Pilot KaVA (KVN and VERA Array) Monitoring of the M87 Jet

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Very long baseline radio interferometer (VLBI) is a powerful tool for observing nonthermal radio sources in the Universe. In particular, VLBI plays a key role in studying relativistic jets in active galactic nuclei (AGN), since the high-resolution capability allows us to directly access the scales of jet formation and acceleration.

The KVN and VERA Array (KaVA) is the first regularly operated international VLBI network in East Asia, consisting of a total of 7 radio telescopes. A feature of KaVA is that the array operates for a quasi-full year. This offers an ideal opportunity to monitor the structural evolution of relativistic jets via detailed multi-epoch observations.

In order to promote early science with KaVA, here we focused on the active galaxy M87. M87 is a giant radio galaxy located at the center of the Virgo cluster and one of the nearest AGN jets. Thus we can directly resolve scales of initial jet formation very close to the black hole by using VLBI.

From December 2013 to June 2014, we performed KaVA 22 GHz monitoring observations of the M87 jet at intervals of 2–3 weeks. In Figure 1 we show multi-epoch KaVA images of M87 obtained by this program. We successfully acquired high-quality jet images at many epochs. As a result, we discovered that the jet speed gradually transitions from subluminal to superluminal motions around distances of several hundred Schwarzschild raii (Rs) to thousands of Rs from the black hole. The observed location of the superluminal motions is much closer to the jet base than that seen in previous studies. This suggests that the efficient acceleration of the jet is already started from much closer to the black hole than previously thought.

This initial result demonstrates that KaVA is indeed a powerful instrument for studying relativistic jets. We will further continue our monitoring of M87 by KaVA or EAVN to reveal more detailed velocity fields of this jet.

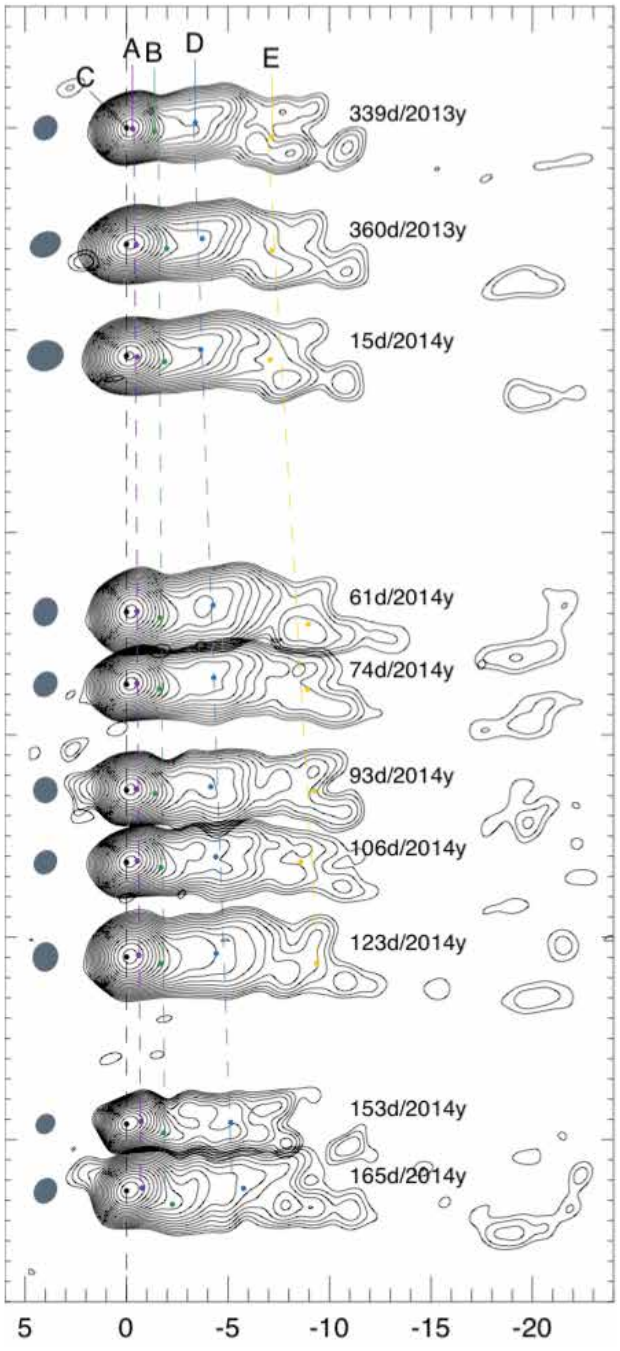

Figure 1: Multi-epoch KaVA 22 GHz images of the M87 jet obtained between January 2013 and June 2014 [1].

Reference

[1] Hada, K., et al.: 2017, *PASJ*, **69**, 71