Multi-wavelength observation of blazar Mrk 421 in extreme X-ray flare

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Abstract

Blazars are highly variable active galactic nuclei that can be detected for all wavelengths and thought to have relativistic jets. Blazar Mrk 421 exhibited extreme X-ray flares in 2010. We performed optical photopolarimetric follow-up observations using the Kanata telescope. In 2010, the variability in the X-ray band was significant, while the optical and ultraviolet (UV) flux decreased gradually. Polarization properties also exhibited unique variability in 2010, suggesting the presence of systematic component of polarization and magnetic field alignment for the emergence of a new polarized emission region. The results revealed different behaviors in terms of spectral evolution and suggested different variability mechanisms between 2010 and 2011. In 2010, the radiation was likely the result of energy injection into the emitting regions with an aligned magnetic field. In contrast, in 2011 the superposition of different emission regions may have contributed to the low degree of observed polarization. It also implies that high-energy electron which were not accelerated to ultra-relativistic velocities were injected in 2011.