

Interactions of X-ray binaries with their surrounding material

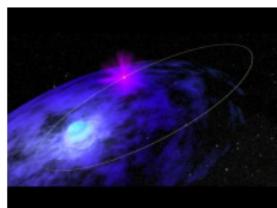
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Sumin Tang (KIT/Caltech)
Josh Grindlay, Edward Los (Harvard)

11 April 2013 – HEAD meeting, Monterey

The many High Mass X-ray Binaries



$10^{32} \text{ erg s}^{-1}$ → $10^{35} \text{ erg s}^{-1}$ → $10^{38} \text{ erg s}^{-1}$ → $10^{41} \text{ erg s}^{-1}$

- **Be HMXB**

Decretion disk around fast rotating B0-2e star

- **Super-giant HMXB**

Wind fed or Roche lobe overflow

- **Ultra-luminous X-ray sources (ULXs)**

> Eddington luminosity for a stellar mass black hole ($> 10^{39} \text{ erg s}^{-1}$)

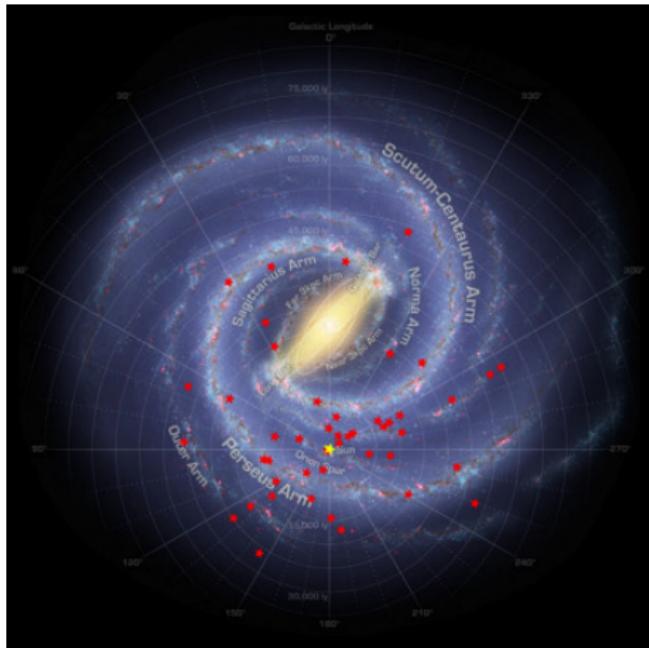
Super-Eddington accretion state

- + **Check the source ESO 243-49 HLX-1 at $10^{42} \text{ erg s}^{-1}$**

Intermediate mass black hole ($10^4 M_\odot$)

[talk by S. Farrell 403.08 + posters]

Spatial distribution of HMXBs



[Coleiro et al. 2013]

HMXBs

- Young objects
- Close to star forming regions
[Bodaghee et al. 2012]
[Coleiro et al. 2013]

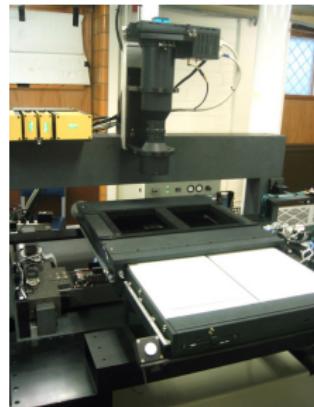
What role in:
life cycle of interstellar matter?
Galaxy evolution?

Interactions with gas/dust?

1. 100-yr variability
2. Far-infrared observations

DASCH

Digital Access to a Sky Century at Harvard



- ~525 000 photographic plates (e.g. 8 in x 11 in), **all sky coverage**
- **1885 à 1992**, different telescopes (84 plate series)
- **Fast digitizer**: 95 sec for 2 plates, 400 per day... 4 years! [Simcoe et al 2006]
- **Specific Pipeline**: $\pm 0.8\text{--}3''$, ± 0.12 mag [Laycock et al. 2010, Servillat et al. 2011]

<http://hea-www.harvard.edu/DASCH>

NSF grants AST0407380, AST0909073 and the Cornel & Cynthia K. Sarosdy Fund for DASCH

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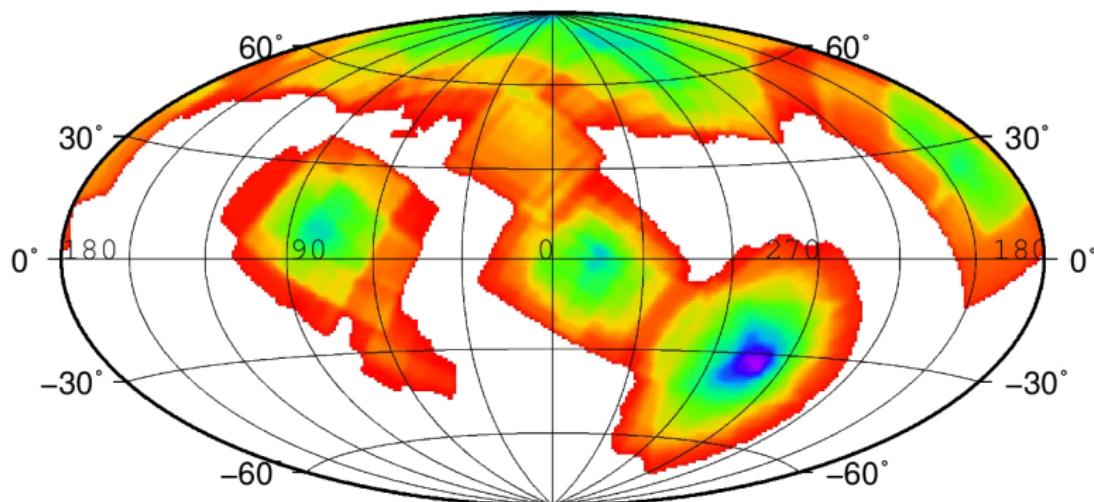
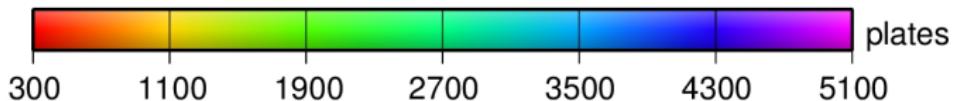
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DASCH

Digital Access to a Sky Century at Harvard

Variability of the sky over **100 yr** : a new time domain!

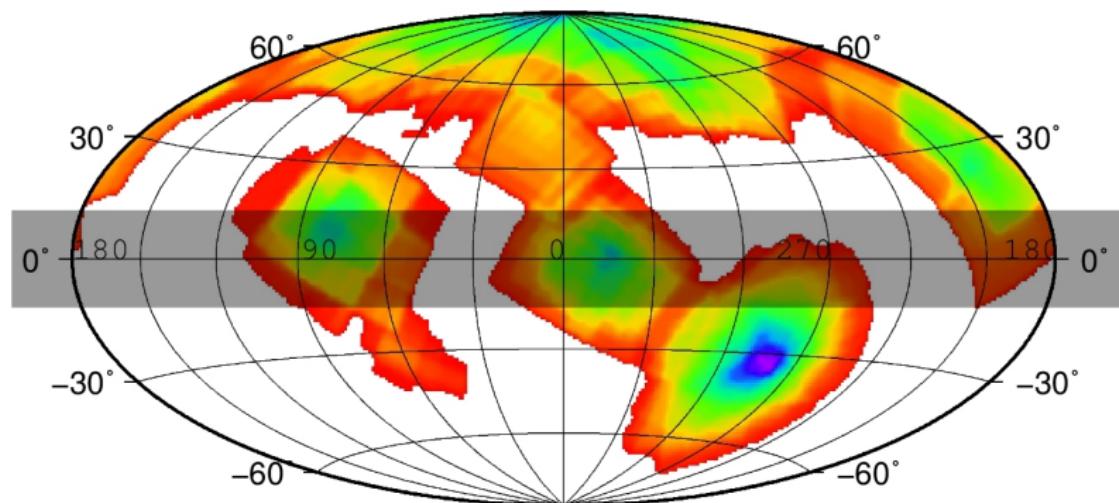
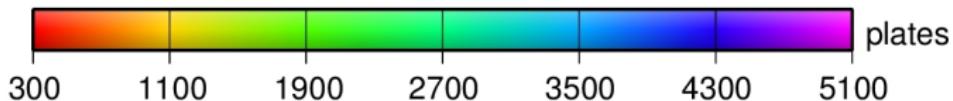


Current status: 36 000 plates digitized (7%)

DASCH

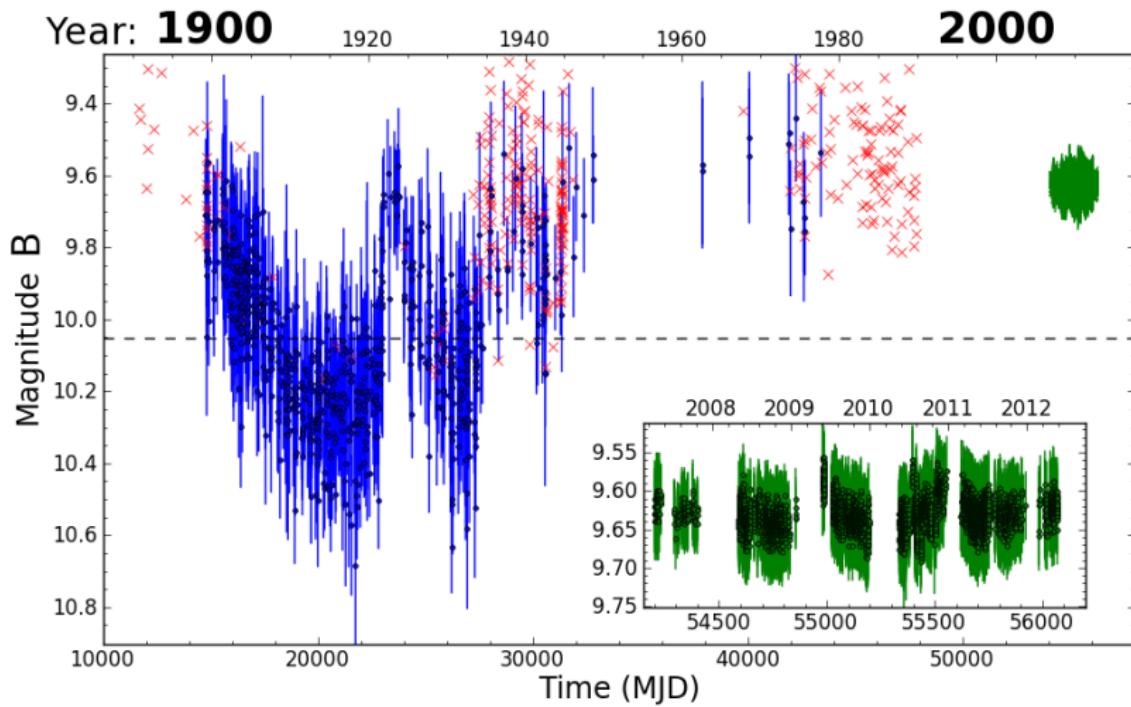
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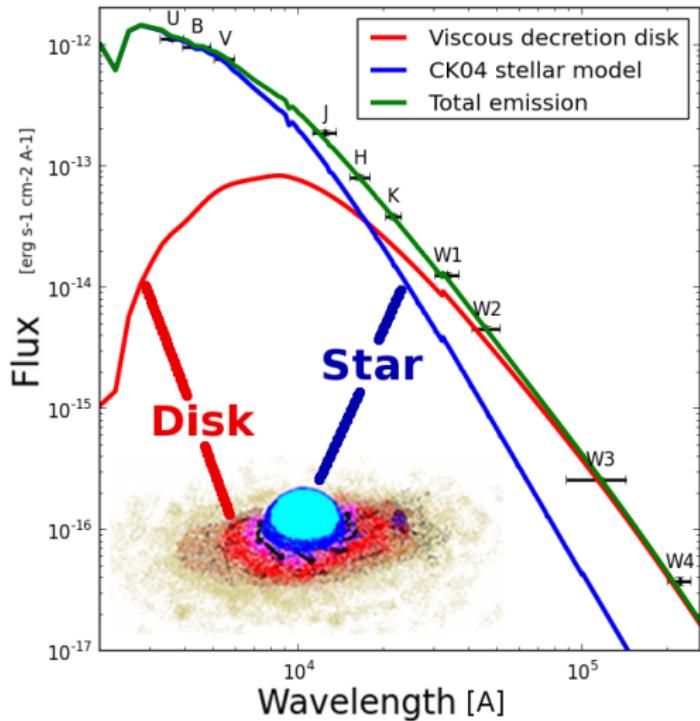
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SAO 49725: a Be-HMXB candidate over 100 years



[Servillat et al. 2013a, PoS; Servillat et al., in prep.]

SAO 49725: infrared excess and disk model



Multi-color viscous disk

- Temperature gradient
- $r_{out} \sim 100 \times r_{star}$
- Inclination $\sim 70^\circ$
- Time scales ~ 10 yr

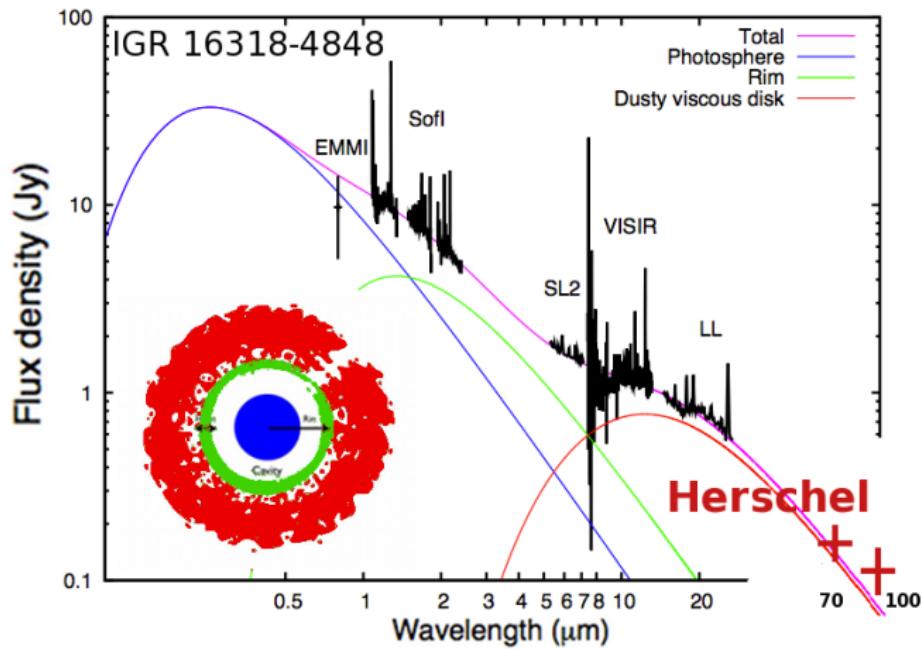
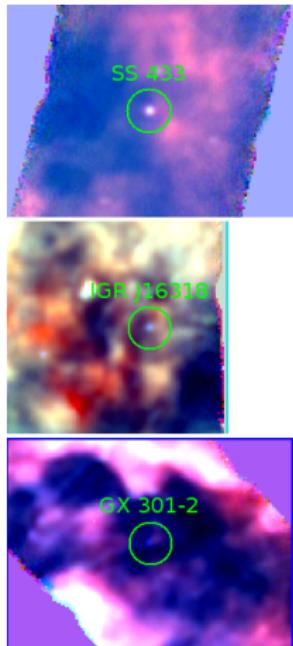
Hard X-rays at $10^{32} \text{ erg s}^{-1}$

- γ Cas-like objects
- Accretion on white dwarf?
- No direct evidence

100-yr variability

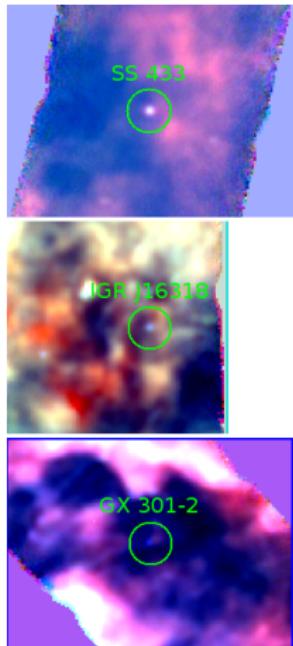
- Instability + white dwarf
- Ejection event

Herschel views on obscured HMXBs



[Chaty, Coleiro, Servillat et al. 2013, PoS]

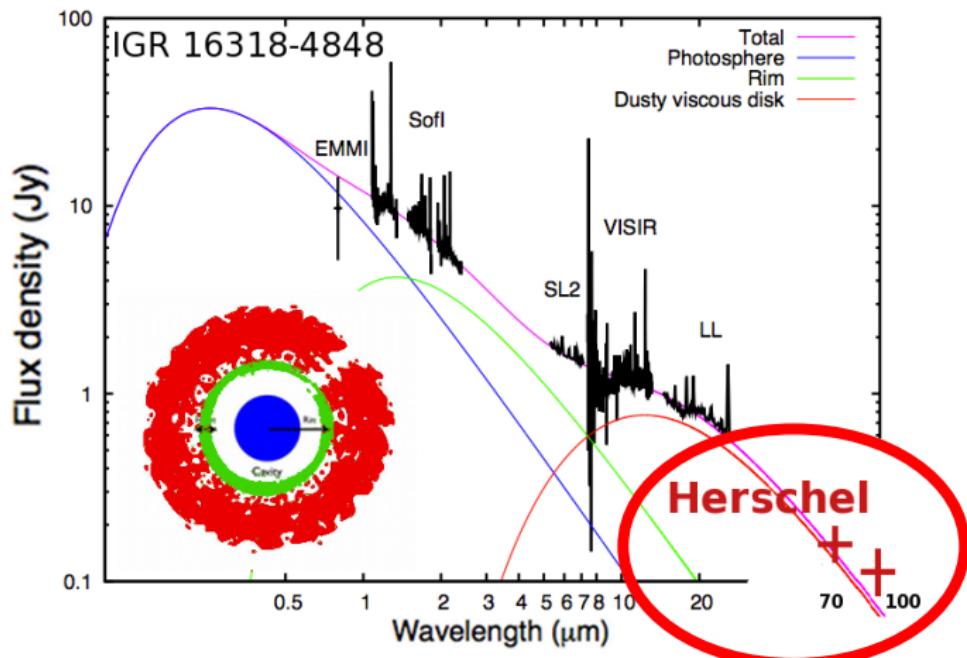
Herschel views on obscured HMXBs



blue: 70 μm

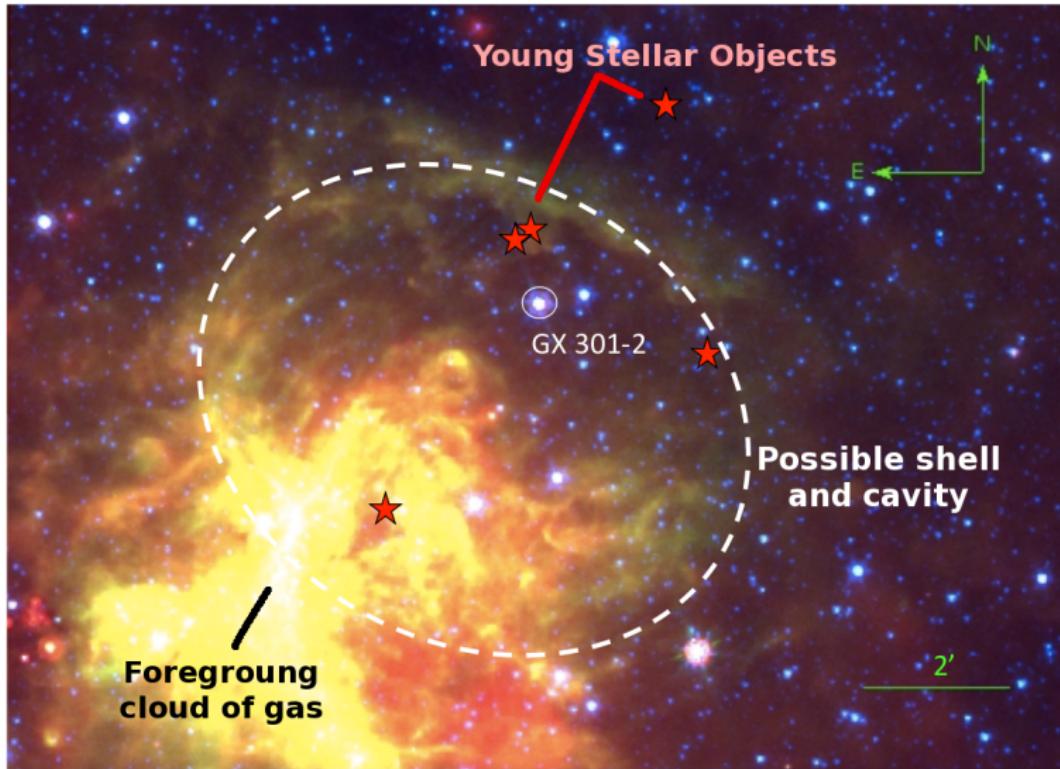
green: 100 μm

red: 160 μm



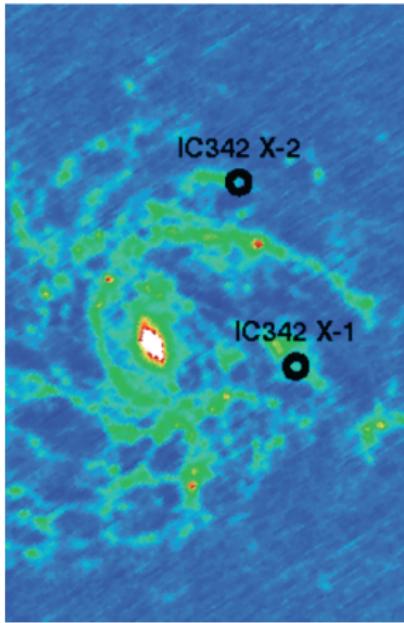
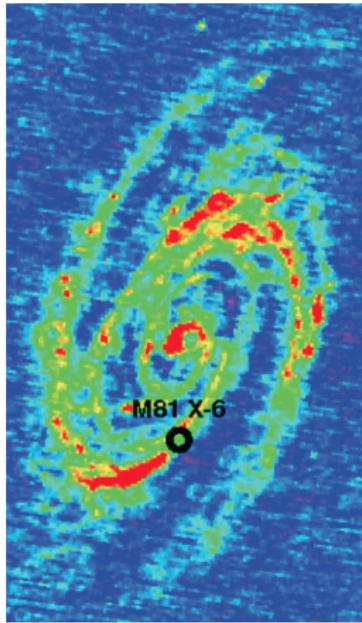
[Chaty, Coleiro, Servillat et al. 2013, PoS]

Embedded HMXBs: triggering star formation?



[Coleiro, Servillat, & Chaty, in prep]

Herschel views on ULXs



[Servillat et al. 2013b, PoS]

Survey

- 20 galaxies with ULXs
- 70 – 600 μm
- Trace cold matter

Preliminary results

- Spatial correlation
- Offset
- Distance \leftrightarrow Age

High Mass X-ray binaries

- Young objects, close to star forming regions
- Interactions with surrounding material

New ways to look at them

100-yr variability with the DASCH project

- Accretion / Ejection history

Far infrared observation with *Herschel*

- Geometry of the systems
- Surrounding cold material

- Possibly trigger new star formation