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Geometric masking in AGN jets and its implications for unification and blazar physics

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Abstract

We explore the implications of the recently proposed Geometric Masking scenario for the AGN Unification Scheme, the blazar sequence, and broader blazar phenomenology, and assess its consistency with recent observations. Phase-resolved analysis of PKS 2155$-$304 shows that extreme GeV spectral hardening events are locked to the trough of its $sim 1.7$,yr quasi-periodic oscillation, indicating that high-flux states are dominated by a soft, geometrically amplified envelope that outshines an underlying hard core. Independent support comes from the detection of TeV emission in the FSRQs S5~1027+74 and 3C~273 when integrating over low-flux states, revealing hard spectra inconsistent with a purely cooling-dominated interpretation. We argue that Doppler boosting preferentially enhances the soft component when the jet is closely aligned, creating a visibility bias that extends the AGN Unification Scheme and introduces a geometric modulation layer within the blazar sequence. In this framework, low-flux states correspond to windows of geometric transparency rather than intrinsic quiescence, and misaligned systems act as permanently unmasked laboratories of particle acceleration. The scenario implies that the duty cycle of extreme acceleration in AGN jets is substantially higher than inferred from flux-selected observations.

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