Contribution ID: **72** Type: **Flash-talk**

Joint Radiative and Kinematic Modelling of X-ray Binary Ejecta: Energy Estimate and Reverse Shock Detection

Black hole X-ray binaries in outburst launch discrete, large-scale jet ejections which can propagate to parsec scales. The kinematics of these ejecta appear to be well described by relativistic blast wave models originally devised for gamma-ray burst afterglows. In kinematic-only modelling a crucial degeneracy prevents the ejecta energy and interstellar medium density from being accurately determined.

I will present the first joint Bayesian modelling of the lightcurves and kinematics of a large-scale jet ejection from the X-ray binary MAXI J1535-571. We find that the ejecta is launched perpendicular to the disc with an initial energy of $E_0 \approx 5 \times 10^{43}$ erg, and propagates into an underdense $n < 10^{-4}\,\mathrm{cm}^{-3}$ interstellar environment. We find that a long-lived reverse shock powers the bright, early ($t_{\mathrm{obs}} < 100$ days) ejecta emission. Further analysis suggests long lived reverse shocks are likely ubiquitous for outflows with moderate Lorentz factors, making them a unique laboratory for shock acceleration physics. This work lays the foundation for future parameter estimation studies using all available data of X-ray binary jet ejecta.

Contribution

Oral talk

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Session Classification: Flash-talk

Track Classification: Flash-talk