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Observational constraints on the blazar jet wobbling timescale

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Blazars are a subclass of radio-loud active galactic nuclei, where the jet is aligned close to the line of sight. Blazars emission is dominated by non-thermal processes, where Doppler boosted radiation originates from a relativistic population of charged particles within the jet. From radio to TeV energies, blazars are highly variable on timescales from minutes to over a year. There are several mechanisms proposed to explain such extreme variability, including changes in the viewing angle of the jet, propagating along the rotation axis of the accretion disc. If the angular momentum of matter accreting onto a spinning supermassive black hole (SMBH) is misaligned with the SMBH spin, Lense-Thirring precession of such tilted disc can be expected, which leads to variation of Doppler beaming of the jet emission. Such explanation is supported by radio observations of jet precession observed for some sources. The radio-emitting regions, however, are located far from the central engine, and thus the observed time scales in this band can be affected by e.g. a variation of the bulk Lorentz factor along the jet.

In this contribution, we derive expected time scales of the jet wobbling using SMBH masses and compare them with the time intervals between flares in long-term (over $\sim$ 15 years) X-ray light curves of bright blazars observed by Swift-XRT. We found that for Mrk 421 and 3C 273, the derived time scales are consistent with the observational constraints, while for the other sources we are mostly limited by an uncertainty in the Doppler beaming factor.

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Collaboration

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