GENJI/VERA によるブレーザー OJ287 の VLBI モニター観測

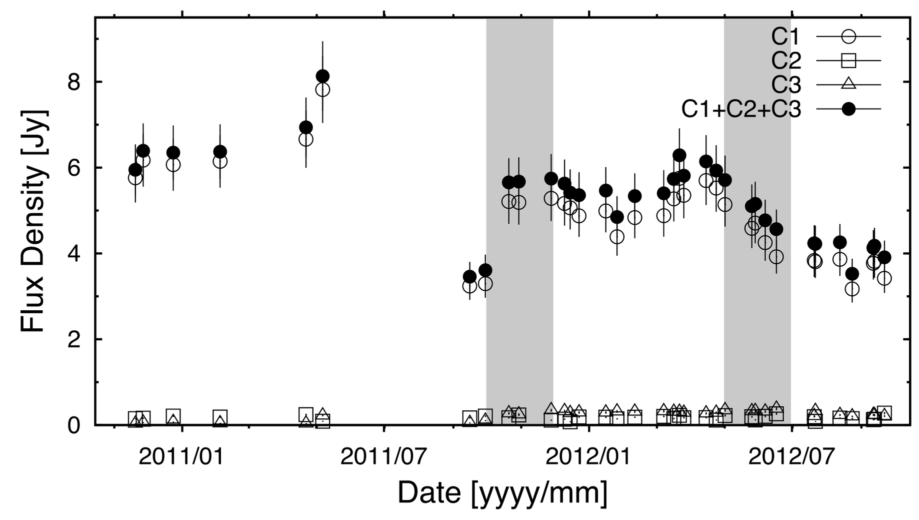
Satoko Sawada-Satoh[1], Kazunori Akiyama[2], Motoki Kino[3], Hiroshi Nagai[4], Kotaro Niinuma[5], and the GENJI team
1: Mizusawa VLBI Observatory/NAOJ, 2: University of Tokyo, 3: ISAS/JAXA,
4: Chile Observatory/NAOJ, 5: Yamaguchi University

Introduction

OJ 287 is known to show a rapid variability across a wide range of wavelength. Recent gamma-ray monitoring by Fermi revealed the high activity of OJ 287 in 2011 and 2012. We present the VLBI monitoring results of blazer OJ 287 at 22 GHz band using the VERA (VLBI Exploration of Radio Astrometry) in the same time range from 2010 November to 2012 September. This research is a part of the monitoring program GENJI (Gamma-ray Emitting Notable AGN Monitoring by Japanese VLBI; Nagai et al. 2013, PASJ 65, 24), which is a monitoring program of gamma-ray bright AGNs with the VERA. Time interval of the monitoring is typically once or twice per month.

Core-Jet Structure

The core-jet structure is represented by three components; the core (C1), the jet component (C2) and the inner jet component (C3). The components C1 and C2 could be identified as ‘C’ and ‘j’ of the VLBA 43-GHz images (Agudo et al. 2012, 747, 63). Several innermost jet components could be included into the components C1 or C3, because the angular resolution is 5 times lower than that of the VLBA 43-GHz images.



22-GHz Light Curve

The 22-GHz light curve of OJ 287 by GENJI/VERA monitoring from 2010 November to 2012 September reveals three obvious increasing activities around 2011 May, 2011 October and 2012 March. In this period, two pronounced gamma-ray flares in OJ 287 are reported by Fermi LAT. The two gamma-ray flaring events seem to occur with/after the two radio increasing events, unlike the previous gamma-ray flaring events in 2009 (Agudo et al. 2011, ApJ, 726, L13).

Fig.1 Light curve of OJ 287 at 22 GHz by GENJI programme with the VERA. We adopted 10% for the flux error. Grey rectangles represent the periods of the gamma-ray flaring event at a 1x10^{-6} photons cm^{-2} s^{-1} reported by Fermi LAT.

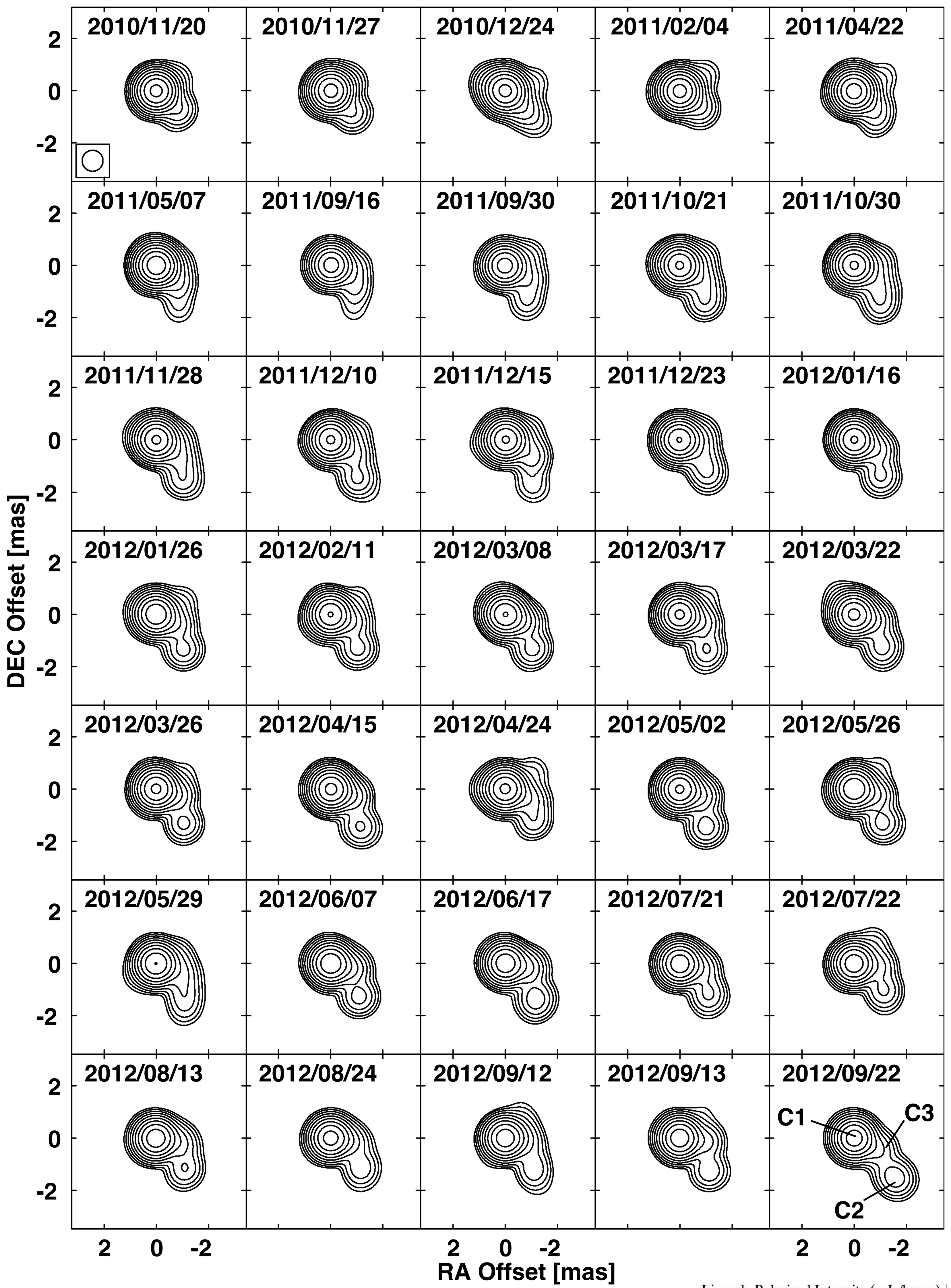
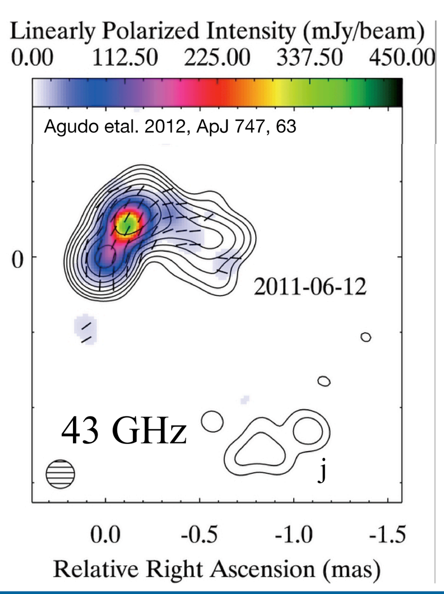


Fig.2 VERA 22-GHz images of OJ287 from 2010 November to 2012 September. Images are convolved with a circular beam size (FWHM) of 0.8 mas, which corresponds to the typical minor axis of synthesized beam in our observations. Contours start at 3 mJy beam^{-1}, increasing by a factor of 2. The structures can be resolved into three components, the core (C1), the jet component (C2) and the inner jet component located between C1 and C2 (C3). The component C2 could be identified as ‘j’ of the VLBA 43-GHz images.



Jet Motion

The angular separation between the components C1 and C2 increased ~0.8 mas from 2010 November to 2012 September. It corresponds to a superluminal motion with an apparent velocity of ~8c, applying rectilinear motion. The superluminal speed is consistent with the velocity (6.7±0.4c) of the jet component ‘j’ measured with the VLBA at 43 GHz. From 2010 November to 2011 April, the relative position was stalled to the position at (−0.8, −0.7) in fig 3, and then moved along the direction at the position angle of −160 degree until 2011 November. After that, the motion of the component C2 rapidly changed the direction to backward from 2011 November to 2012 August. The time scale of the jet-direction variation is shorter than one year. This jet-direction variation was seen in the high state period of gamma-ray with two flares in 2011 and 2012. Such a synchronization between the jet position angle change and the core flux brightening has been reported in the innermost jet region mapped with the VLBA 43 GHz monitoring.

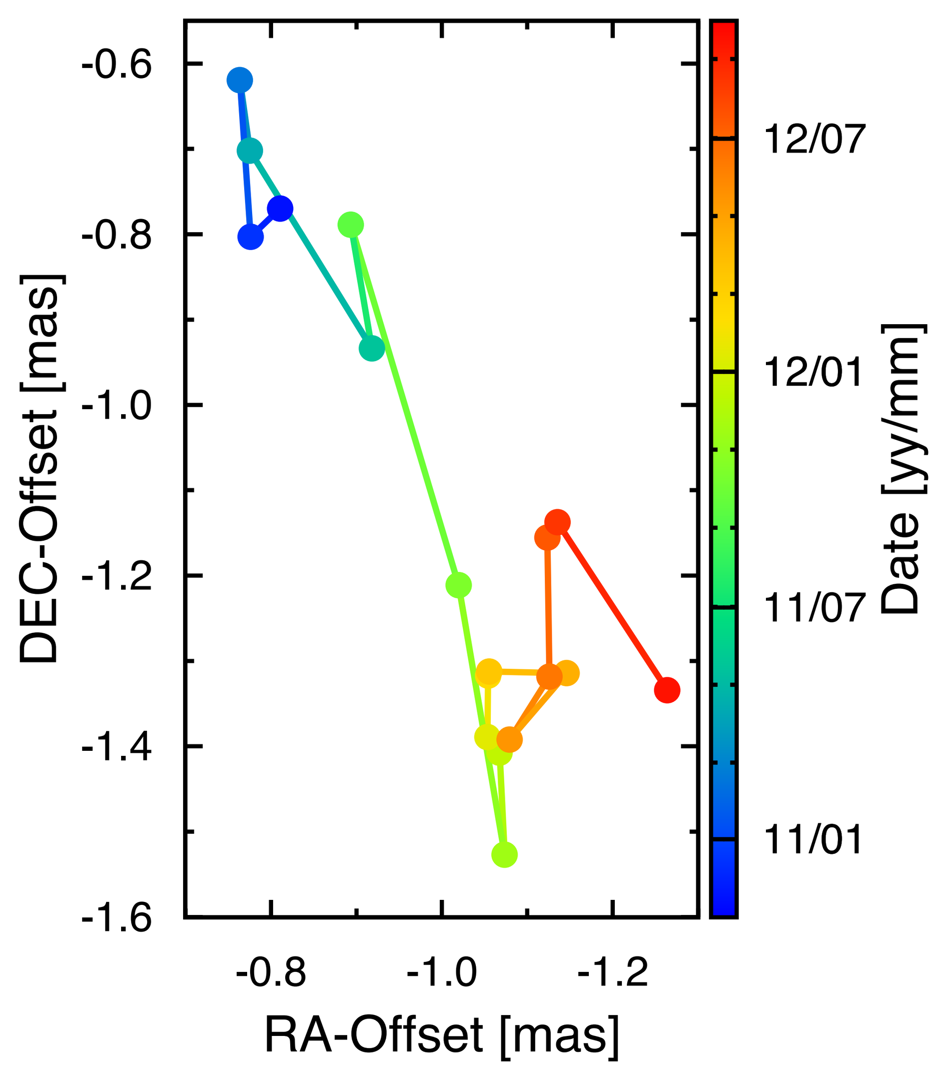


Fig.3 Relative motion of the component C2 with respect to the component C1. Data points are obtained averaging by month from 2010 November to 2012 September, expect January, March, June, July and August in 2011. Positional accuracy is ~0.1 mas.