Modeling the ejections in MAXI J1836-194 with internal shocks driven by the accretion flow's variability

Mathias Péault*[1], Julien Malzac†[1], Mickael Coriat‡[1], Karri Koljonen[2], Thomas Russell[3], and Dave Russell[4]

[1]IRAP-Toulouse – Université Paul Sabatier-Toulouse III - UPS – France
[2]Finnish Centre for Astronomy with ESO – Finland
[3]Anton Pannekoek Institute for Astronomy, University of Amsterdam – Netherlands
[4]New York University, Abu Dhabi – United Arab Emirates

Abstract

MAXI J1836-194 is a black hole transient, discovered in 2011. It was observed at several different phases of an outburst with an excellent multi-wavelength coverage (Russell et al. 2013). In most of these observations the jet appears to dominate the spectral energy distribution (SED) from radio to IR. We model the evolution of the jet SED during this outburst using the internal-shock model implemented in the ISHEM code (Malzac 2014). In this model, the jet emission results from shocks triggered by fast fluctuations of the ejection velocity. The shape of the SED is almost entirely determined by the fluctuations' power spectrum. The other jet parameters can only shift the SED in frequency or in normalisation. These fluctuations may be related to the accretion flow's variability, which is best traced using the X-ray light curves. For this reason, we use the observed X-ray power spectra in our model to calculate the jet SED for five different luminosities and spectral shapes. We show that the model successfully matches the observed SEDs. In order to reproduce the spectral evolution we need to vary at least 2 parameters. In this scenario, both the jet power and (time-averaged) Lorentz factor increase with the source's luminosity. This is qualitatively in accordance with the interpretation proposed by Russell et al. (2015) in order to explain the peculiar radio/X-ray correlation observed in this source. However, due to the large degeneracy in the other parameters, this scenario is not unique. I present a in-depth exploration of the parameter space.

Keywords: black hole physics, X, rays binaries, shock waves, accretion, accretion disks, relativistic processes

*Speaker
†Corresponding author: Julien.Malzac@irap.omp.eu
‡Corresponding author: mickael.coriat@irap.omp.eu