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Investigating the Mini and Giant Radio Flare Episodes of Cygnus X-3

Egron E., Pellizzoni A., Righini S., Giroletti M., Koljonen K., Pottschmidt K., Trushkin S., Lobina J., Pilia M., Wilms J., Corbel S., Grinberg V., Loru S., Trois A., Rodriguez J., Lähteenmäki A., Tornikoski M., Enestam S., Järvelä E.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2020. The American Astronomical Society. All rights reserved. The microquasar Cygnus X-3 underwent a giant radio flare in 2017 April, reaching a maximum flux of ~16.5 Jy at 8.5 GHz. We present results from a long monitoring campaign carried out with Medicina at 8.5, 18.6, and 24.1 GHz, parallel to the Metsähovi radio telescope at 37 GHz, from 2017 April 4 to 11. We observe a spectral steepening from α = 0.2 to 0.5 (with S ν ∝ ν α) within 6 hr of the epoch of the flare's peak maximum, and rapid changes in the spectral slope in the following days during brief enhanced emission episodes while the general trend of the radio flux density indicated the decay of the giant flare. We further study the radio orbital modulation of Cyg X-3 emission associated with the 2017 giant flare and with six mini-flares observed in 1983, 1985, 1994, 1995, 2002, and 2016. The enhanced emission episodes observed during the decline of the giant flare at 8.5 GHz coincide with the orbital phase φ ~ 0.5 (orbital inferior conjunction). On the other hand, the light curves of the mini-flares observed at 15-22 GHz peak at φ ~, except for the 2016 light curve, which is shifted 0.5 w.r.t. the other ones. We attribute the apparent phase shift to the variable location of the emitting region along the bent jet. This might be explained by the different accretion states of the flaring episodes (the 2016 mini-flare occurred in the hypersoft X-ray state).

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