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Jet Kinematics of the Quasar 4C +21.35 from KaVA Observations

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We present the jet kinematics of the flat spectrum radio quasar (FSRQ) 4C +21.35 using time-resolved KVN and VERA array (KaVA) radio maps obtained from September 2014 to July 2016. During the observing campaigns, observations were performed bi-weekly at 22 and 43 GHz quasi-simultaneously. At 22 GHz, we identified three jet components near the core with apparent speeds from (7.5 ± 0.1)c to (13.2 ± 0.2)c. It is found that the timing of the ejection of the new component detected in 2016 coincides with the γ-ray flare in November 2014.At 43 GHz, we found four inner jet (<3 mas) components with speeds from (1.8 ± 0.1)c to (6.7±0.4)c. Jet component speeds tend to be higher with increasing distances from the core.

We compared our data with archival Very Long Baseline Array (VLBA) data from the Boston University (BU) 43 GHz and the Monitoring Of Jets in Active galactic nuclei with VLBA Experiments (MOJAVE) 15.4 GHz monitoring programs. Whereas MOJAVE data and our data are in a good agreement, jet speeds obtained from the BU Program data in the same time period are about twice as high as the ones we obtain from the KaVA data. The discrepancy at 43 GHz indicates that radio arrays with different angular resolution identify and trace different jet features even when the data are obtained at the same frequency and at the same time. The flux densities of jet components decay exponentially, in agreement with a synchrotron cooling time scale of ~1 year. Using known Doppler factor (~5) and electron Lorentz factor values (~9 000), we estimate the magnetic field strength to be ~2–4 μT.When adopting a jet viewing angle of 5◦, the intrinsic jet speed is of order 0.99c.