

Monitoring LMXBs with the Faulkes Telescopes

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Also to blame (a bit) Dave Russell (Amsterdam)
Rob Fender (Southampton)
Paul Roche (LCOGT/Cardiff)
Simon Clark (Open University)



About Me

Based at Faulkes Telescope Project
(part of LCOGT), Cardiff University

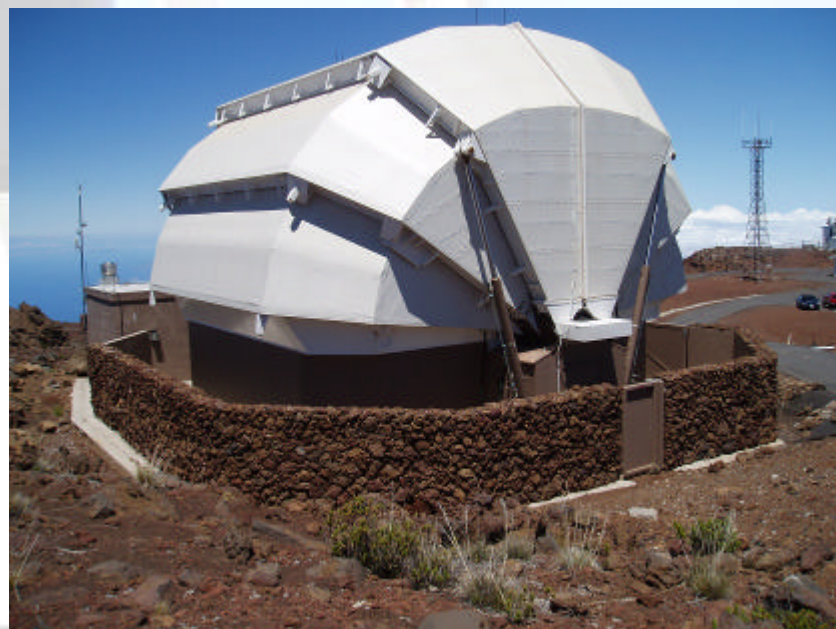
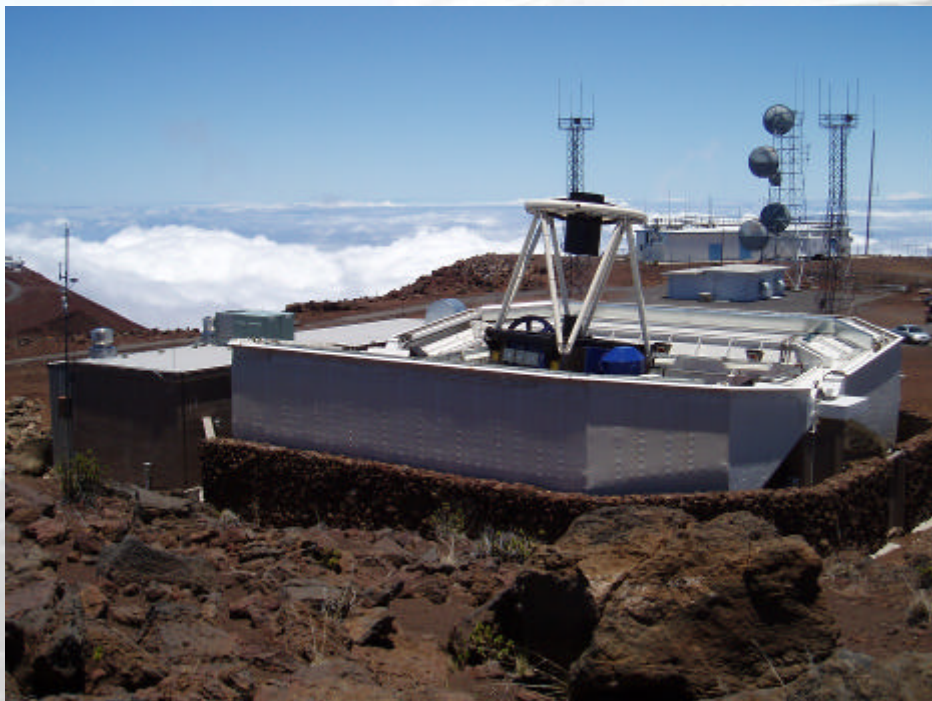
Registered PhD student with The
Open University thesis title

‘Temporal Fluctuations in Accretion
Around X-Ray Binaries’

The Sites



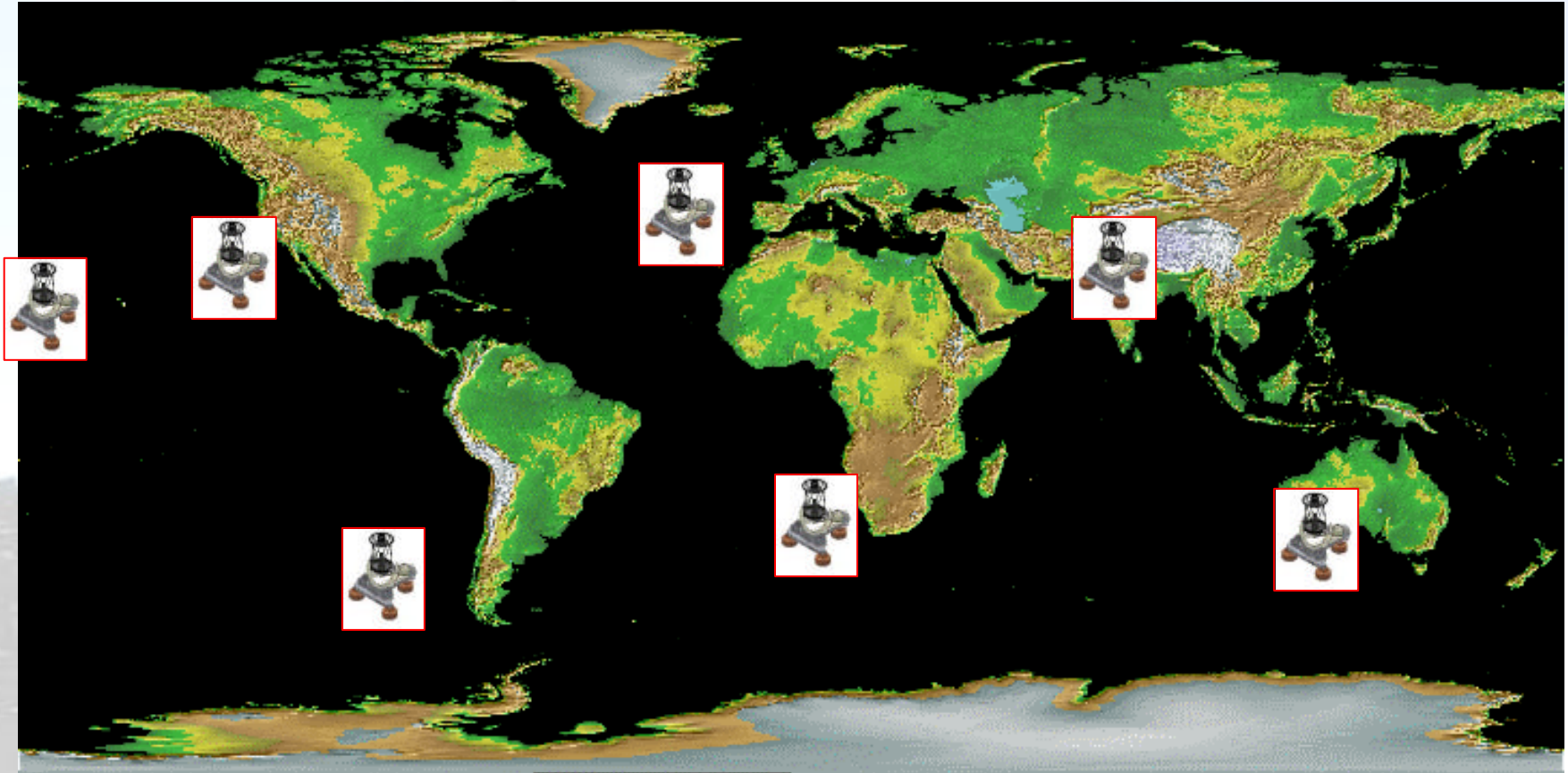
FT North – Haleakala, Maui



6 January 2009

LOFAR and the Transient Radio Sky

The Planned LCOGT Network



Multiple sites offer 24 hour coverage and redundancy

Filters / Cameras



- u'g'r'i'z'y'
- BVR
- Ha, H β , O III
- Seeing $\sim 0.75'' - 2''$
- 4.6' x 4.6' FOV
- 2048 x 2048 pixels in 2 x 2 binning

X-ray Binaries

Luminous X-ray sources where material flows onto a compact object (NS or BH)

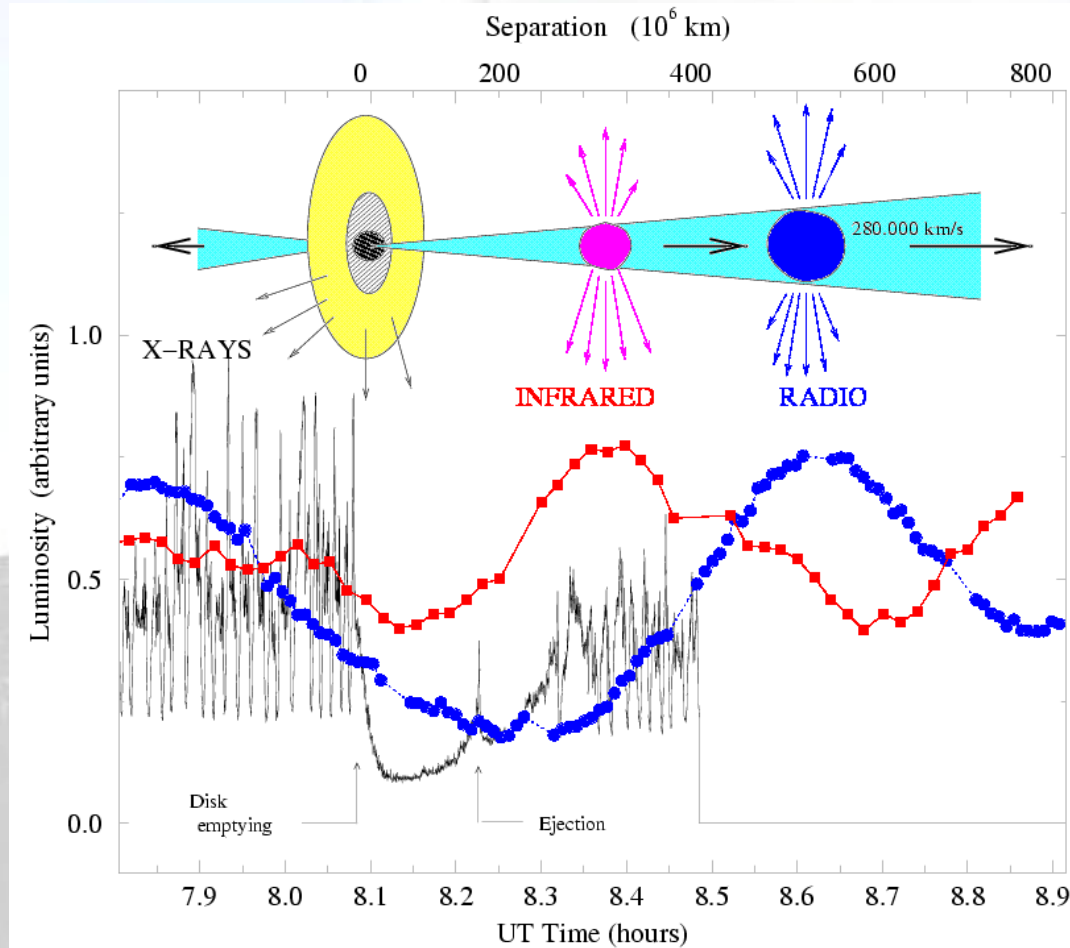
$$L_X \sim 10^{34-38} \text{ erg/s}$$

Persistent, transient and periodic behaviour

Indicative of blackbody temperature ~ 10 million K

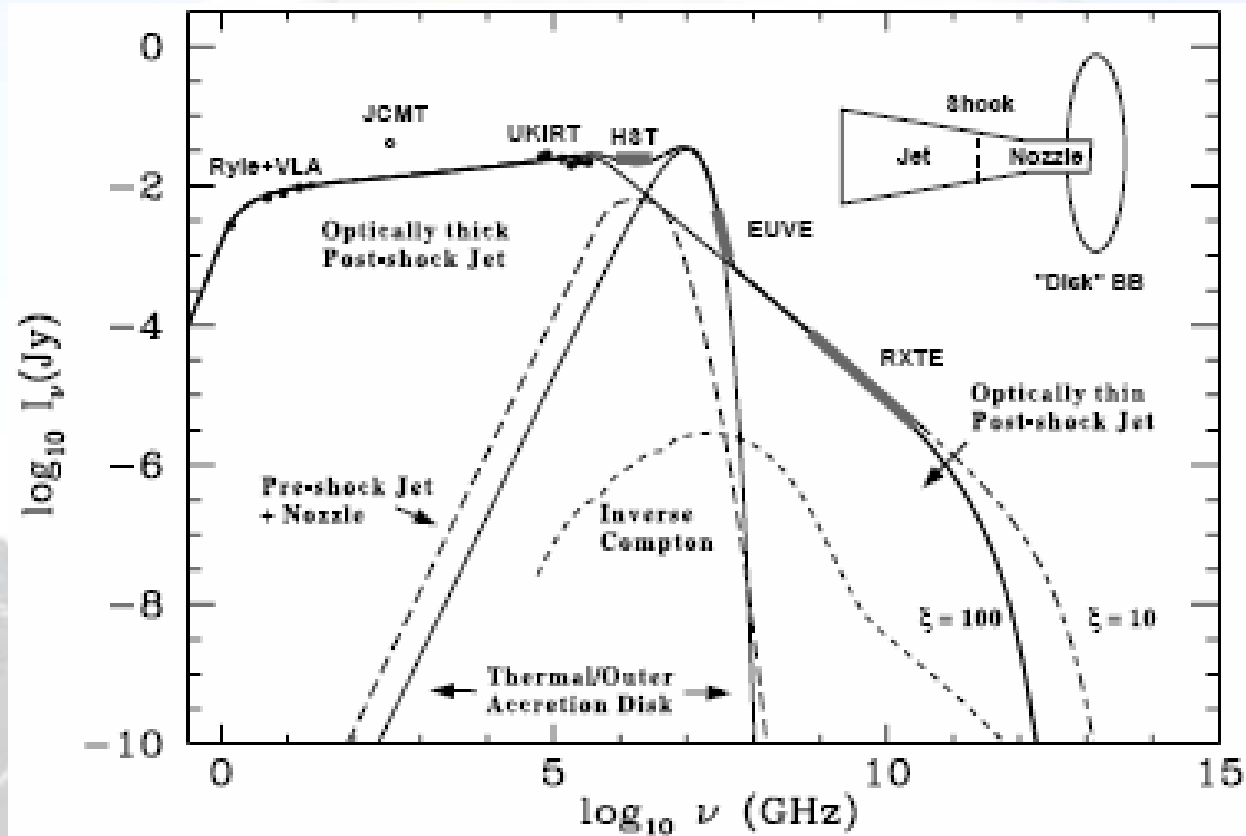
Around 300 known sources in our Galaxy

GRS1915+105



Mirabel et al, 1998

Example SED



Markoff et al., 2001

Low-mass X-ray Binaries (LMXBs)

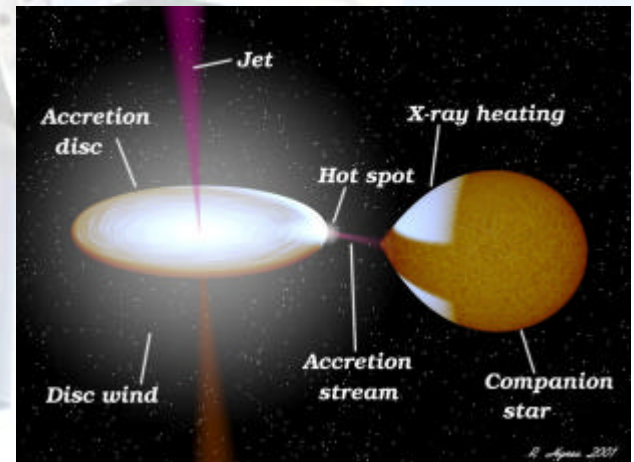
Donor usually main sequence star

Accretion by Roche lobe overflow

Long-lived ($\sim 10^7 - 10^9$ years)

System's luminosity usually dominated by disc

Usually found in globular clusters and Galactic bulge



Aims of the Project

To identify and monitor transient outbursts in LMXBs - LMXBs can brighten in the optical / near IR up to a month before X-ray detection

To study their variability in quiescence (cf. X-rays) (constraints on duty cycles)

LMXB Monitoring

30 sources split between North & South (NS & BH)

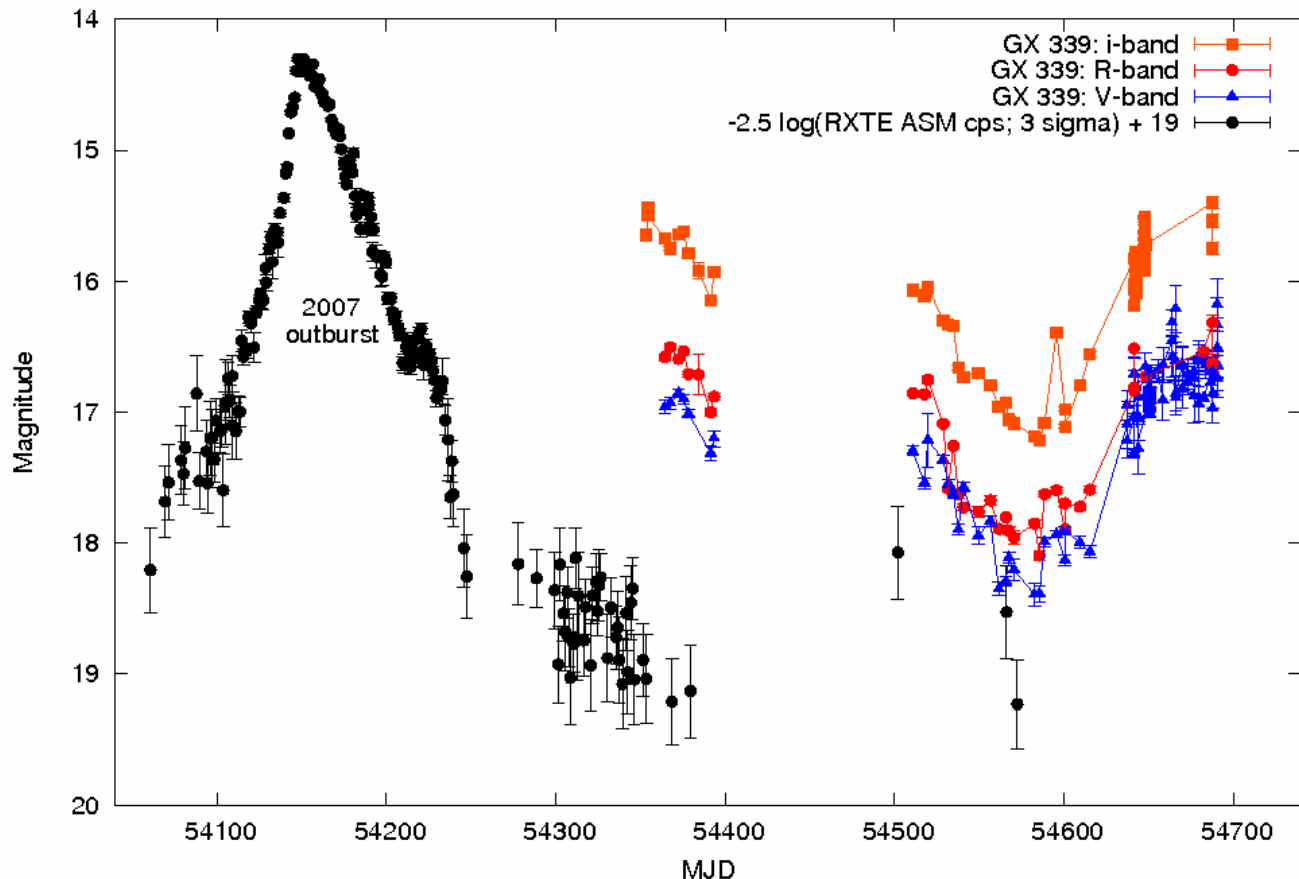
Monitored once per week in V, R, i' since 2006

Cadence increased after ATel or interesting activity (ASM only detects $> 10^{35}$ erg s⁻¹)

Future move towards z and y filters (IR), more telescopes, spectroscopy

GX339-4

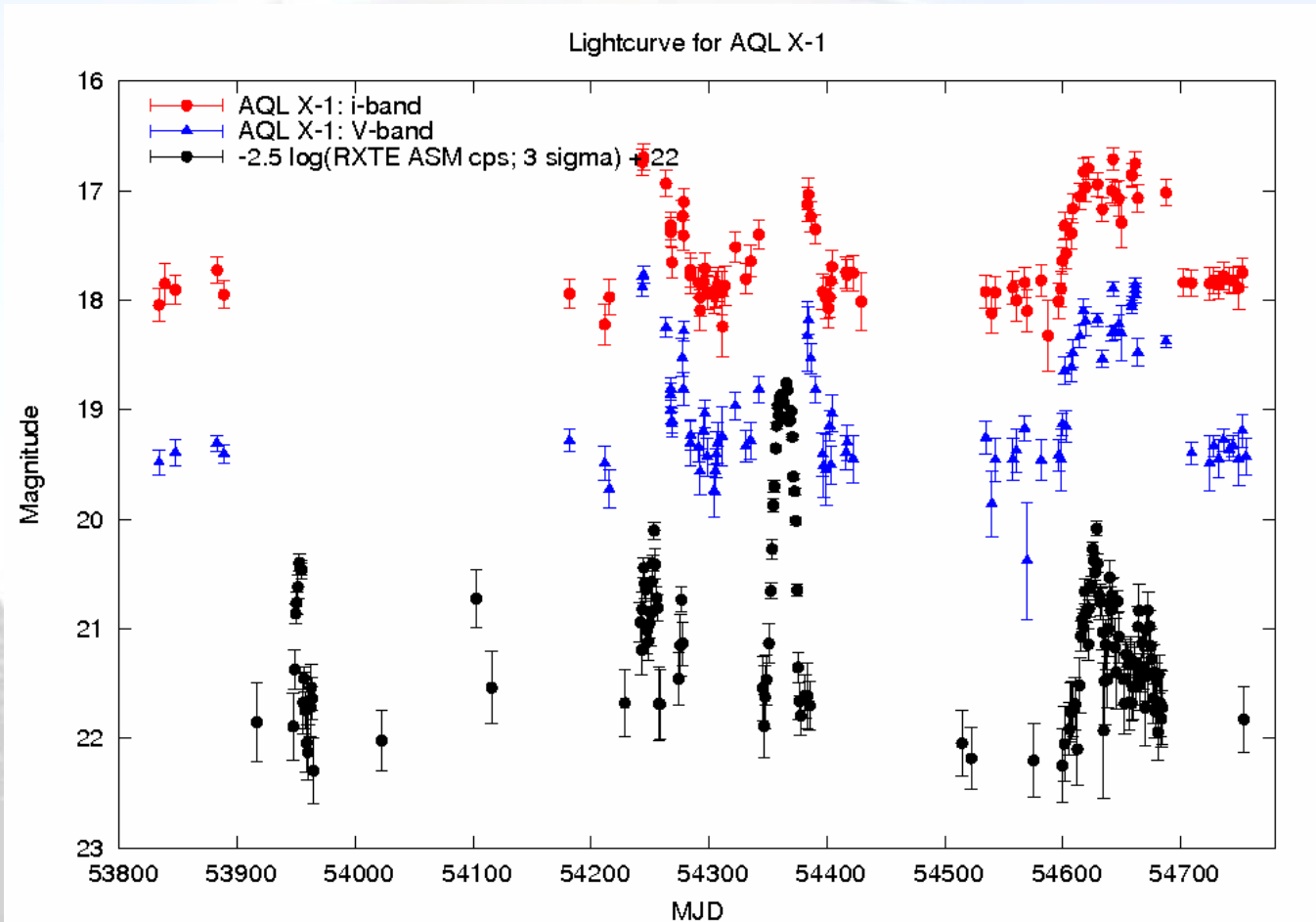
Lightcurve for GX 339-4 (Faulkes Telescope South, UVOT on Swift, SAO 0.75-m Telescope)



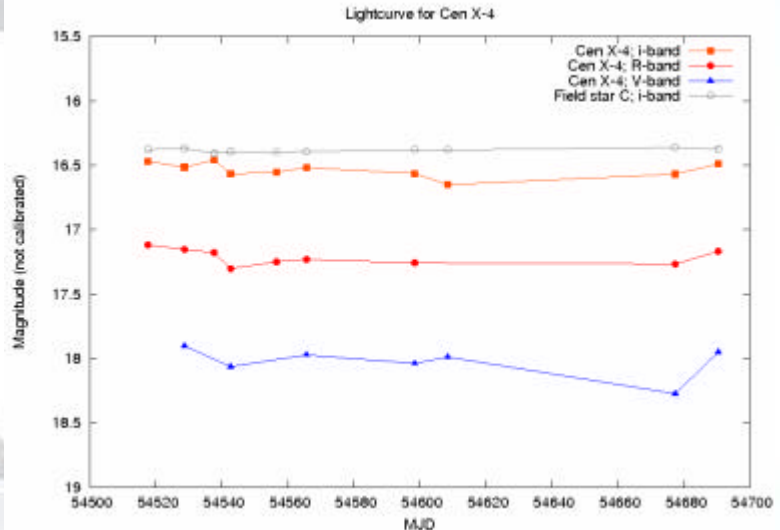
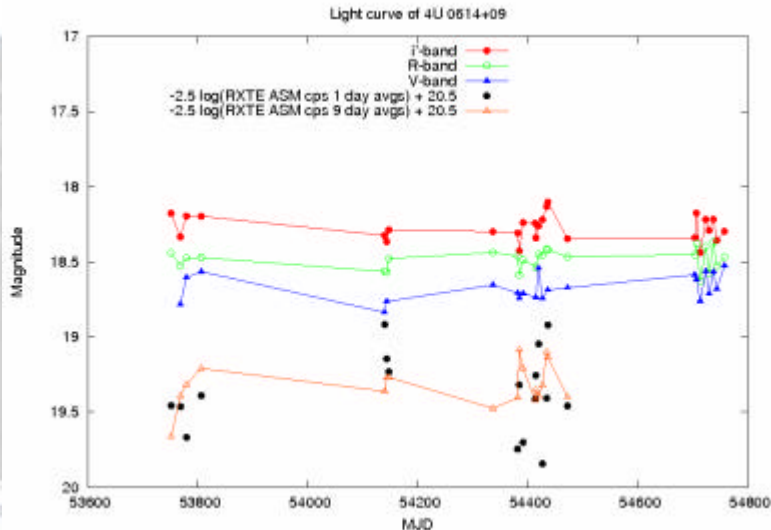
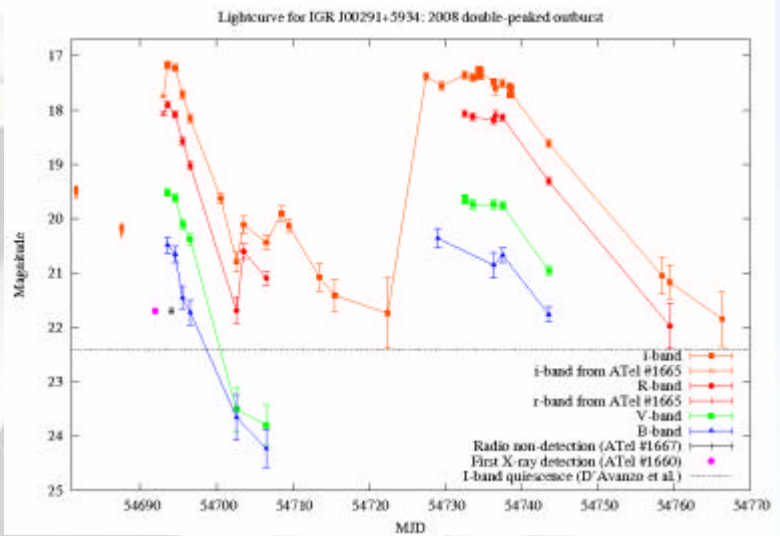
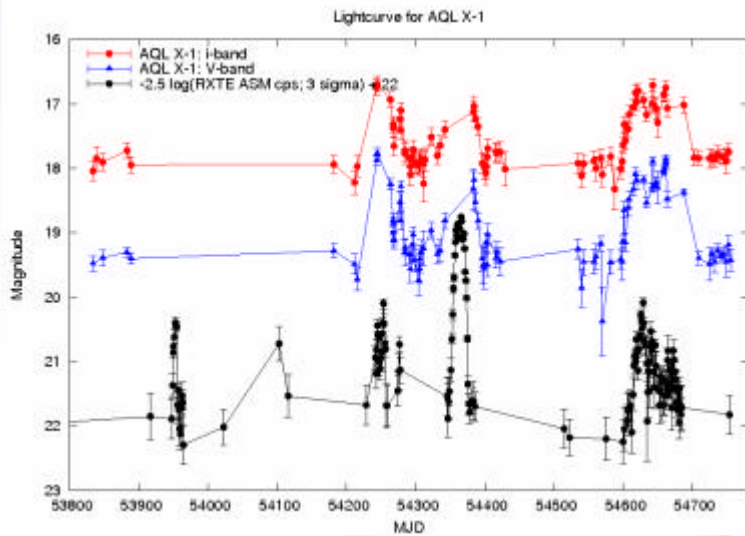
See ATel
1586, Russell
et al., 2008

Aquila X-1 (long-term)

See ATel
1218,
Maitra et
al., 2007



4 Types of Behaviour



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LOFAR and the Transient Radio Sky

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Other Work

Also building datasets on

- HMXBs (e.g. Cyg X-1, SS433, V0332)
- SFXTs

However these systems more dominated by donor star, so disc/jet behaviour harder to identify

Summary

Currently monitoring 30 LMXBs with two 2-metre telescopes (1 paper submitted, 6 in prep.)

More telescopes and instrumentation coming online (near IR, spectrographs)

Monitoring of systems to become closer to 'real-time'

faulkes-telescope.com

www.lcogt.net