

Evolution of AGN jets from multiepoch core-shift studies

Alexander Plavin, Yuri Y. Kovalev, Alexander Pushkarev, Andrey Lobanov

The observed position of the jet base ("core") in radio-loud active galactic nuclei changes with frequency ("core shift" effect) because of synchrotron self-absorption. Studying this effect enables us to reconstruct properties of the jet regions close to the central engine. We present new results based on multi epoch core shift measurements in 40 AGNs. Each of them has been observed with global VLBI at 2 and 8 GHz over more than ten epochs from 1994 to 2016. The core shifts are determined using a specially developed automatic procedure to minimize possible biases. Our measurements show that the offsets between the core positions at 2 and 8 GHz are typically about 0.5 mas, and they vary in time with a typical magnitude of 0.4 mas and maximum variations reaching up to 0.8 mas. The temporal variations show a strong dependence between the core position and its flux density, suggesting that changes in both are likely to be related to nuclear flares injecting a denser plasma into the flow. We deduce that the density of relativistic particles flowing through the core regions significantly increases during these flares, while the magnetic field strength and plasma speed do not change substantially. We show that the expected inverse frequency dependence for the shift cannot hold at all times, especially during strong activity periods. This effect has to be taken into account when using core shift measurements to infer various jet parameters and to increase the absolute astrometric accuracy.