VLBI monitoring of gamma-ray blazars with VERA: *GENJI* project

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Abstract:
We present an overview of a VLBI monitoring project for gamma-ray blazars entitled ***GENJI*** (Gamma-ray Emitting Notable-AGN monitoring by Japanese VLBI). In order to explore gamma-ray emission regions, GENJI aims for densely-sampled monitoring of gamma-ray loud blazars with a Japanese VLBI array of VERA (VLBI Exploration of Radio Astrometry) at 22GHz.

Introduction

Gamma-ray loud blazars are known as the most powerful relativistic jets in the Universe. In spite of various dedicated investigations, it is not yet clear where and how gamma-rays are produced. Since they are essentially originated in compact and highly variable regions, a densely-sampled VLBI monitoring is indispensable for exploring the origin of gamma-rays. Here we will present an overview of a new pilot project entitled GENJI (Gamma-ray Emitting Notable-AGN monitoring by Japanese VLBI).

VERA

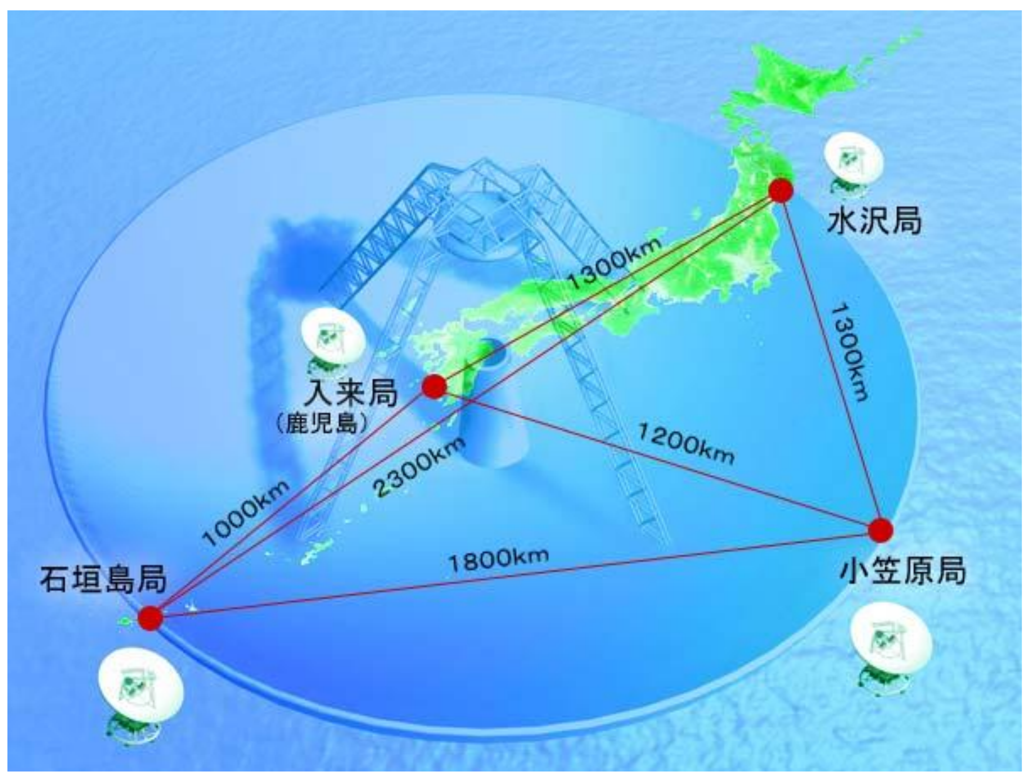


Fig. 1 VERA array. VERA is a Japanese VLBI array dedicated to phase-referencing VLBI astrometry to explore the 3D structure of Milky Way with a target accuracy of 10 μas level (e.g. Kobayashi et al. 2003, Honma et al. 2003). VERA consists of four 20m-telescopes.

Basic Concept of GENJI

GENJI aims for weekly monitoring of gamma-ray loud blazars with VERA mainly at 22 GHz. Central to the achievement of dense-sampling monitoring is the systematic selection control of VERA calibrators which correspond to gamma-ray loud blazars. Compared with the project MOJAVE (Monitoring of Jets in AGN with VLBA experiment, e.g., Lister et al. 2009) with its observational interval ~ month, we conduct shorter interval observations (Nagai et al. *in prep*).

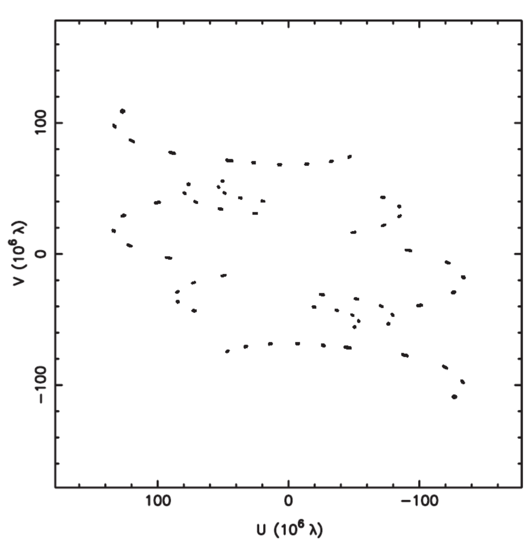
Observations

On-source-time for each GENJI source is typically ~30 minutes which consists of 4-6 scans at different hour angles. Each of the GENJI sources is observed almost once per two-week. LHCP is received and sampled with 2-bit quantization, and filtered by the VERA –digital-filter-unit. The data –recording-rate is 1024 Mbps. A typical baseband-allocation is 256MHz for GENJI sources.

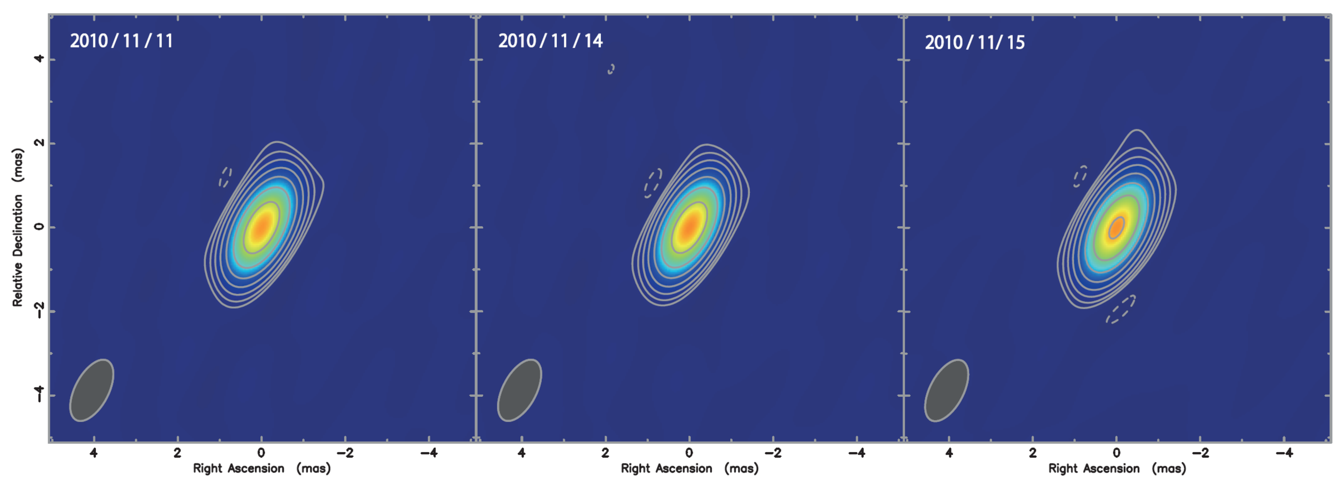
GENJI sources

Source	Alias	R.A. (J2000)	DEC (J2000)	z	Optical ID
J0136+4751	DA55	01h36m58.5497s	+47d51m29.100s	0.859	FSRQ
J0319+4130	3C84	03h19m48.1601s	+41d30m42.106s	0.0176	RG
J1230+1223	M87	12h30m49.4233s	+12d23m28.043s	0.004360	RG
J1512-0905	PKS1510-091	15h12m50.5329s	-09d05m59.828s	0.36	FSRQ
J1613+3412	DA406	16h13m41.0642s	+34d12m47.908s	1.39712	FSRQ
J1733-1304	NRAO530	17h33m02.7057s	-13d04m49.547s	0.902	FSRQ
J2202+4216	BL Lac	22h02m43.2913s	+42d16m39.979s	0.0686	BL Lac
J2253+1608	3C454.3	22h53m57.747s	+16d08m53.560s	0.859	FSRQ

Data Quality Check



An example of typical uv-coverage for NRAO530.



Total intensity images of NRAO530 All images are convolved with an identical synthesized beam of 1.6 * 0.8 mas with the position angle of -28 deg.

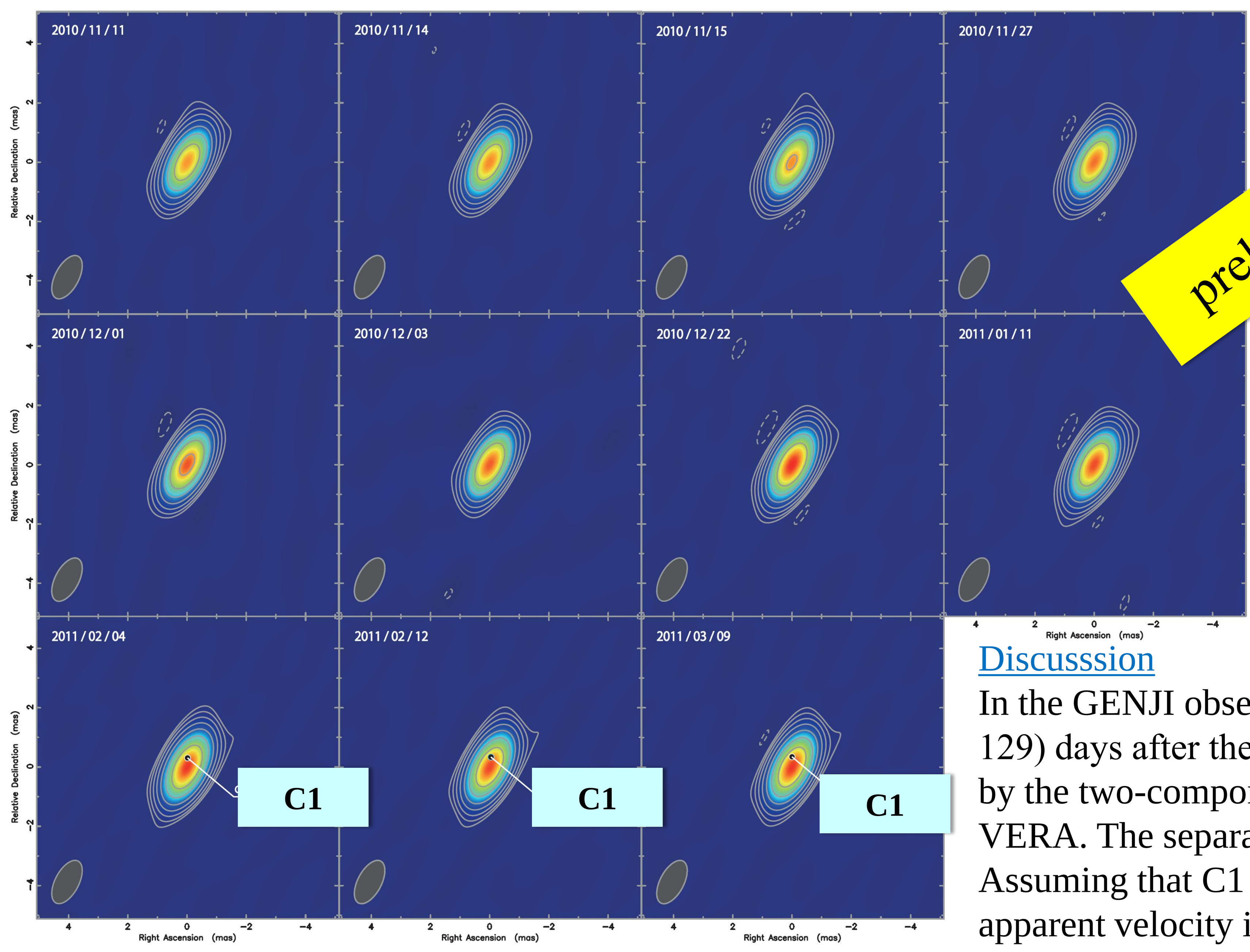
Comparison of nearly synchronous epochs

	Nov 11	Nov 14	Nov15
Total intensity (Jy)	3.16	3.24	3.22
Peak intensity (Jy/beam)	3.17	3.27	3.23
Image rms (JY)	0.01	0.01	0.007
Position Angle	-26	-26	-31
Major axis (mas)	1.64	1.53	1.58
Minor axis (mas)	0.82	0.88	0.93

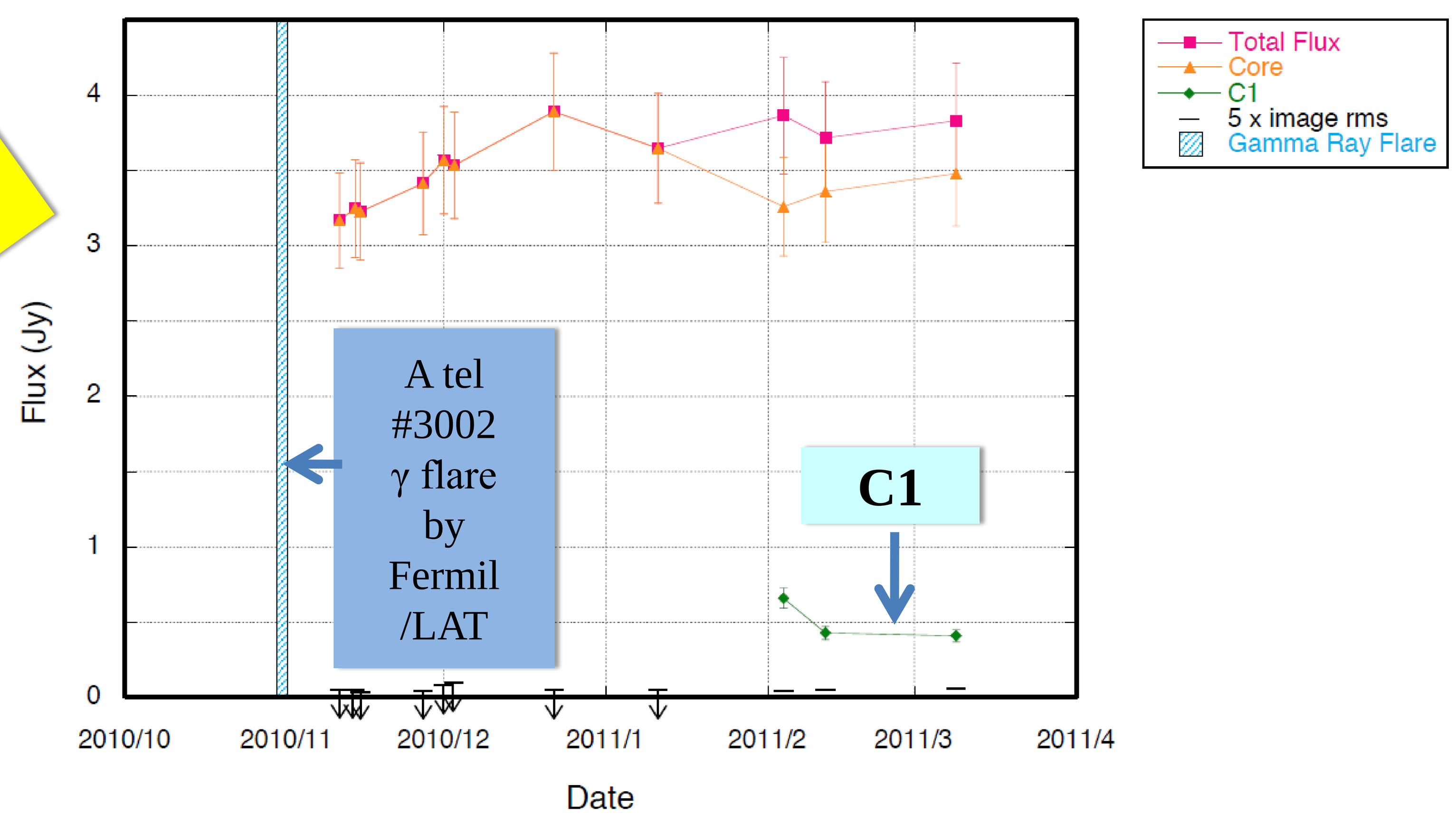
The comparison of nearly synchronous epochs above shows the consistent (i.e., same) images within a flux error of ~10%.

VERA observation after γ-ray flare NRAO 530: Emergence of a new-born component? (PI: K. Akiyama)

11-epoch images of NRAO 530 by VERA at 22GHz



Light-curve of NRAO530 by VERA at 22GHz



Discusssion

In the GENJI observation, we find a new component C1 after ~(96-129) days after the γ-ray flare detected by Fermi/LAT (Atel #3002) by the two-component Gaussian fitting of the CLEANed images of VERA. The separation between the Core and C1 is (0.33-0.36) mas. Assuming that C1 was ejected from Core at the flare time, then the apparent velocity is (52-60)c which is the fastest one ever found in NRAO530.

Reference

Kobayashi H. et al. 2003, ASP conf . 306, 367
Honma M. et al. 2003, PASJ, 55, L57
Nagai H. et al. *in preparation*
Lister et al. 2009, AJ, 137, 3718