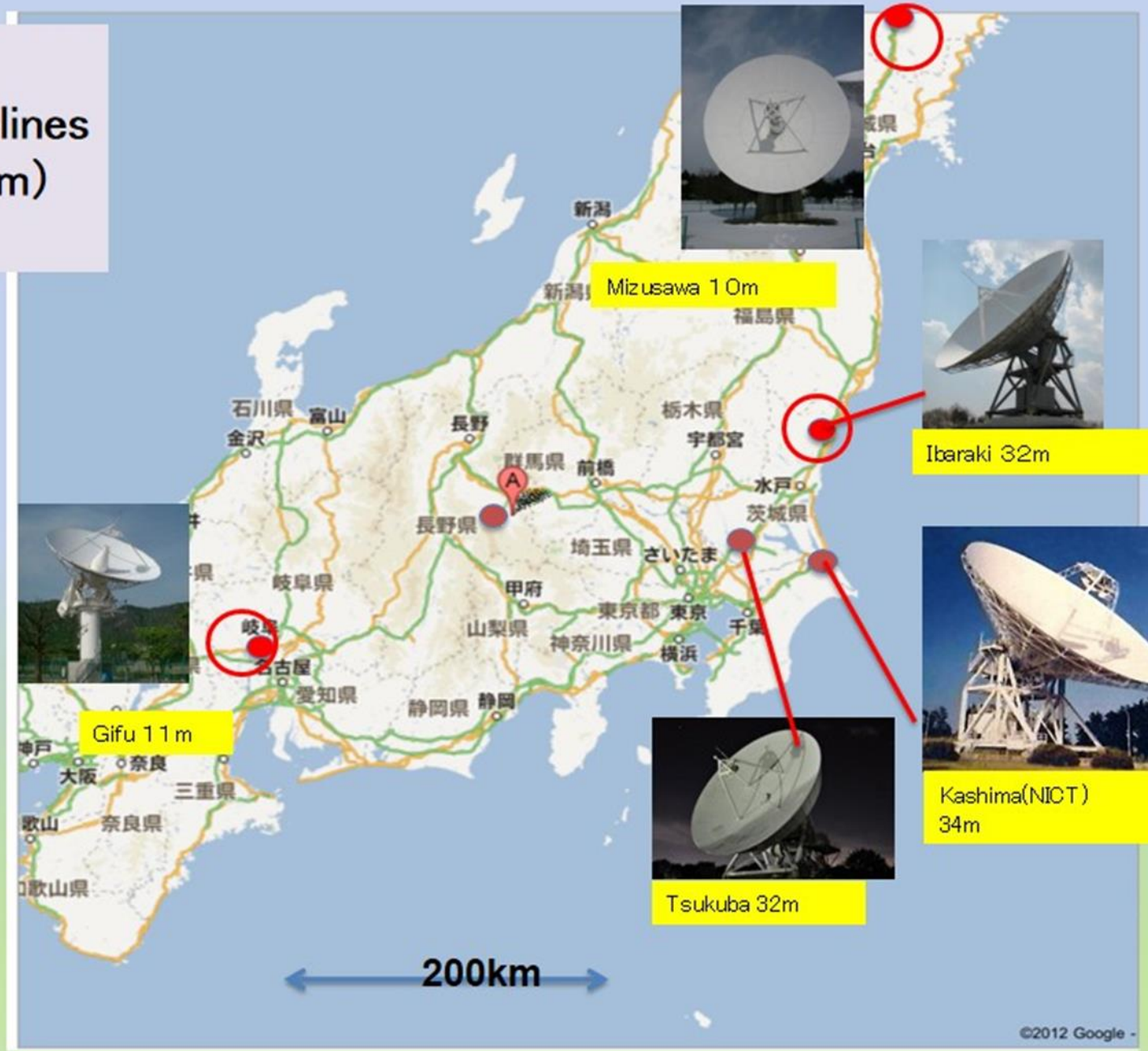


Motion of G2 cloud near SgrA*(+)
Gillessen et al. 2012 Nature



2012 Jul NIRC2 L image
Phifer et al ApJ L.2013 Aug

Daily
Short baselines
(80～300km)
@22GHz



Possible brightening at 22 GHz of Sgr A*

- ATel #5013; **M. Tsuboi, Y. Asaki(ISAS/JAXA), Y. Yonekura(Ibaraki Univ.), H. Kaneko, Y. Miyamoto, M. Seta, N. Nakai(Univ. of Tsukuba), O. Kameya, M. Miyoshi(NAOJ), H. Takaba, K. Wakamatsu(Gifu Univ.), Y. Fukuzaki(GSI), T. Morimitsu(Univ. of Tokyo), M. Sekido(NICT), T. Oka, S. Takekawa (Keio Univ.), T. Omodaka, T. Handa(Kagoshima Univ.), and A. Takumi(OUJ)**

  on **26 Apr 2013; 13:00 UT**

  Credential Certification: Masato TSUBOI (tsuboi@vsop.isas.jaxa.jp)

  - Subjects: Radio, Black Hole, Transient
  - Referred to by ATel #: 5014, 5016, 5020, 5025

- We report a possible brightening at 22 GHz of Sgr A* during daily monitoring observations with a short-baseline VLBI (Mizusawa10-m RT, Takahagi32-m RT, Tsukuba32-m RT, and Gifu11-m RT) which is a subset of the Japanese VLBI Network. This purpose of the monitor is to search the increase of 22-GHz emission from Sgr A* induced by the interaction of the G2 cloud with the accretion disk (Gillessen et al. 2012, Nature, 481, 51). The average flux density at 22 GHz of Sgr A* was 1.05+-0.16 Jy (preliminary) in the observing period in February and March 2013 (ATel #4923). The error is scattering of the data in the period. The flux density was gradually increased. The average flux density in DOY=105-113 d is 1.55+-0.18 Jy (preliminary). Because the amplitude of the brightening can be still explained by usual variability of Sgr A*, the relationship between the brightening and the X-ray flare detected by Swift (ATel #5006, #5008) is not clear for the present. We will continue the daily monitoring observations of Sgr A*.

The results has been published to APJ Letters in 2015 Jan. 1

The Astrophysical Journal Letters, 798:L6 (4pp), 2015 January 1 doi:10.1088/2041-8205/798/1/L6
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NO MICROWAVE FLARE OF SAGITTARIUS A* AROUND THE G2 PERIASTRON PASSING

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ABSTRACT

In order to explore any change caused by the G2 cloud approaching, we have monitored the flux density of Sgr A* at 22 GHz from 2013 February to 2014 August with a sub-array of the Japanese Very Long Baseline Interferometry Network. The observation period included the expected periastron dates. The number of observation epochs was 283 days. We have observed no significant microwave enhancement of Sgr A* in the whole observation period. The average flux density in the period is $S_\nu = 1.23 \pm 0.33$ Jy. The average is consistent with the usually observed flux density range of Sgr A* at 22 GHz.

Key words: galaxies: nuclei – Galaxy: center – ISM: individual objects (G2)

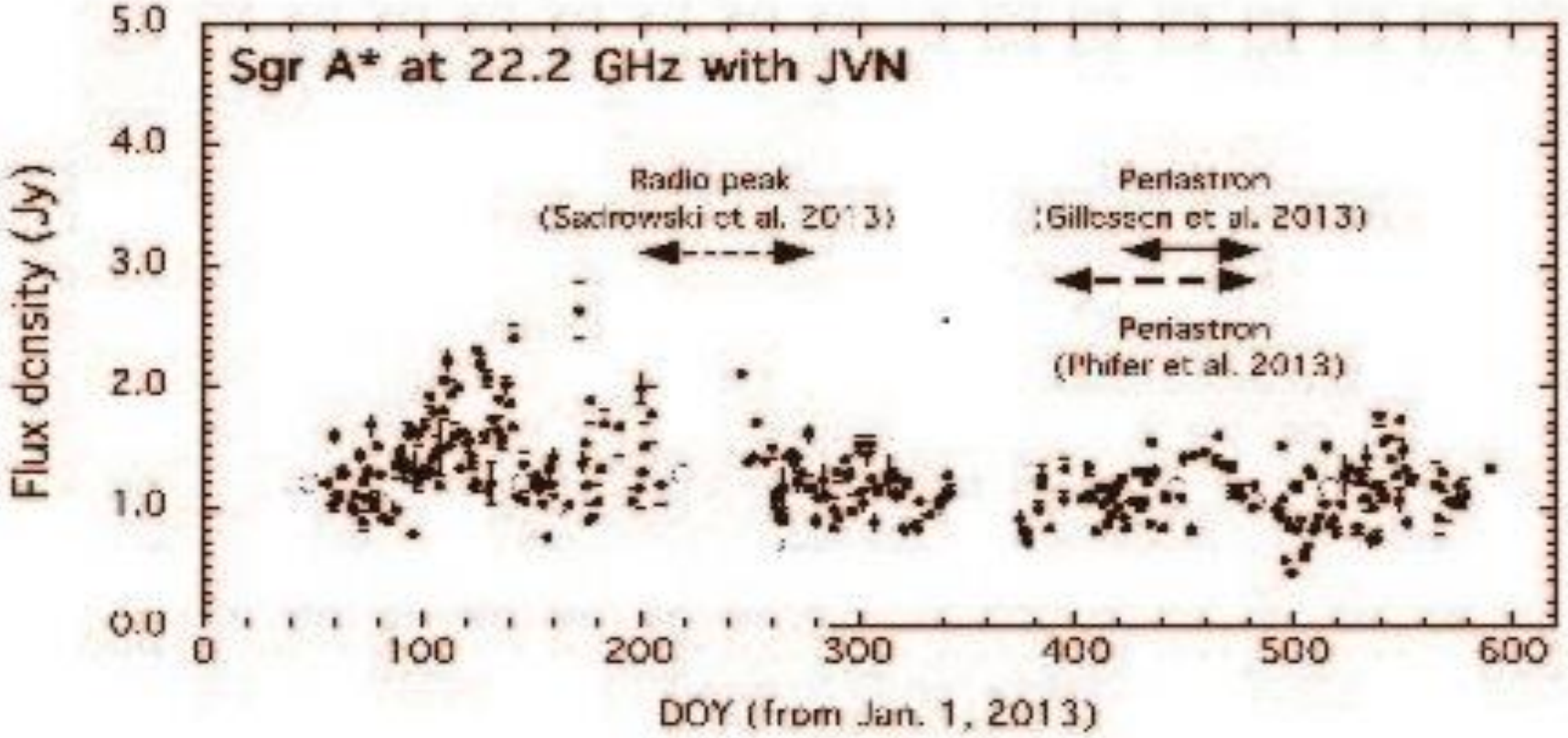
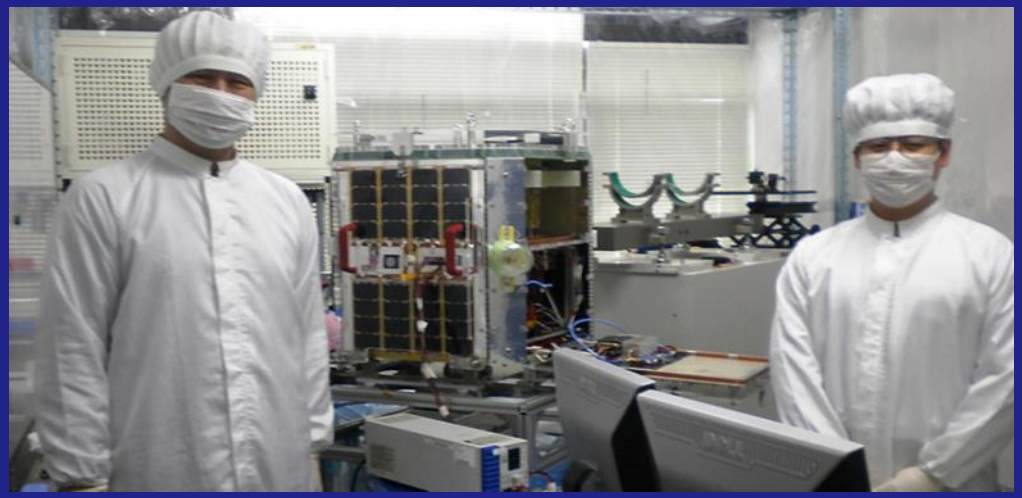


Fig. 1.— The light curve of Sgr A* at 22.2 GHz with the JVN monitor (filled circles). The horizontal axis is the elapsed day (DOY) from 1 Jan, 2013. The monitor had been performed from Feb. 25, 2013 to Aug. 12, 2014. The error bars show only statistical errors ($\pm 1\sigma$) of each data. We have observed no significant enhancement of the flux density of Sgr A* at 22.2 GHz in the whole monitor epoch. Open circles shows the flux densities of Sgr A* at 21.2 GHz from the NRAO public data.

Nano-JASMINEへの期待

- 水沢10mアンテナをNano-JASMINE衛星のダウンリンク局として使う予定。
- 日本初の位置天文学衛星に期待
- JASMINE衛星へつながるノウハウの蓄積



まとめ

- 国立天文台水沢10m電波望遠鏡は、22GHz帯のSgrA*の電波強度モニターとして、2013年2月より2014年8月までほぼ毎日1回の頻度で国内の大学連携VLBIにかかわる岐阜局、茨城局、鹿島局、つくば局等と共にVLBI観測を行ってきた。速報は、APJ Lettersに掲載した。

- 水沢10m局をダウンリンク局として使う事でNano-JASMINEによる日本初の位置天文衛星観測により、特に固有運動の高精度測定による天の川銀河研究への貢献に期待したい。

謝辞
多大なサポートを頂いているVERAグループ、SgrA*モニター観測グループ、Nano-JASMINEグループの皆様に厚く感謝いたします。