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VLBI polarisation variability and implications for jet models

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Summary

For over 20 years, the variability of Active Galactic Nuclei (AGN)
on a wide range of time scales has often be interpreted in a shock paradigm, where the observed total-intensity and polarisation
variability is associated with the formation and propagation of shocks along the relativistic jets of these objects. While various types of
shock models have been successful at explaining the observed
variability, it remains difficult to conclusively demonstrate the
action of shocks in some cases. At the same time, a growing number of
AGN jets have now been found to show clear signs of helical magnetic
(B) fields, most strikingly the presence of Faraday-rotation gradients across their VLBI jets, due to the systematically changing line-of-sight
component of the B field across the jet. This compels us to take very
seriously the idea that many, possibly all, AGN jets have helical B fields, which, in fact, could come about very naturally as a consequence
of the joint action of rotation of the central black hole+accretion disc and the jet outflow. This suggests a new paradigm in which an underlying helical B field determines the "global" properties of the jets, while
the effects of relativistic shocks, and possibly interaction with the
surrounding medium, determine the local properties of individual regions in the jets. This retains shocks as a likely mechanism for much of the observed variability, although we should not exclude the possibility that some of this variability is associated with magnetic phenomena, such as reconnection. Various types of parsec-scale polarisation variability in AGNs will be briefly reviewed, including variability of their linear polarisations, circular polarisations, Faraday rotation measures and rotation-measure distributions.

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