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Geometry transition as a common effect in nearby AGN jets

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Observational studies of collimation in jets in active galactic nuclei (AGN) are a key to understanding their formation and acceleration processes. We have performed an automated search for jet shape transitions in a sample of 367 AGN using VLBA data at 15 GHz and 1.4 GHz. This search has found ten nearby jets at redshifts $z < 0.07$ with a transition from a parabolic to conical shape, while the full sample is dominated by distant AGN with a typical $z \approx 1$. The ten AGN are 0111+021, 0238−084, 0415+379, 0430+052, 0815−094, 1133+704, 1514+004, 1637+826, 1807+698, 2200+420. We conclude that the geometry transition may be a common effect in AGN jets. It can be observed only when sufficient linear resolution is obtained. Supplementing these results with previously reported shape breaks in the nearby AGN 1H 0323+342 and M87, we estimate that the break occurs at 10^5–10^6 gravitational radii from the nucleus, which is the typical Bondi radius distance. We suggest that the jet shape transition happens when the bulk plasma kinetic energy flux becomes equal to the Poynting energy flux, while the ambient medium pressure is assumed to be governed by Bondi accretion. Our model predictions on the jet acceleration and properties of the break point are supported by observational data.

Detailed discussion of the results can be found in Kovalev et al. (2020, MNRAS, 495, 3576).