

Dense Optical and Near-Infrared Monitoring of CTA 102 during High State in 2012 with Oister; Detection of Intra-Night “Orphan Polarized Flux Flare”

ITOH, Ryosuke¹, FUKAZAWA, Yasushi¹, TANAKA, T. Yasuyuki¹, ABE, Yuhei², AKITAYA, Hiroshi¹, ARAI, Akira³, HAYASHI, Masahiko⁴, HORI, Takafumi⁵, ISOGAI, Mizuki⁶, IZUMIURA, Hideyuki⁴, KAWABATA, S. Koji¹, KAWAI, Nobuyuki⁷, KURODA, Daisuke⁴, MIYANOSHITA, Ryo⁸, MORITANI, Yuki¹, MOROKUMA, Tomoki⁹, NAGAYAMA, Takahiro¹⁰, NAKAMOTO, Jumpei², NAKATA, Chikako⁵, OASA, Yumiko¹¹, OHSHIMA, Tomohito⁵, OHSUGI, Takashi¹, OKUMURA, Shin-ichiro¹², SAITO, Yoshihiko⁷, SAITO, Yu¹³, SASADA, Mahito⁵, SEKIGUCHI, Kazuhiro⁴, TAKAGI, Yuhei³, TAKAHASHI, Jun³, TAKAHASHI, Yukihiro², TAKAKI, Katsutoshi¹, UEMURA, Makoto¹, UENO, Issei¹, URAKAWA, Seitaro¹², WATANABE, Makoto², YAMANAKA, Masayuki⁵, YONEKURA, Yoshinori¹³, YOSHIDA, Michitoshi¹

1: Hiroshima University, 2: Hokkaido University, 3: University of Hyogo, 4: NAOJ, 5: Kyoto University, 6: Kyoto Sangyo University, 7: Tokyo Institute of Technology, 8: Kagoshima University, 9: The University of Tokyo, 10: Nagoya University, 11: Saitama University, 12: Japan Spaceguard Association, 13: Ibaraki University

The relativistic jets are extremely powerful and fast outflow of plasma which emerge from the vicinity to the massive black hole. The AGN jets are characterized by high kinetic powers and large-scale structure and radiate in all wavebands from the radio to the gamma-ray bands via the synchrotron and the inverse Compton scattering process. But the mechanism of collimation, production and acceleration are not understood.

CTA 102, classified as a flat spectrum radio quasar at $z = 1.037$, produced an exceptionally bright optical flare in 2012 September [1,2]. Following the Fermi Large Area Telescope detection of enhanced γ -ray activity, we closely monitored this source in the optical and near-infrared bands for the 10 subsequent nights using 12 telescopes in Japan and South Africa [3].

On MJD 56197 (2012 September 27, ~ 4 days after the peak of bright γ -ray flare), polarized flux showed a transient increase, while total flux and polarization angle (PA) remained almost constant during the “orphan polarized-flux flare.” We also detected an intra-night and prominent flare on MJD 56202. The total and polarized fluxes showed quite similar temporal variations, but the PA again remained constant during the flare. Interestingly, the PAs during the two flares were significantly different from the jet direction. The emergence of a new emission component with a high polarization degree (PD) up to 40% would be responsible for the observed two flares, and such a high PD indicates the presence of a highly ordered magnetic field at the emission site. We argued that the well-ordered magnetic field and even the observed directions of the PA, which is grossly perpendicular to the jet, are reasonably accounted for by transverse shock(s) propagating down the jet.

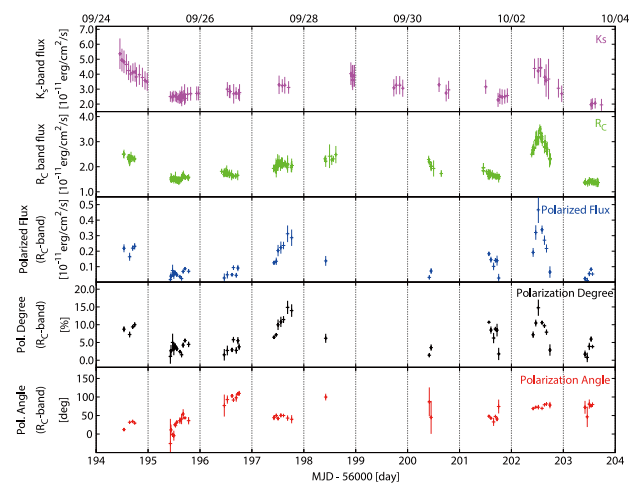


Figure 1: Multi-wavelength light curves of CTA 102 from September 24 to October 3 in 2012. Top panel: NIR (K_S -band) flux. Second panel: optical (R_C -band) flux. Third panel: polarized flux (PF) in the R_C band. Fourth panel: polarization degree (PD) in the R_C band. Bottom panel: polarization angle in the R_C band.

References

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- [2] Orienti, M., D’Ammando, F.: 2012, *The Astronomer’s Telegram*, **4409**, 1.
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