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EXPLORING EMISSION LINE VARIABILITY AND JET-BROAD LINE REGION INTERACTION IN THE BLAZAR TON 599

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Blazars, a highly variable Active Galactic Nuclei (AGNs) subclass, provide a unique opportunity to explore the physical processes within their relativistic jets and emission regions. In this study, we investigate the multiwavelength variability of the blazar TON 599, a Flat Spectrum Radio Quasar (FSRQ), with a particular emphasis on its emission line behavior. We focus on the Mg II λ2798 Å emission line, a key tracer of the ionized gas in the broad-line region (BLR), and its role in jet-induced variability. In addition to optical emission lines, we analyze gamma-rays (0.1–300 GeV), X-rays (0.2–10 keV), optical continuum (λ3000 Å), optical polarization, and millimeter-wavelength light curves. Three cross-correlation methods are employed to investigate temporal relationships between the emission line and continuum across various wavelengths. Using the Non-Thermal Dominance (NTD) parameter, our analysis confirms that synchrotron emission dominates the continuum during active states, highlighting the jet's primary role in the observed variability. The Mg II emission line exhibits quasi-simultaneous variability with the optical continuum, suggesting photoionization driven by the jet's non-thermal radiation. Additionally, the minimal time lag between gamma-ray and optical/near-ultraviolet emissions supports a synchrotron self-Compton origin for the most variable component of the gamma-ray emission. These findings highlight the importance of emission line variability and multiwavelength observations in constraining the interaction

between jets and the BLR in blazars. The results contribute to a deeper understanding of AGN emission mechanisms and the complex interplay between jets and their surrounding environments.