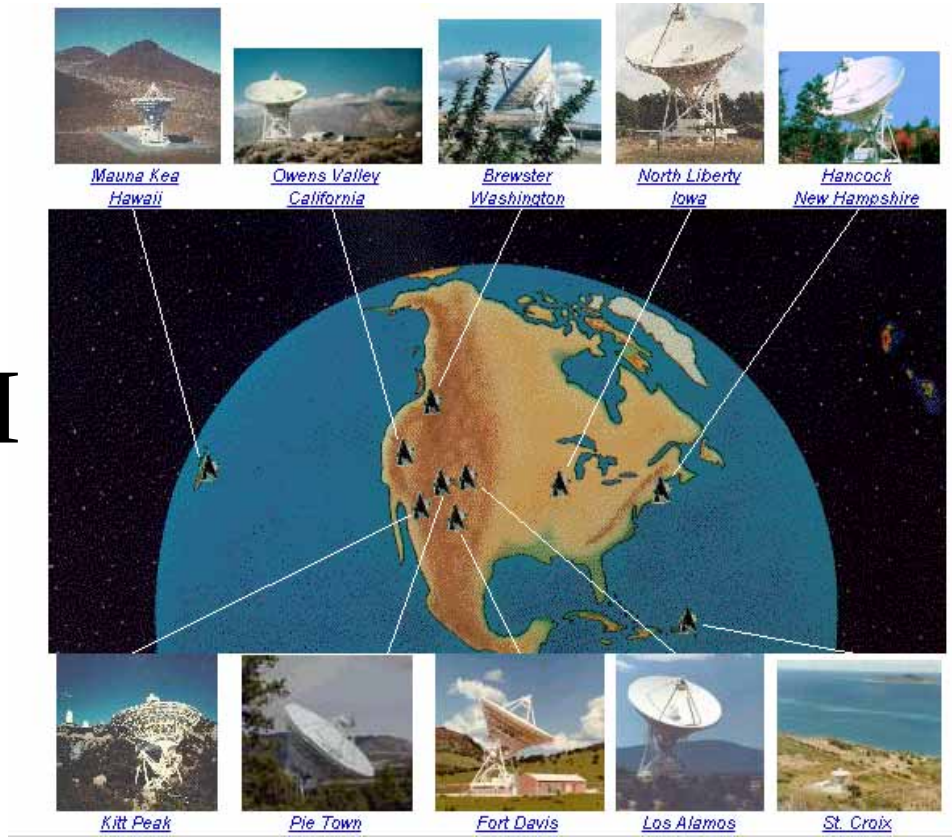
天文ＶＬＢＩ国際標準ステータス

三好　真
(ＶＬＢＩ天文学)

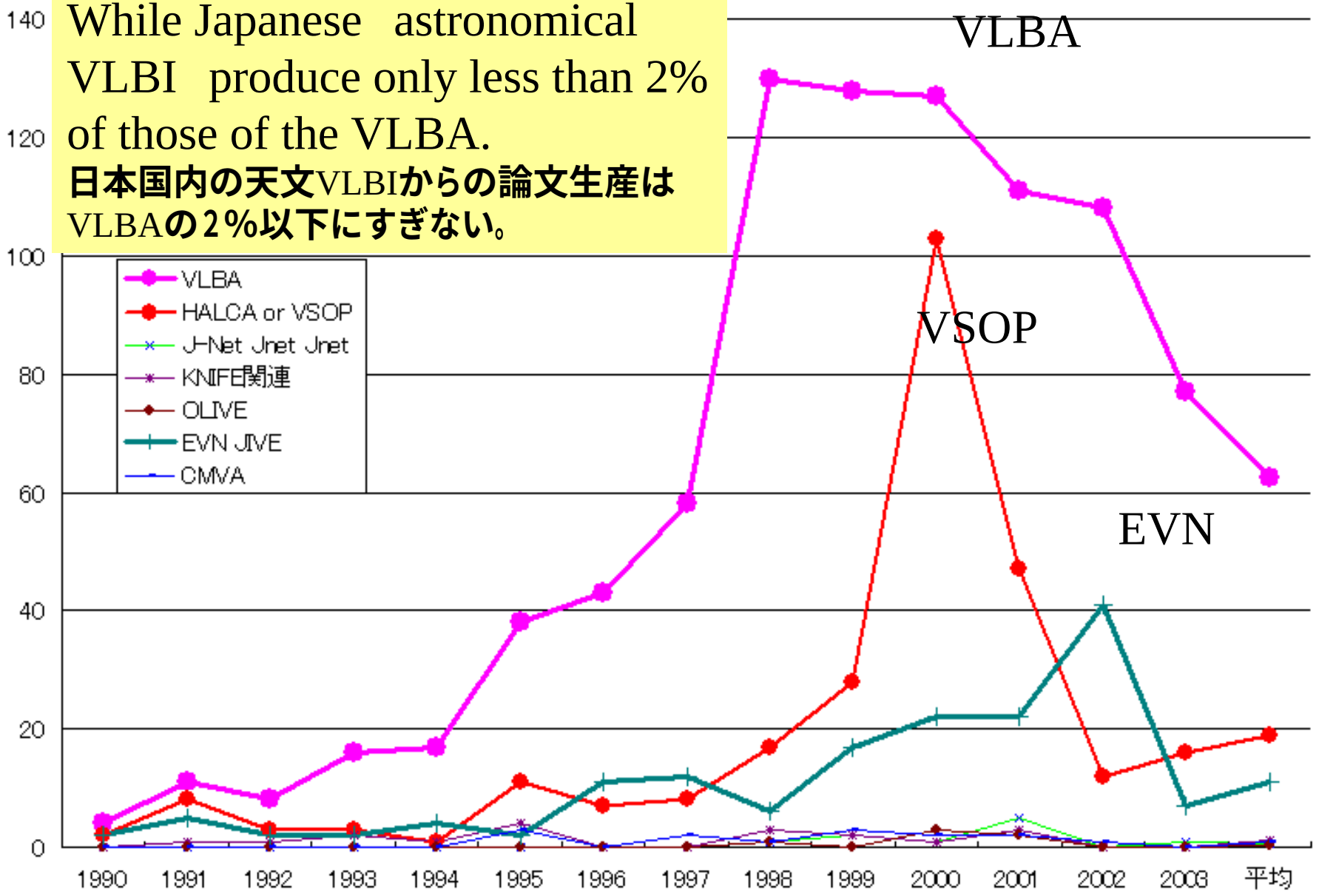
World standard in astronomical VLBI is the VLBA.



論文数世界一: The most of papers come from the VLBA. While Japanese astronomical VLBI produce only less than 2% of those of the VLBA.

日本国内の天文VLBIからの論文生産はVLBAの2%以下にすぎない。

ADS031201



VLBA
the best VLBI instrument

25m鏡10台 (＋VLA, ボン100m)
最大基線長　8600km
観測波長　90, 50, 21, 18, 13, 6, 4, 2, 1, 0.7 & 0.3cm
最大記録レート　512MBPS
空間分解能　0.17 mas (43GHz)
柔軟な運用体制　ex.　**ガンマ線バーストなど突発現象**
頻繁なモニター観測もできる　ex.　**SIOメーザ3週間おき、75回。**
データ、相関処理後12ヶ月でdata open use
成果がでるよう細かい配慮ー　失敗観測も再観測する場合多い
全局･同一システム　　較正が大変やりやすい。

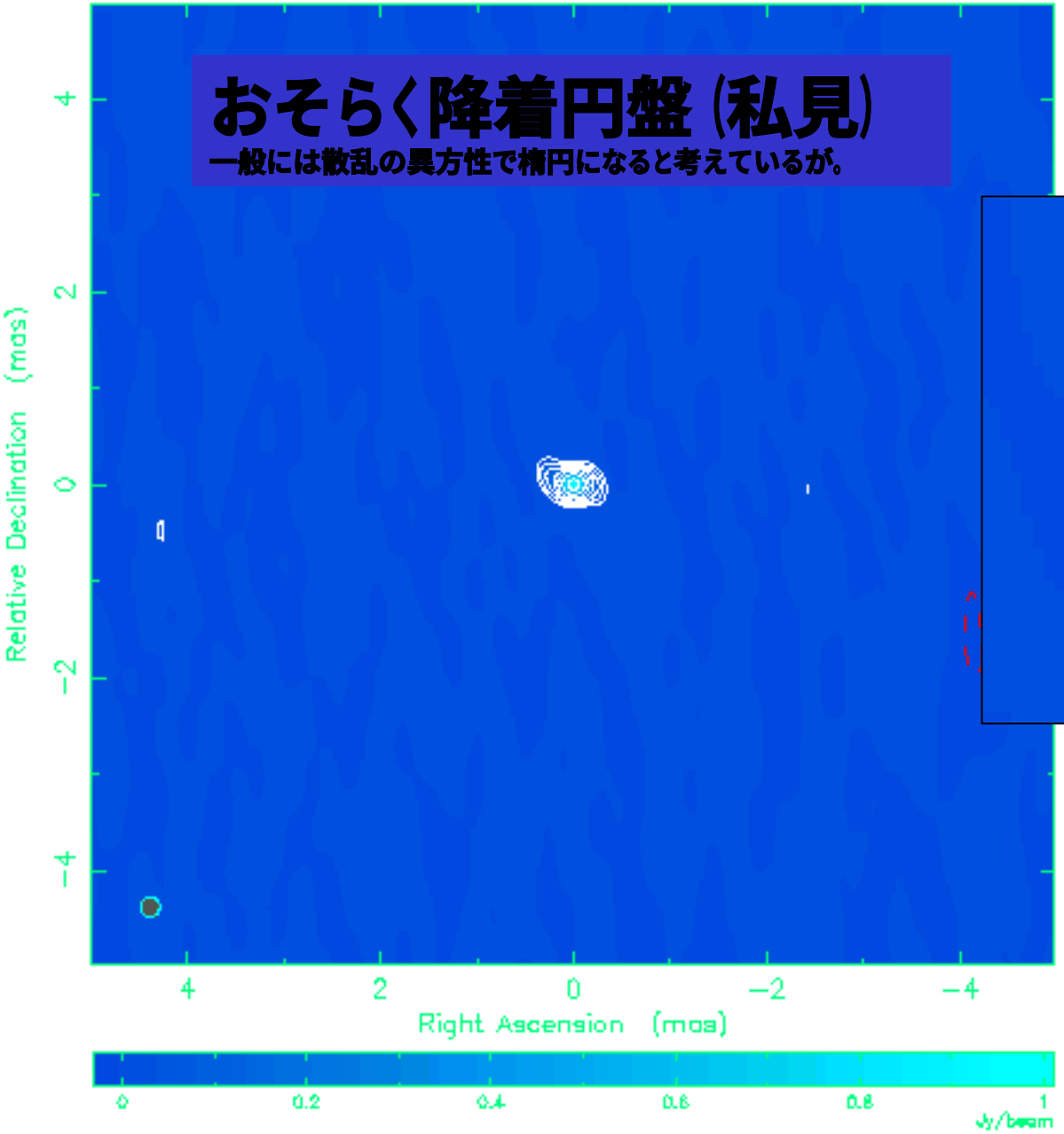
mm-VLBIもＶＬＢＡがやってくれます。

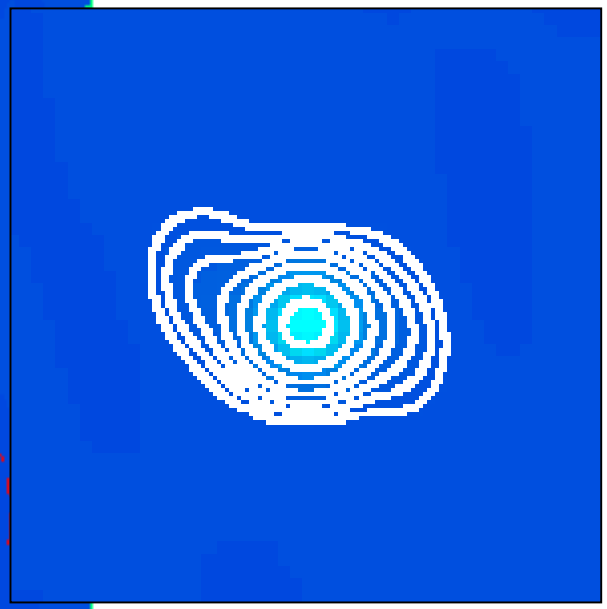
VLBA, 3mmにおける性能

- **フリンジ検出は１９９８年４月　　(もう５年も前)**
- **Tsys 130K** typical at zenith Efficiency typical 40Jy/K (System Equivalent Flux Density SEFD about 5000Jy).

- **PT, KP, LA, FD, NL, MK, OV available now. 7局に配備**
  HN by February (?)
- Dynamic Scheduling
  (天候見ておこなう。待たせることもある)
- **512MB/s available**, if approved by proposal committee
  (ＶＬＢＡレコーダ２台並列運転。８時間まで)

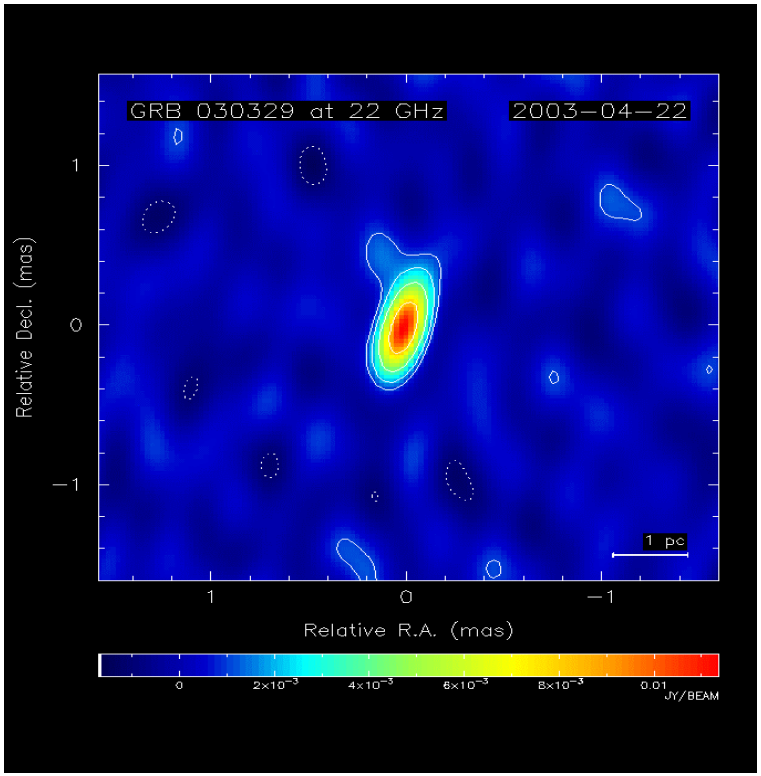
SgrA*@86GHz





Shen et al. (2004?)

即時対応の機動力。
VLBA shows excellent mobile power.



ex. GRB observations
発見　　3年3月29日
VLBA観測　4月1，6日
Bonn100m加えて観測　4月22日
Bonn,VLA,GBT加えて　5月19日

Taylor and Frail observed GRB 030329 with the VLBA on April 1 and April 6. On April 22, they used the 100-meter radio telescope in Effelsberg, Germany in addition to the VLBA. On May 19, they used the VLBA, the Very Large Array (VLA) in New Mexico, the NSF's Robert C. Byrd Green Bank Telescope in West Virginia, and the Effelsberg telescope. http://www.nrao.edu/pr/2003/grb030329/

長期にわたる高頻度観測も行えます。
VLBA performs long and frequent monitor

Ex. TX Cam

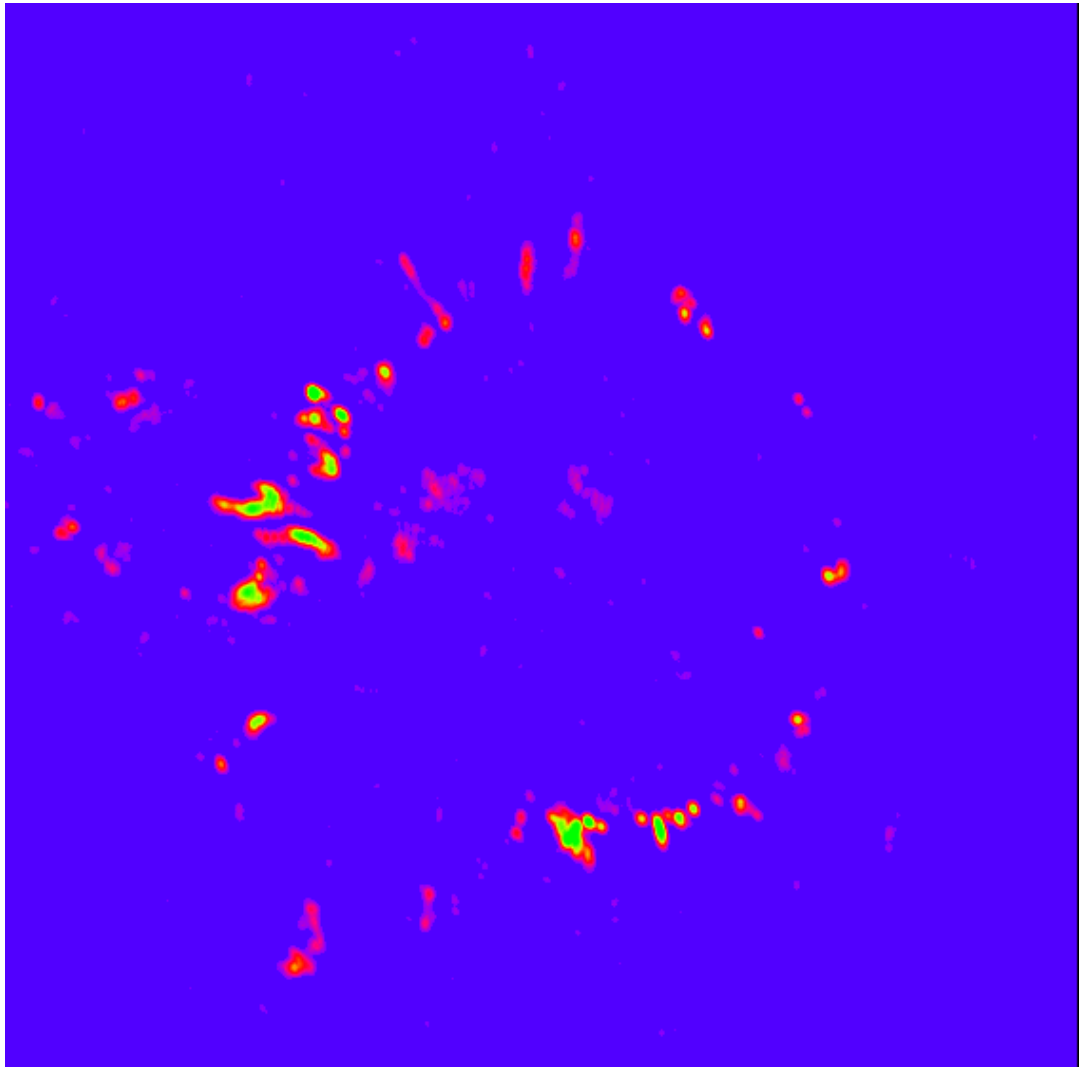
SiO maser

J=1−0, *v=1*

by Diamond et al.

Every 3 weeks

More than 4 years



超大型電波望遠鏡と組んで
マイクロJyの高感度VLBI観測も実現

ボン100m

アレシボ305m

The VLBA + α has the highest sensitivity about a few micro Jy.

GBT100m

VLA
130m相当

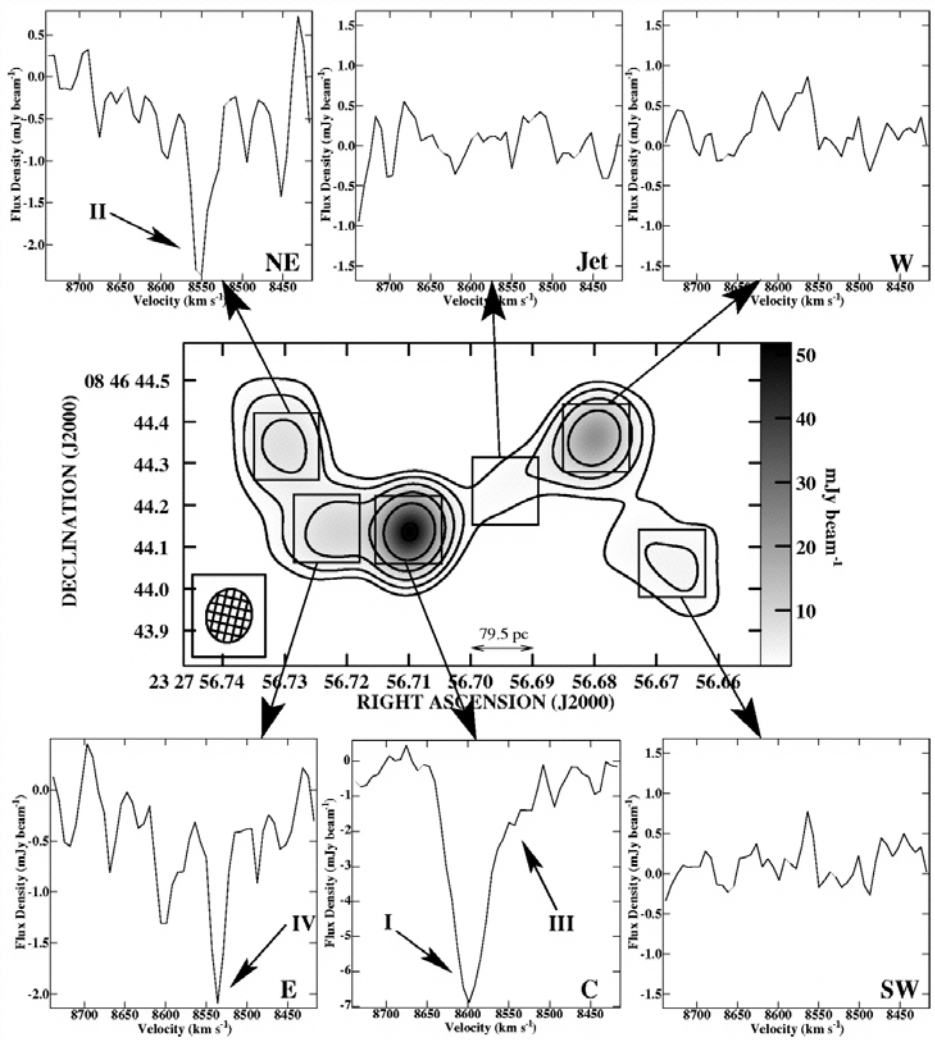
example1 :

Sensitive VLBI Continuum and H I: First Scientific Observations with the Combined Array VLBA, VLA, and Arecibo

Emmanuel et al., 2003ApJ...597..809M

We present phase-referenced VLBI observations of the radio continuum emission from, and the neutral hydrogen 21 cm absorption toward, the luminous infrared galaxy NGC 7674. The observations were carried out at 1380 MHz ***using the VLBA, the phased VLA, and the 305 m Arecibo radio telescope***. These observations constitute the first scientific use of the Arecibo telescope in a VLBI observation with the VLBA. The high- and low-resolution radio continuum images reveal several new continuum structures in the nuclear region of this galaxy. At ~100 mas resolution, we distinguish six continuum structures extending over 1.4" (742 pc), with a total flux density of 138 mJy. Only three of these structures were known previously. All these structures seem to be related to active galactic nucleus (AGN) activity. The overall S-shaped pattern that the radio structures seem to form could be the result of the interstellar medium diverting the outcoming jets from the central AGN. However, we cannot rule out the possibility of a black hole merger that could result in a similar structural pattern. At the full resolution of the array (11✕5 mas), we detect only two of the six continuum structures. Both are composed of several compact components with brightness temperatures on ***the order of 10^7 K***. While it is possible that one of these compact structures could host an AGN, they could also be shocklike features formed by the interaction of the jet with compact interstellar clouds in the nuclear region of this galaxy. Complex H I absorption is detected with our VLBI array at both high and low angular resolution. Assuming that the widest H I disk or torus feeding a central AGN, we estimate an enclosed dynamical mass of ~7✕10^7 M_{sl} comparable to the value derived from the hidden broad Hβ H IH IH INGC 7674 spectrum toward the continuum structures with H I absorption is very consistent with the Arecibo single-dish H I absorption spectrum at 3&farcm;3 resolution.

Continuum image of the nuclear region in NGC 7674 at 1380 MHz. The restoring beam size is 92 ✕ 76 mas in position angle 16 5. A two-dimensional Gaussian taper falling to 30% at 2.5 M was applied. The contour levels are -0.5, 0.5, 1, 2, 4, 8, 16, and 32 mJy beam^{-1}. The rms noise level is 78microJy beam^{-1}. The properties of the labeled components are listed in table 4.



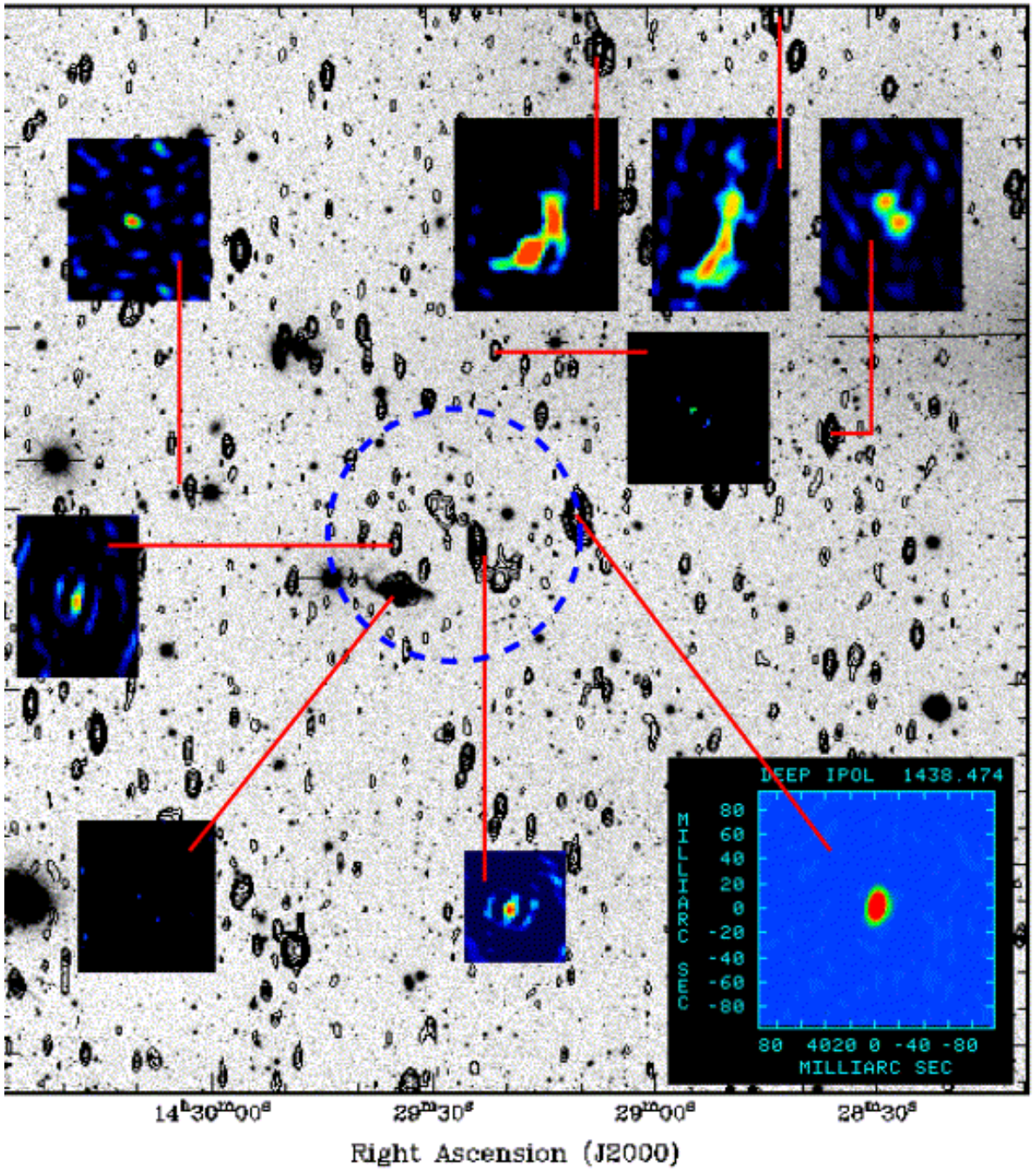
example2:

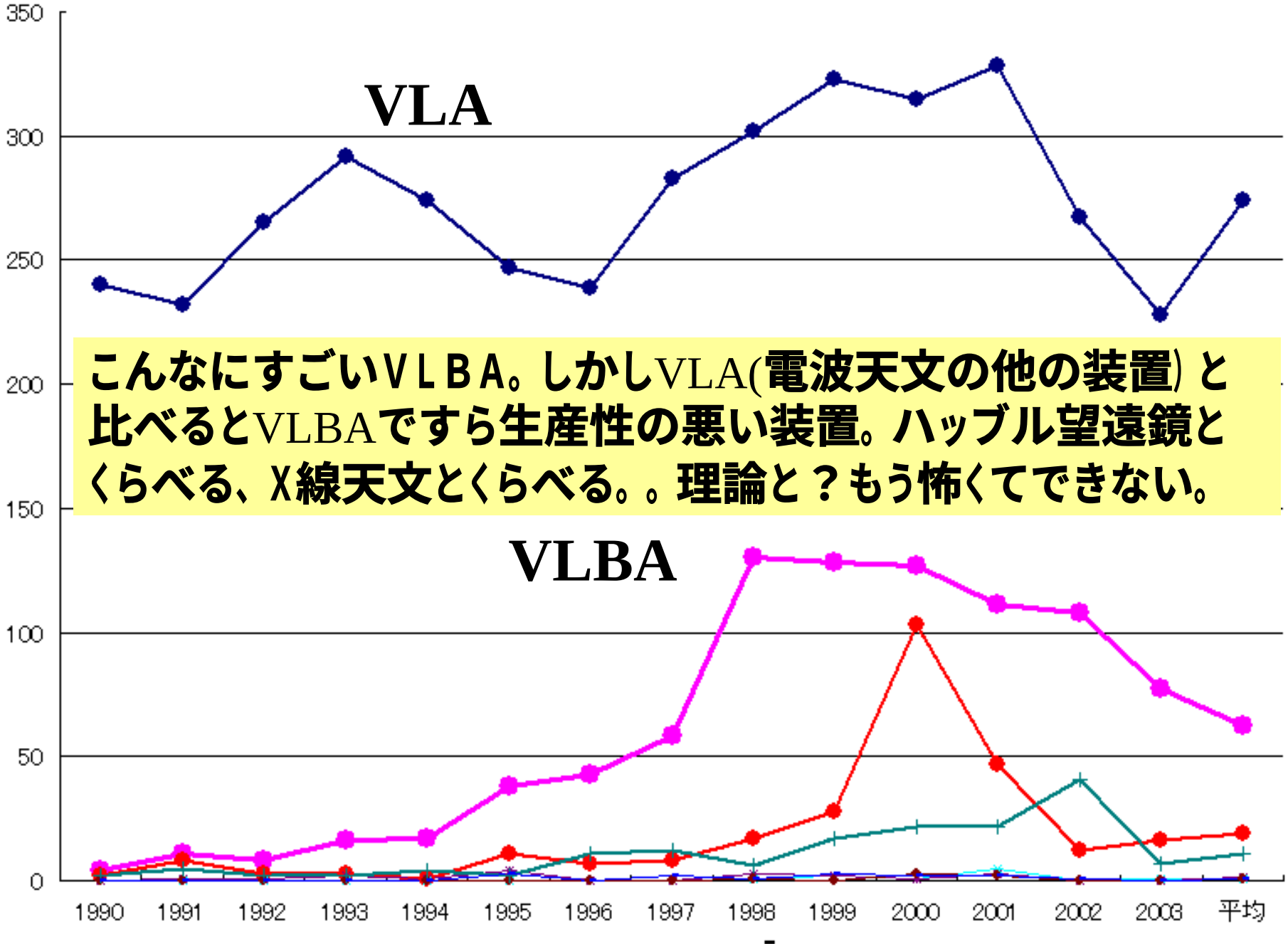
The deepest and widest VLBI survey yet:
VLBA+GBT 1.4 GHz observations in Bootes
Garrett et al. in New Astronomy Reviews, 47, 385-389.

Abstract

We present preliminary results from the deepest VLBI observations yet conducted. VLBA+GBT 1.4 GHz observations of a region within NOAO-N, reach an r.m.s. noise level of *9 microJy per beam*. Three sources are clearly detected (/>) within the inner 2 arcmin of the GBT primary beam, including two sub-mJy sources and the `in-beam' calibrator. In addition, by tapering the data, we map out a much larger area of sky, reaching well beyond the half-power point of the GBT primary beam. An additional 6 sources are detected in the extended field. We comment briefly on the scientific motivation for even deeper and wider VLBI surveys, and note that the summed response of sources in the field will permit self-calibration techniques to be employed in any region of the radio sky, including so-called `blank' fields.

Fig. 2. **Deep VLBA+GBT 1.4 GHz** observations of a small portion of the NOAO-N Bootes deep field.
The VLBI detections are shown inset. Radio line contours (produced by the WSRT) are superimposed on the NOAO optical field). One non-detection is also shown (bottom left)—a bright, presumably nearby (star forming) spiral galaxy that is well detected by the WSRT. These are the deepest images made with VLBI to date (Garrett, Wrobel and Morganti in preparation) **with an r.m.s. noise of 9 microJy/beam.**




VLA
VLBA
こんなにすごいＶＬＢＡ。しかしVLA(電波天文の他の装置)と比べるとVLBAですら生産性の悪い装置。ハッブル望遠鏡とくらべる、Ｘ線天文とくらべる。。理論と？もう怖くてできない。
350
300
250
200
150
100
50
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
平均

世界はここまで来た

a few μJy、数十μ秒角、ミリ波まで共同利用

しかもＶＬＢＡは、

・安定・均一・高信頼・高機動力

・すぐにe-VLA (0-300km) と組んで密なuvカバー

８６GHzまで,特徴の無い天文地上ネットはいらない。

作っても閑古鳥がくるだけ。

Ref. 「車より熊の方がたくさん走る高速道路」