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Physics of extragalactic plasma elements through multi-frequency linear and circular radio polarization monitoring

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The radio emission of active galactic nuclei (AGN) jets is polarized due to the incoherent synchrotron radiation mechanism. The linear and circular polarization parameters are directly related with the physical conditions (magnetic field strength and topology, particle density and plasma composition) both in the jet as well as any magnetized plasma regions along the line of sight. However, detecting their polarization properties is a challenging endeavor due to their low levels and possible depolarization effects.

We have developed an end-to-end data analysis methodology to recover the polarization properties of unresolved sources with high accuracy. It has been applied to recover the linear and circular polarization of 87 AGNs measured by the F-GAMMA monitoring program from July 2010 to January 2015 with a mean cadence of 1.3 months. Their linear polarization was recovered at four frequencies between 2.64 and 10.45 GHz and the circular polarization at 4.85 and 8.35 GHz.

The physical conditions required to reproduce the observed polarization properties and the processes which induce their variability were investigated with a polarized radiative transfer code which emulates the synchrotron emission of modeled jets. Here we present our first results on modeling the full-Stokes variability of the blazar 3C 454.3, assuming that it can be attributed to evolving internal shocks propagating downstream.

Primary author(s) : Dr. ANGELAKIS, Emmanouil (Max Planck Institut für Radioastronomie); Dr. MYSERLIS, Ioannis (Max Planck Institut für Radioastronomie)

Presenter(s) : Dr. MYSERLIS, Ioannis (Max Planck Institut für Radioastronomie)

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