Transient Events from a Galactic Black Hole X-ray Binary

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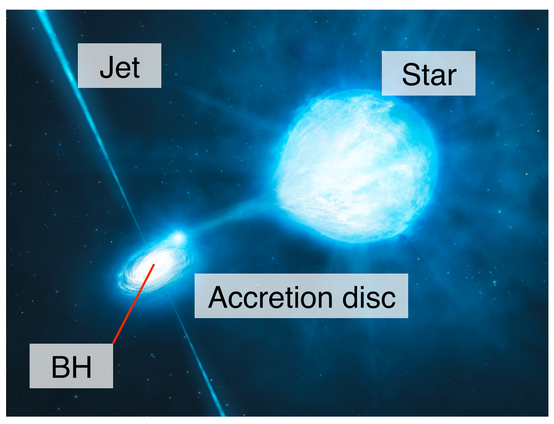
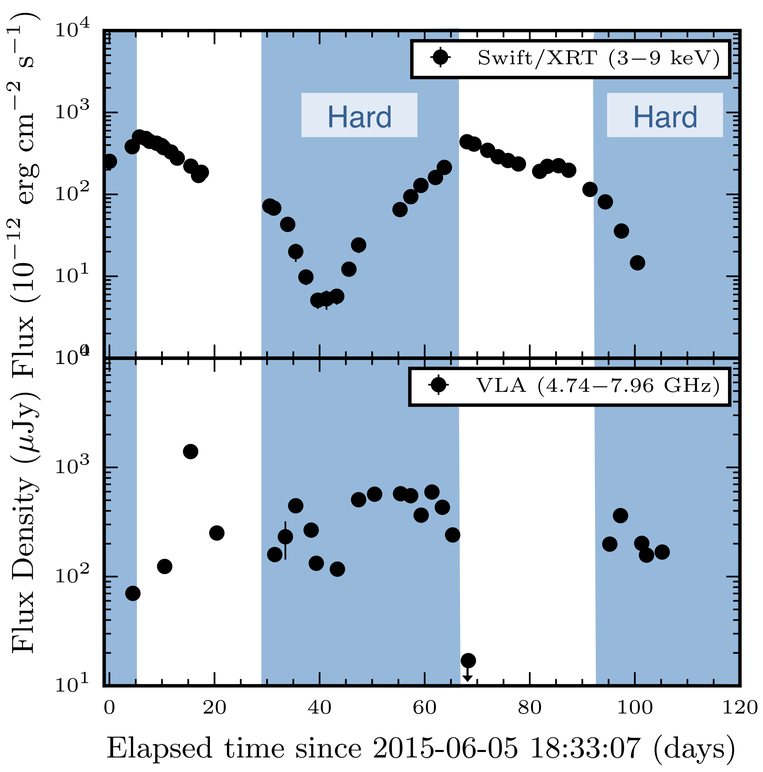
Black Hole X-ray Binaries

Accretion and ejection is an ubiquitous feature, from young stellar objects to active galactic nuclei.
Stellar mass black holes (<20M_{sol}), final evolution phase of the most massive stars, accrete matter from a 'normal' companion.
Most of the time in *quiescent* state (low mass accretion rate), they also undergo outburst phases (~1% of the time).



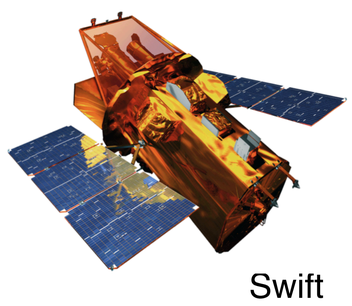
Radio/X-ray monitoring Campaign on GRS 1739-278



Campaign *still ongoing* (PI: J. Tomsick).

Swift + VLA monitoring of the BH transient GRS 1739-278 during its outburst.

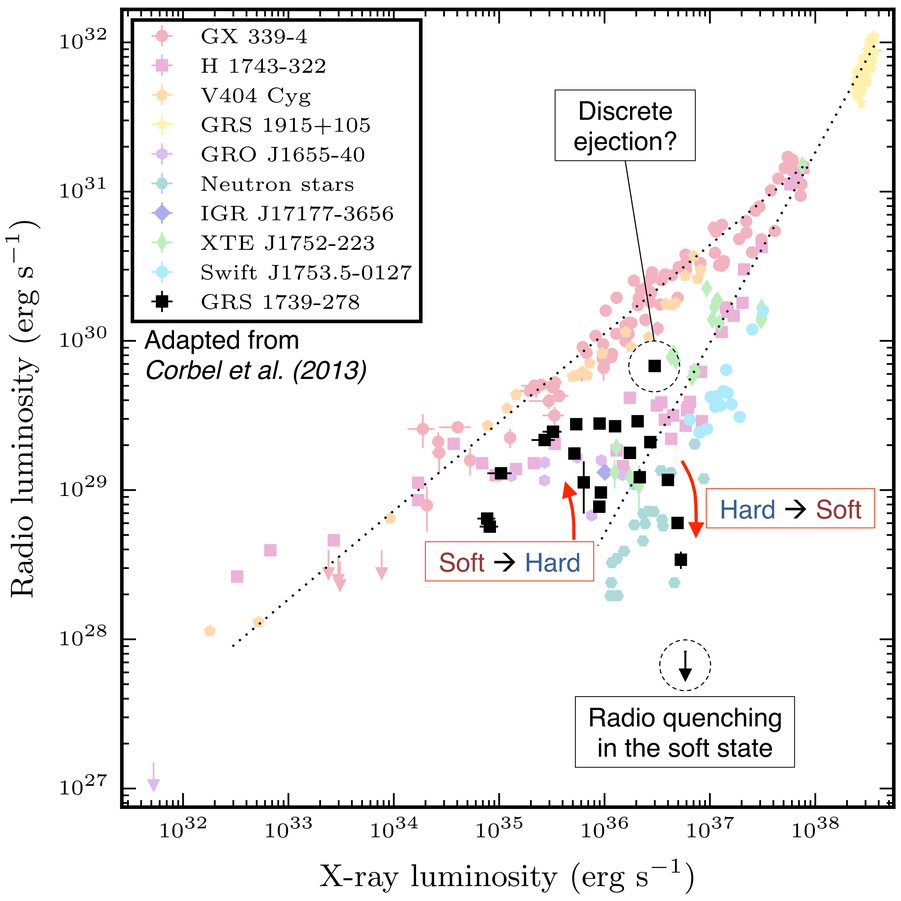
→ understanding the X-ray/radio correlation



Swift

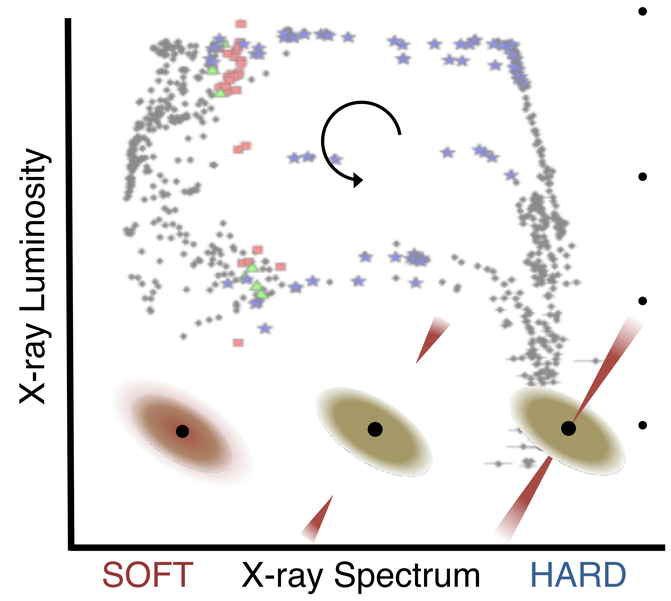
'Universal' radio/X-ray correlation

Strong and 'universal' radio/X-ray correlation during the hard state (*Corbel et al. 2003 ; Gallo, Fender & Pooley 2003*).



Outburst States

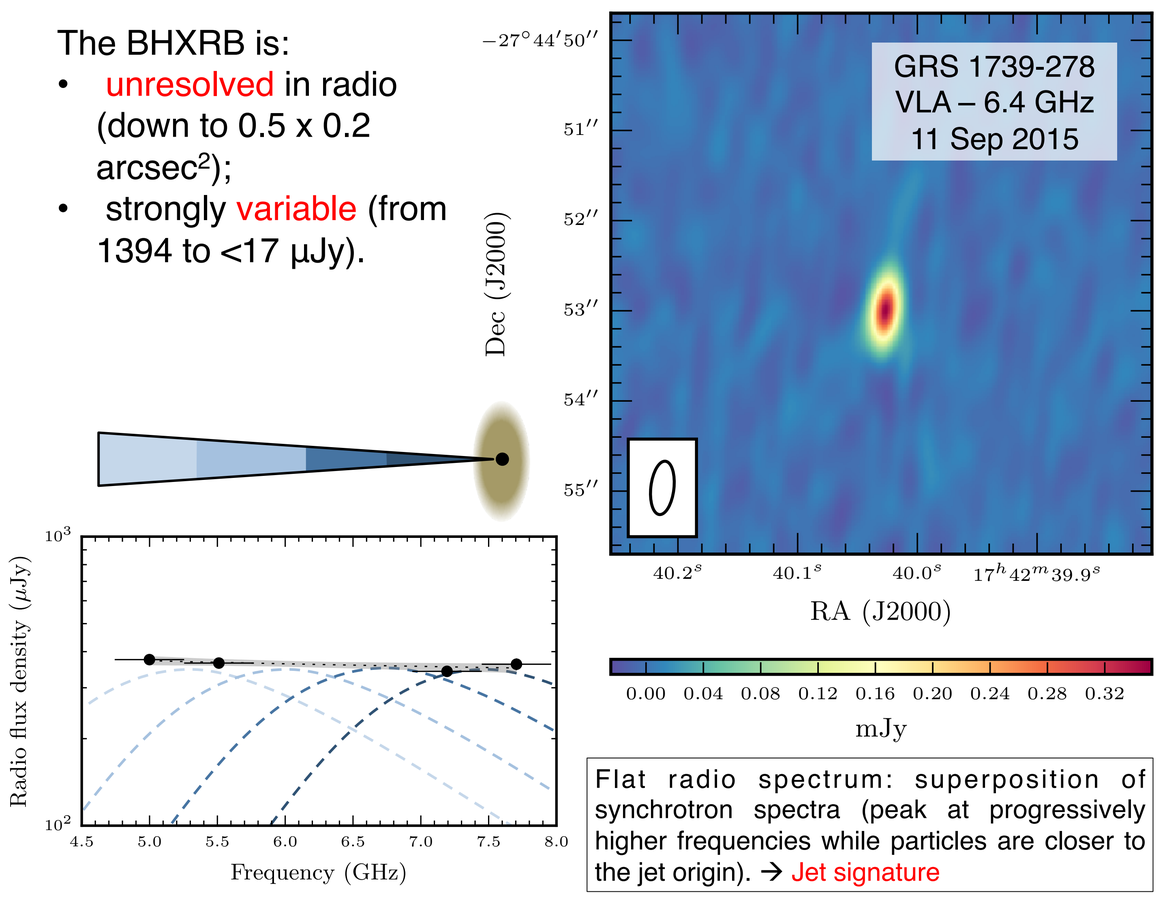
Accretion/outflow connections in black hole X-ray binaries reveal a few distinct states of X-ray behavior (*Fender & Belloni, 2012*).
An outburst progresses through:



- 'Hard': thermal comptonisation (+synchrotron emission) and a powerful, quasi-steady compact jet (radio; *Fender et al., 2001*).
- Discrete ejections as the source passes from the hard to the soft state.
- 'Soft': weaker/absent core jet (no radio) and strong accretion disc wind.
- Switch back to the hard state as the outburst fades (at smaller X-ray luminosity → *hysteresis*).

Radio Observations with the VLA

The BHXRB is:
- unresolved in radio (down to 0.5 x 0.2 arcsec²);
- strongly variable (from 1394 to <17 μJy).



Flat radio spectrum: superposition of synchrotron spectra (peak at progressively higher frequencies while particles are closer to the jet origin). → Jet signature

Conclusion

We still have 3 hours of VLA allocated time (+ Swift X-ray monitoring).

Before drawing the final conclusions:
- GRS 1739-278's behavior is following the global pattern of black hole activity (outburst hysteresis);
- compact jet during the hard state which switches off in the soft state;
- the radio/X-ray correlation plot has been expanded with 25 new measurements at various luminosities and spectral states;
- the radio luminosity during the hard state seems a bit weaker than the standard correlation track expectations (might be filling in the gap between standard and outlier lines).

References

Corbel, S. et al. 2013, MNRAS, 428, 2500
Corbel, S. et al. 2003, A&A, 400, 1007
Fender, R. & Belloni, T. 2012, Science, 337, 540
Fender, R. 2001, MNRAS, 322, 31
Gallo, E. et al. 2003, MNRAS, 344, 60

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