Interactions of X-ray binaries with their surrounding material

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The many High Mass X-ray Binaries

10^{32} \text{ erg s}^{-1} \rightarrow 10^{35} \text{ erg s}^{-1} \rightarrow 10^{38} \text{ erg s}^{-1} \rightarrow 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

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
1. DASCH survey of HMXBs

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: ±0.8-3", ±0.12 mag [Laycock et al. 2010, Servillat et al. 2011]

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

NSF grants AST0407380, AST0909073 and the Cornell & Cynthia K. Sarosdy Fund for DASCH
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Variability of the sky over 100 yr: a new time domain!

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SAO 49725: a Be-HMXB candidate over 100 years

[Mathieu Servillat (CNES/CEA/CfA)]

[Servillat et al. 2013a, PoS; Servillat et al., in prep.]
SAO 49725: infrared excess and disk model

Multi-color viscous disk
- Temperature gradient
- $r_{\text{out}} \sim 100 \times r_{\text{star}}$
- Inclination $\sim 70^\circ$
- Time scales $\sim 10$ yr

Hard X-rays at $10^{32}$ erg s$^{-1}$
- $\gamma$ Cas-like objects
- Accretion on white dwarf?
- No direct evidence

100-yr variability
- Instability + white dwarf
- Ejection event
Herschel views on obscured HMXBs

blue: 70 µm
green: 100 µm
red: 160 µm

[Chaty, Coleiro, Servillat et al. 2013, PoS]
Herschel views on obscured HMXBs

blue: 70 $\mu$m

green: 100 $\mu$m

red: 160 $\mu$m

[Chaty, Coleiro, Servillat et al. 2013, PoS]
Embedded HMXBs: triggering star formation?

[Coleiro, Servillat, & Chaty, in prep]
Herschel views on ULXs

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

Preliminary results
- Spatial correlation
- Offset
- Distance ↔ Age

[Servillat et al. 2013b, PoS]
**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
  - Surrounded cold material

- Possibly trigger new star formation