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Insights into the high-energy emission of archetypical TeV blazars from the first combined X-ray polarization and VHE measurements

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Blazars are among the most intensively studied sources in high-energy astrophysics. Nevertheless, the exact acceleration processes of high-energy particles and emission mechanisms remain unclear. The recently launched IXPE satellite allows for the first time the measurement of polarisation in the X-ray band, hence opening a new window to the cosmos. The two TeV archetypical blazars Mrk421 and Mrk501 are ideal targets to probe the physics of blazar jets thanks to their brightness and proximity. In the conference, we will report novel insights resulting from the first study using a combined X-ray/TeV dataset with X-ray polarization from IXPE. The data was obtained through two extensive multi-wavelength campaigns simultaneous to the first observations of Mrk421 and Mrk501 by IXPE from March to July 2022. We investigate the energy range from radio up to very high energy (VHE; $E > 100\text{GeV}$) gamma rays reaching multi-TeV energies, as measured with the MAGIC telescopes. We find Mrk421 in a variety of emission states, allowing us to correlate different polarisation signatures with the spectral and flux evolution observed at VHE and X-rays. Additional multi-hour NuSTAR observations of Mrk421 simultaneous to IXPE show significant intra-night variability and reveal insights about particle acceleration and cooling processes. For Mrk 501, we find clear evidence for an extreme emission state in March 2022 with a synchrotron component peaking above 1 keV. While the X-ray emission is harder and brighter than usual, the VHE data reveals a far lower inverse-Compton dominance than usual.

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