Contribution ID: **12** Type: **Contributed talk**

Constraining the jet shape of HSP blazars with multifrequency polarimetry

In recent years multifrequency polarimetry is emerging as a powerful tool for investigating blazar jets, especially with the advent of the Imaging X-ray Polarimetry Explorer (IXPE) space observatory.
We study the polarization of High-Synchrotron Peaked (HSP) blazars, where both optical and X-ray emission are due to synchrotron radiation from a population of non-thermal electrons. We adopt an axisymmetric stationary Poynting-dominated jet model, where the electromagnetic fields are determined by the jet shape. In particular, the jet geometry is defined by the pressure profile of the external medium which confines the jet. When jets are confined by a windy-like medium, they acquire a quasi-parabolic shape. In this case, the X-ray polarization degree is $\Pi_{\rm X} \sim 15-50$ % and the optical polarization degree is $\Pi_{\rm O} \sim 5-25$ %. The polarization degree is strongly chromatic, as $\Pi_{\rm X}/\Pi_{\rm O} \sim 2-5$. This chromaticity is due to the softening of the electron distribution at high energies, and is much stronger than for a uniform magnetic field. The Electric Vector Position Angle (EVPA) is aligned with the projection of the jet axis on the plane of the sky. These results compare very well with multifrequency polarimetric observations of HSP blazars.
Instead, when the jet is nearly cylindrical, the polarization degree is large and weakly chromatic (we find $\Pi_{\rm X} \sim 70$ % and $\Pi_{\rm O} \sim 60$ %, close to the expected values for a uniform magnetic field. The EVPA is perpendicular to the projection of the jet axis on the plane of the sky. A cylindrical geometry is therefore practically ruled out by current observations.
We also provide analytical approximated formulae (suitable for blazars) for both the polarization degree and the EVPA as a function of the spectral-index. The polarization degree is highly chromatic (Π scales as the square root of a polynomial of degree 4 in the power-law index of the electron energy distribution) unlike the EVPA.
Our model shows that IXPE data may also be compatible with a non stratified emission region and less sensitive to the specific particle acceleration process (e.g., magnetic reconnection or shocks) than previously thought.

Primary author: BOLIS, Filippo (INAF-OAB and Università dell'Insubria)

Co-authors: Dr SOBACCHI, Emanuele (GSSI); Dr TAVECCHIO, Fabrizio (INAF-OAB)

Presenter: BOLIS, Filippo (INAF-OAB and Università dell'Insubria)

Session Classification: Day 2: Latest results