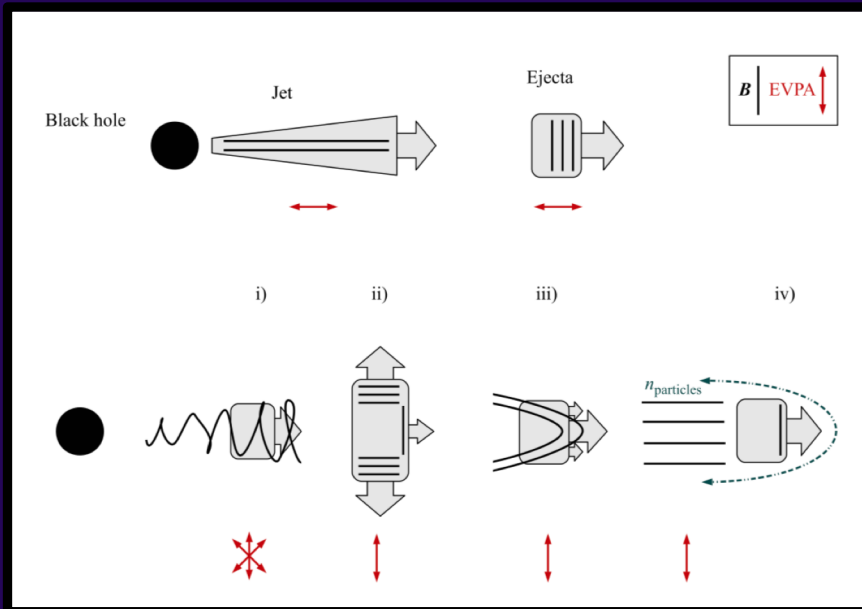
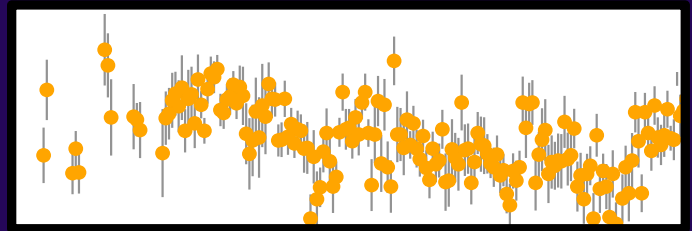
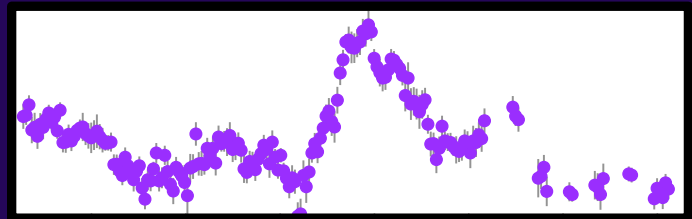
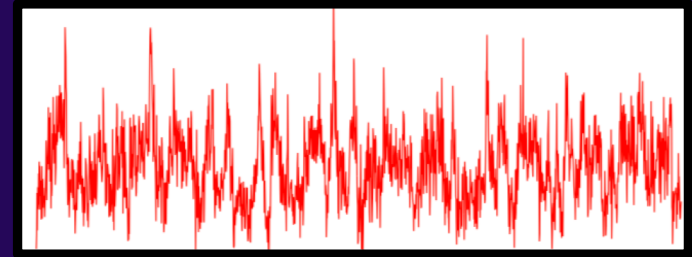
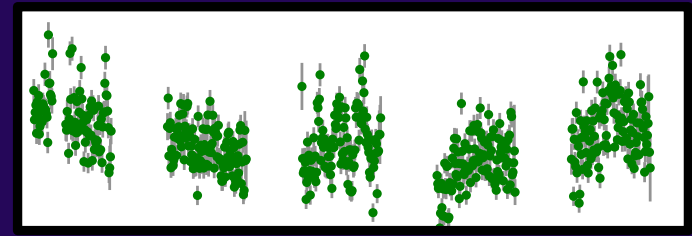


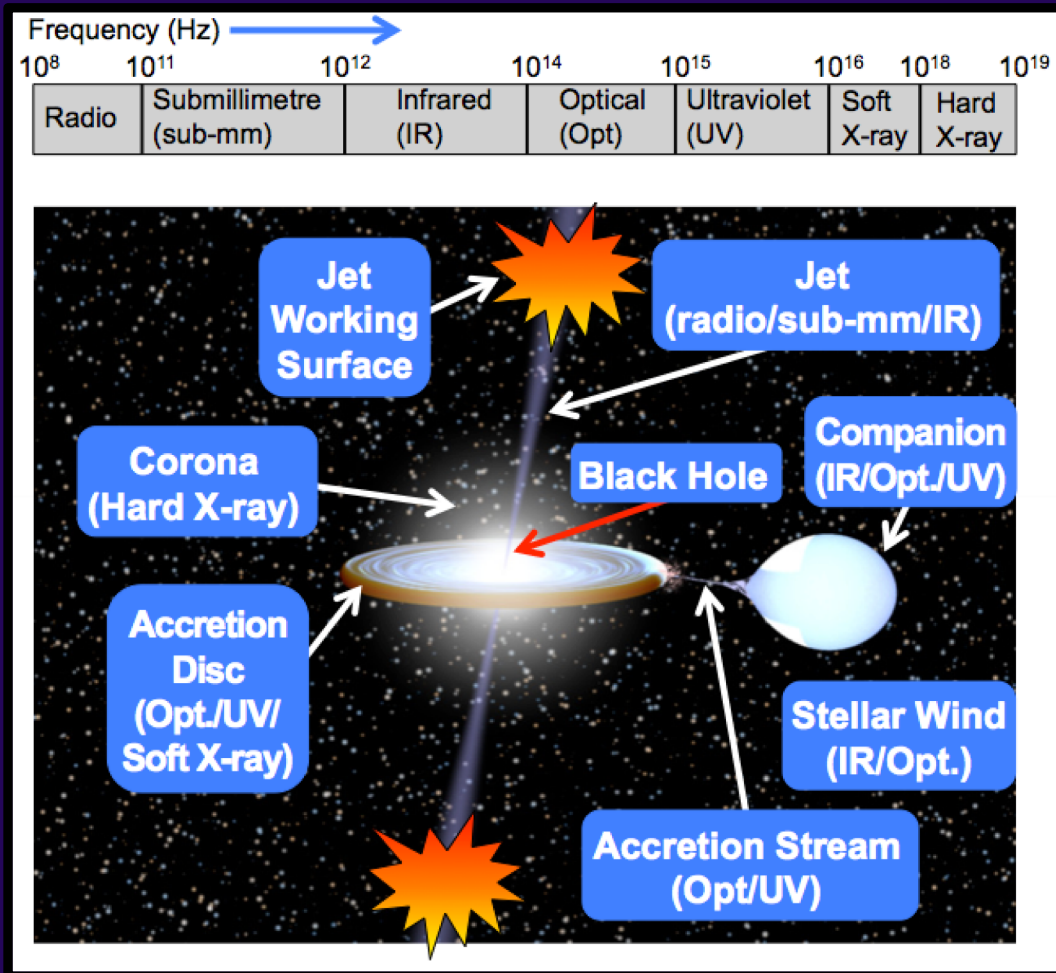
Sub-Millimetre Timing and Polarimetry of Relativistic Jets with SCUBA-2/POL-2

Alex Tetarenko

*East Asian Observatory
James Clerk Maxwell Telescope (JCMT)*



Black Hole X-ray Binaries



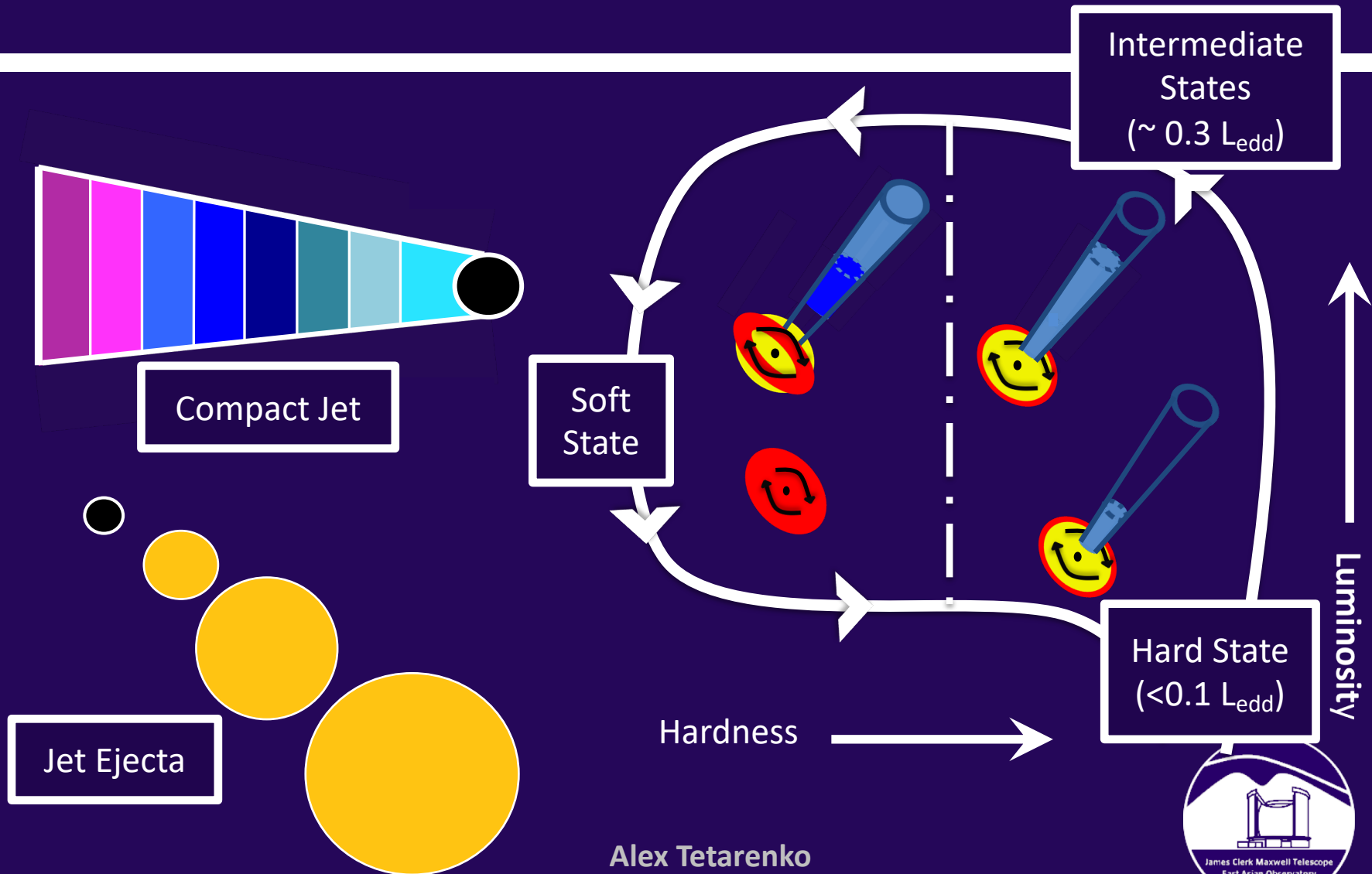
- Black hole accreting matter from a companion star
- Emit across the electromagnetic spectrum
- Rapidly evolve through bright outburst periods on timescales of days to months

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Outburst and Jet Behaviour

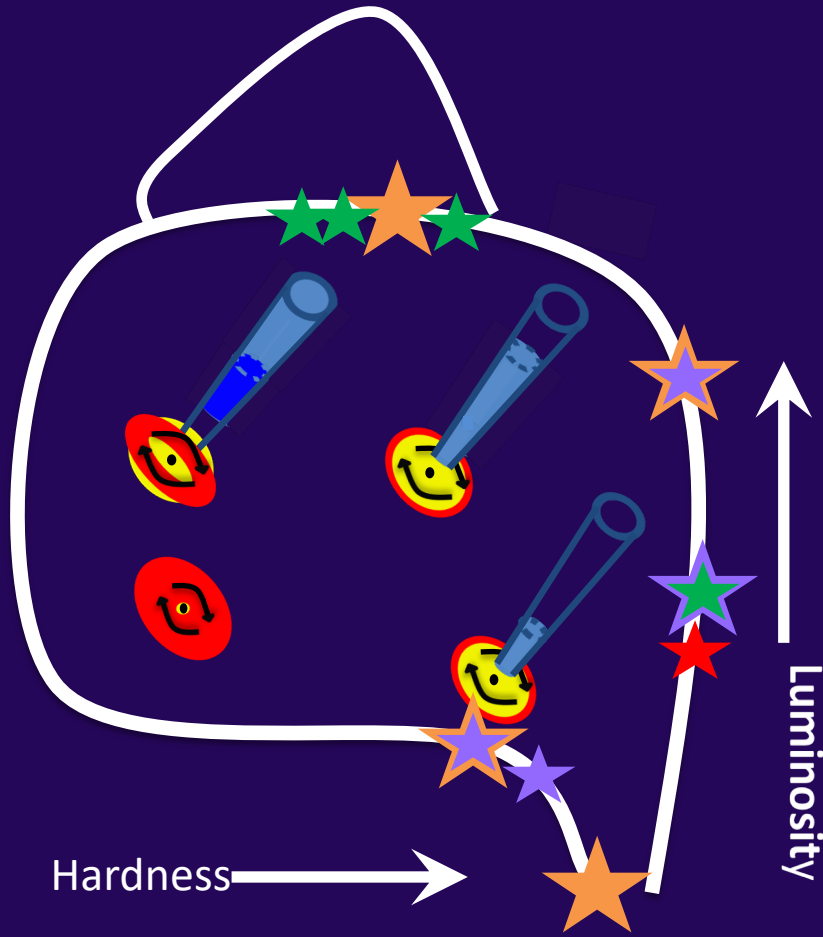


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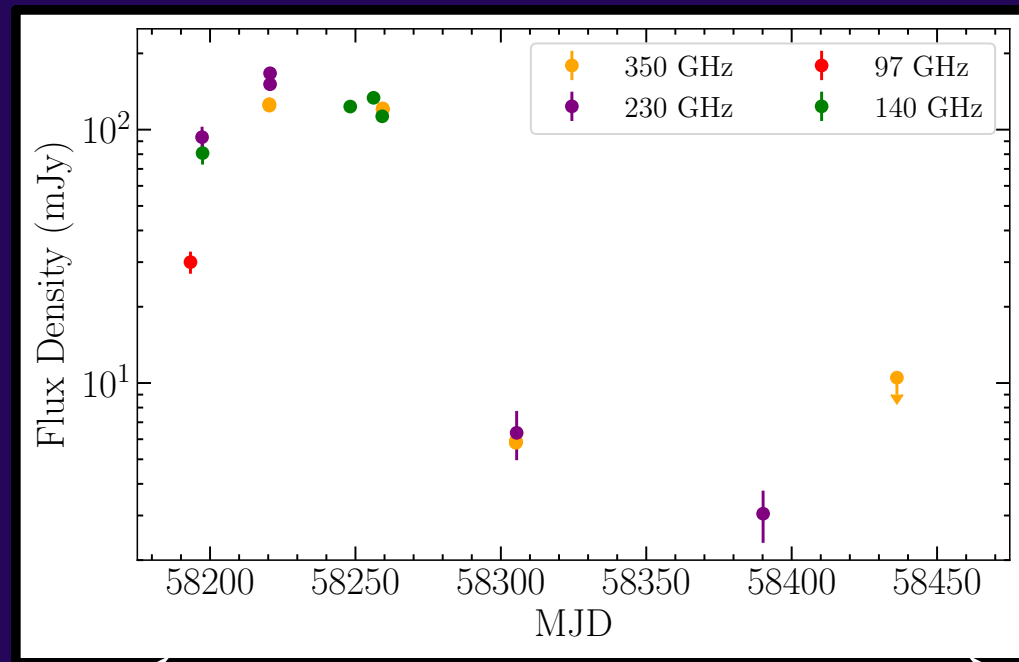
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Sub-mm Observations of BHXBs



MAXI J1820+070; Tetarenko et al., in prep



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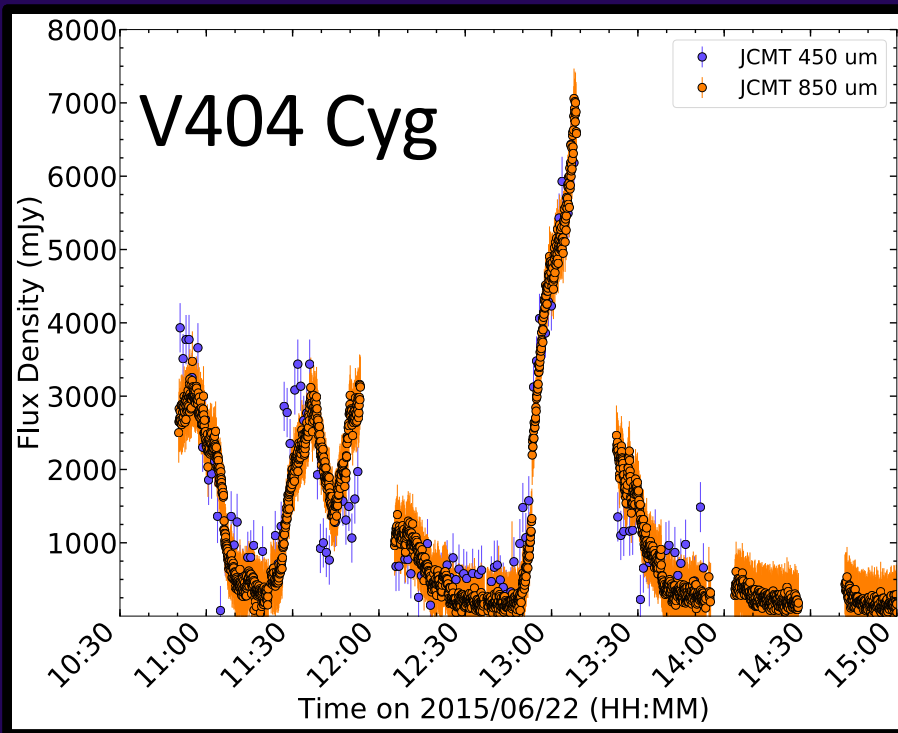


What can we learn from time domain studies of jet emission?

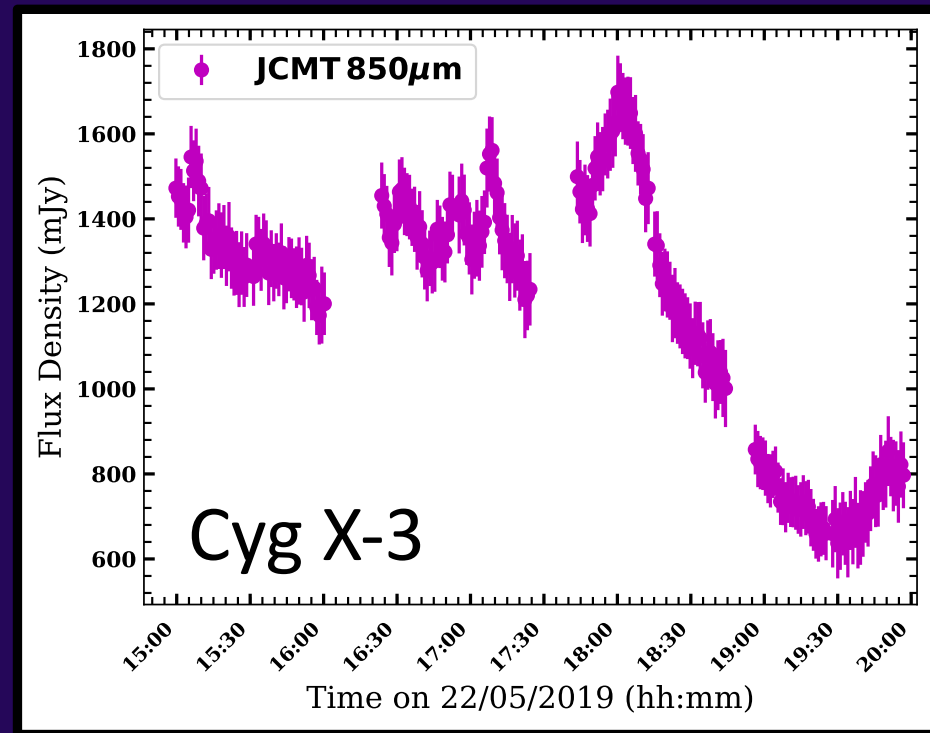
- Map out the jet size scale
- Probe jet geometry, beyond what we can accomplish with high resolution imaging
- Measure compact jet speed
- Probe the connection between the accretion flow and the jet



Sub-mm Variability with SCUBA-2



Tetarenko et al., 2017

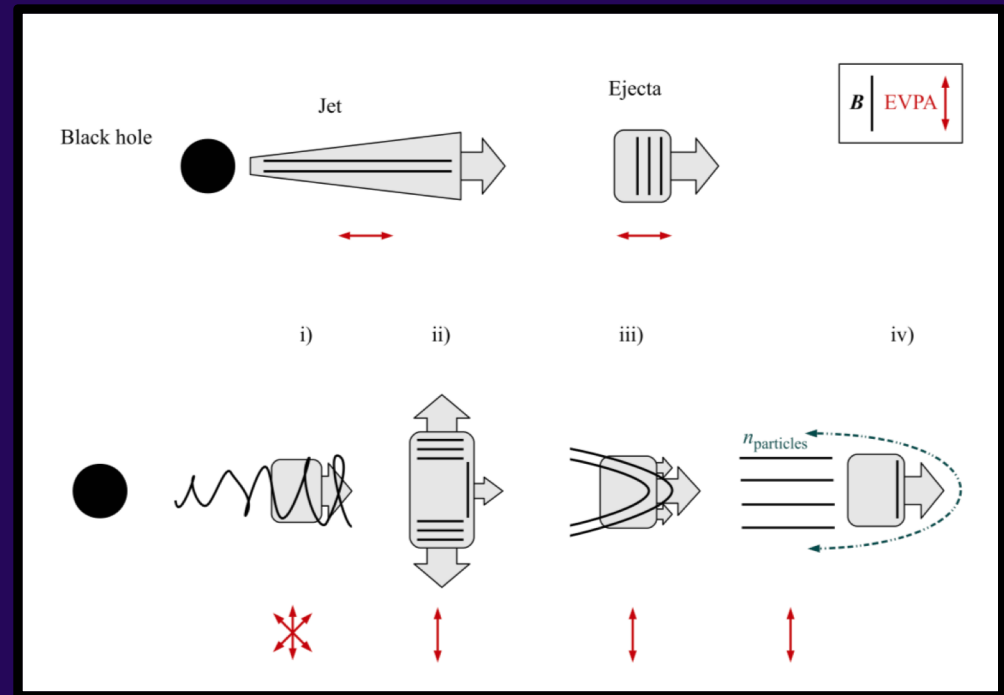


Tetarenko et al., in prep.



What can we learn from polarimetry studies of jet emission?

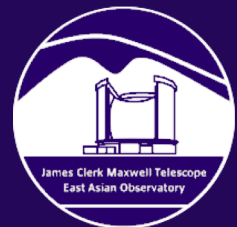
- Infer the orientation of the unresolved jet.
- Magnetic field strength and structure of the jet.
- Insight into the shock and plasma conditions in the jet flow.



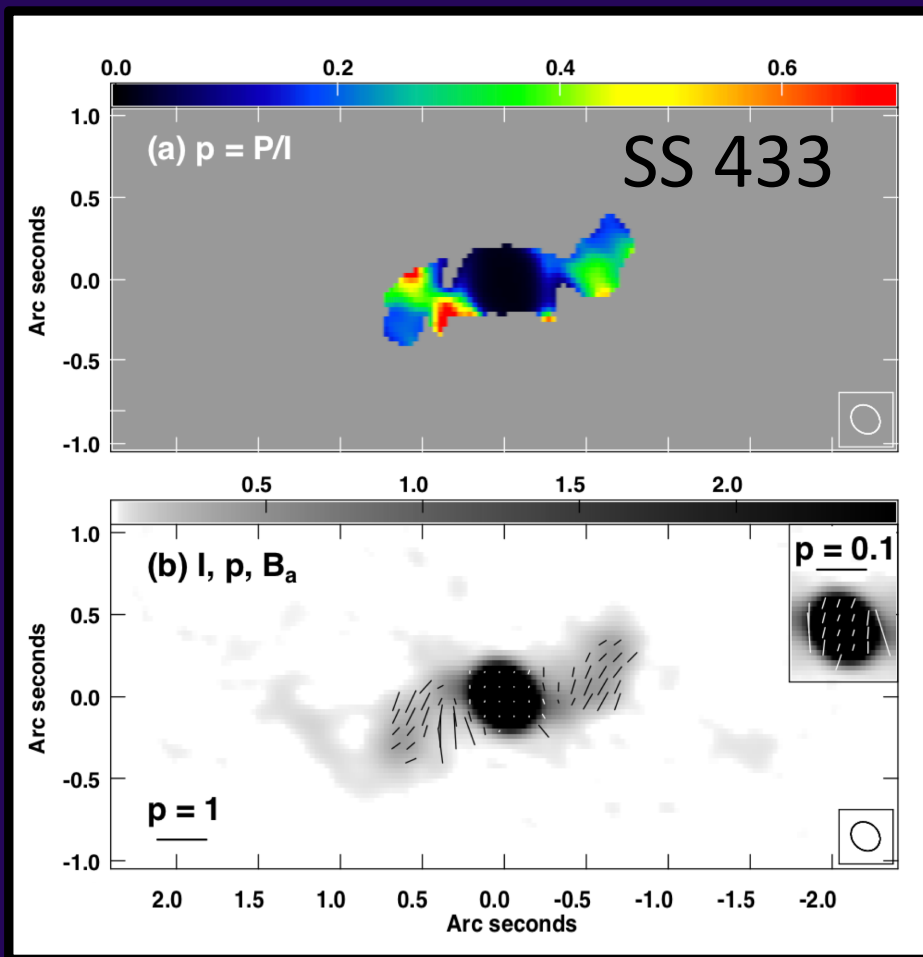
Curran et al., 2014

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Sub-mm polarimetry in BHXBs



- Polarization studies mainly undertaken at radio or OIR.
- Complicated by the effects of Faraday rotation, rapid variations.
- Sub-mm probes jet base region.

Blundell et al., 2018

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PITCH-BLACK

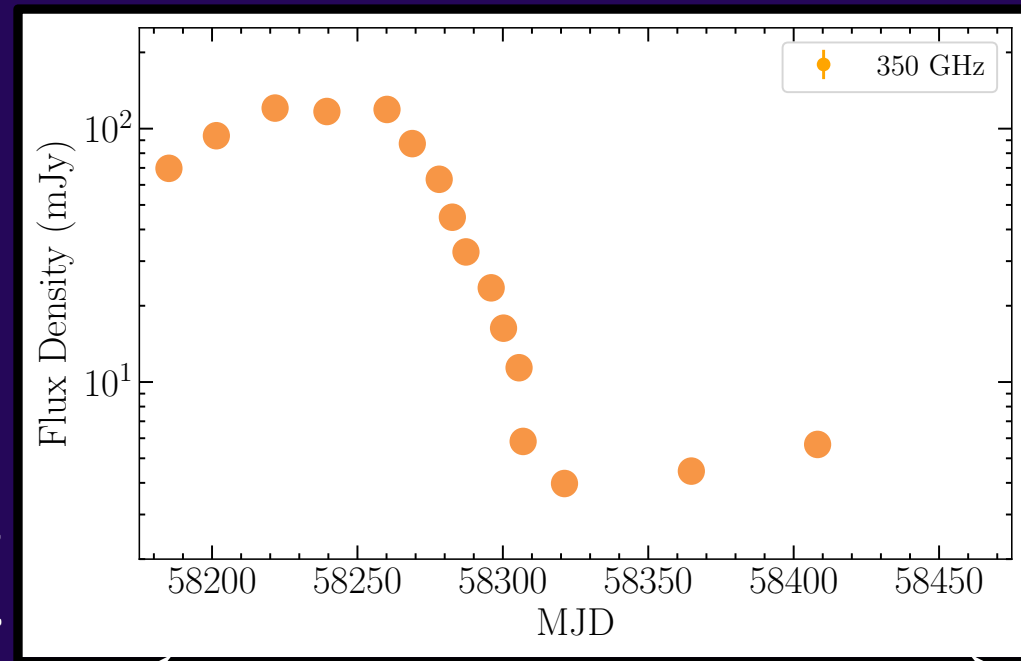
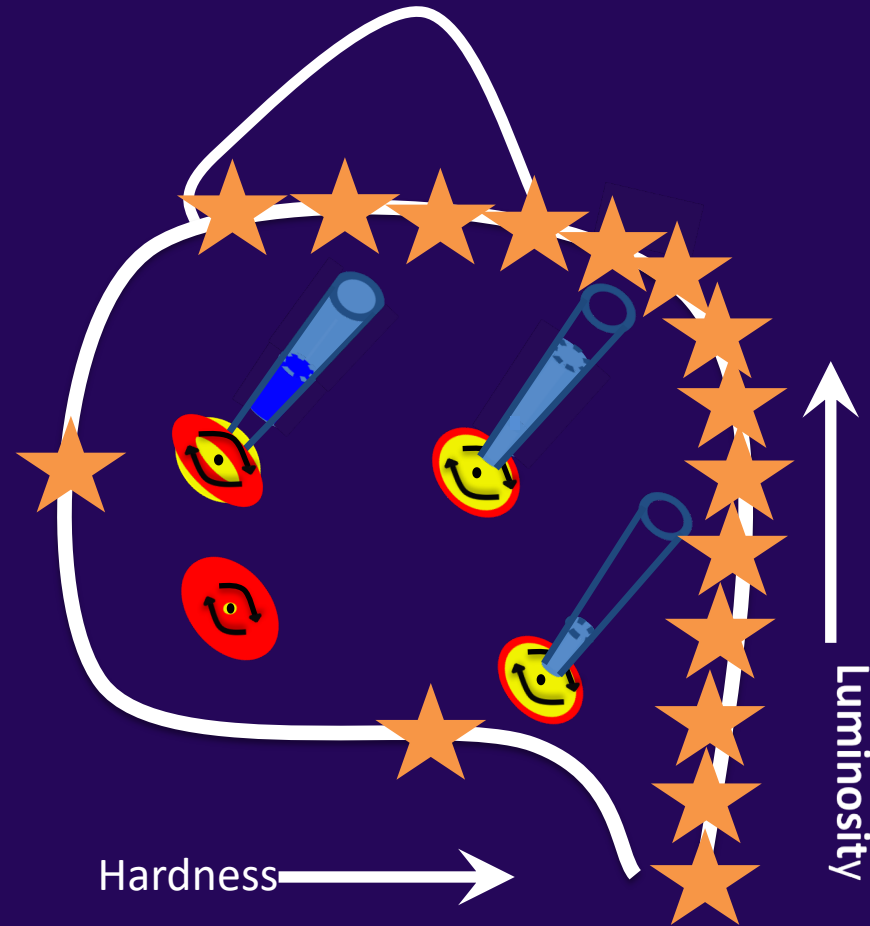
- New proposed JCMT large program using SCUBA-2/POL-2.
- Aim to combine the diagnostic power of sub-mm timing and polarimetry to create a detailed probe of BHXB jets.
- Will observe across outburst accretion states, and different BHXB sources, as well as sync up with supporting multi-wavelength coverage.

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PITCH-BLACK Observations of BHXBs



300 days

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Major Questions we can answer

- How are jets launched and accelerated?
- What are the initial conditions in the launching/acceleration region?
- What role do black hole mass, spin, and accretion rate play in jet production?
- What factors drive jet evolution during outburst?
- What is the origin and structure of the magnetic fields in jets?
- How does the energy released by BHXB jets compare to other feedback processes, such as star formation?

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Looking ahead ...

SUBMILLIMETRE TRANSIENT SCIENCE IN THE NEXT DECADE

EAO SUBMILLIMETRE FUTURES PAPER SERIES, 2019

- SCUBA-2 can only probe the brightest systems.
- A more sensitive sub-mm camera would allow us to sample fainter systems, over shorter timescales.

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Summary

- Combining sub-mm timing and polarimetry can be an incredibly powerful tool for unlocking complicated jet physics.
- Need high cadence observations of BHXB jets during outburst, sampling a range of accretion states and systems.
- JCMT SCUBA-2 is an ideal instrument with which to study transient events.

Thank you!

Alex Tetarenko

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