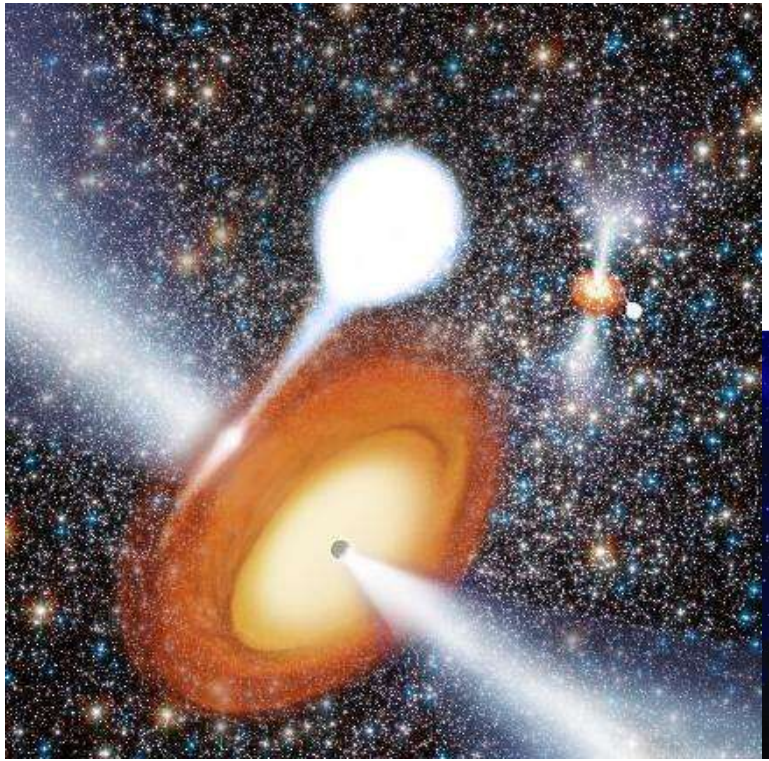
The hunt for ultra-compact X-ray binaries in extragalactic globular clusters: lessons for LISA



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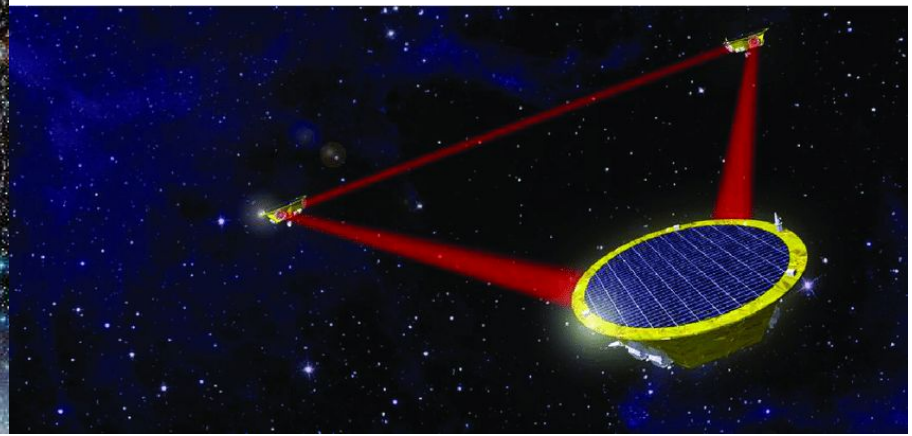
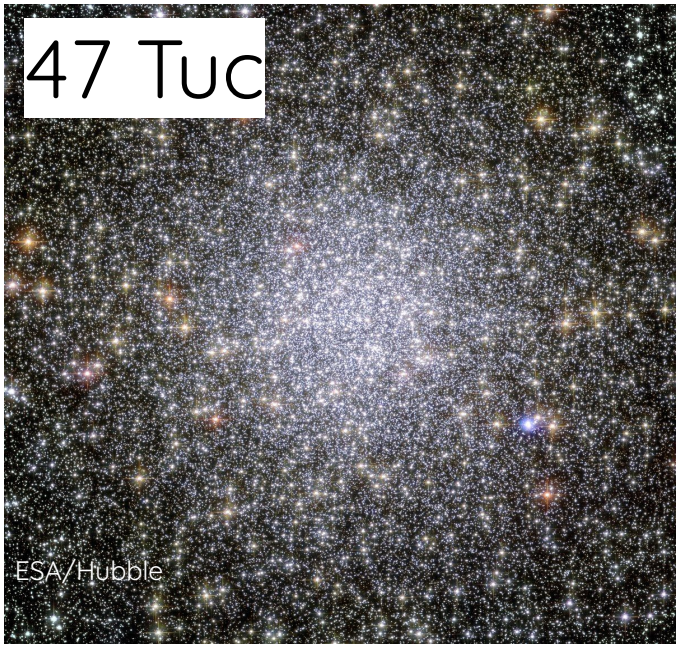
April 28, 2021



Ultra-compact X-ray binaries in globular clusters?

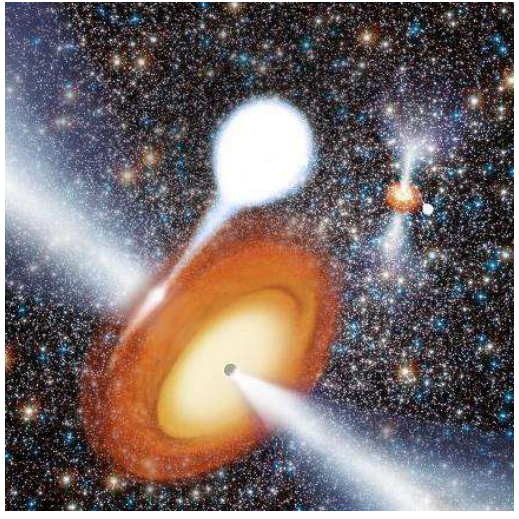
The globular cluster environment is dynamic and crowded, and because of this, all kinds of exotic X-ray binaries form...including ultra-compact X-ray binaries (UCXBs)

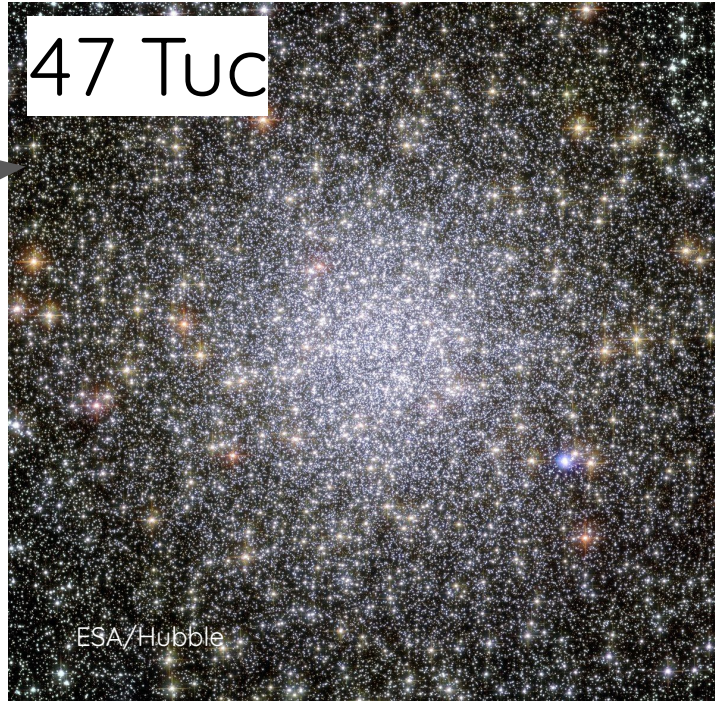


Ultra-compact X-ray binaries in globular clusters?

Some Galactic globular clusters are home to UCXBs, but unfortunately, our Galaxy is home to only ~150 globular clusters making it difficult to find observational evidence to test against theoretical predictions of GC UCXB formation rates for LISA.

Luckily, there are tens of thousands of clusters outside our Galaxy!





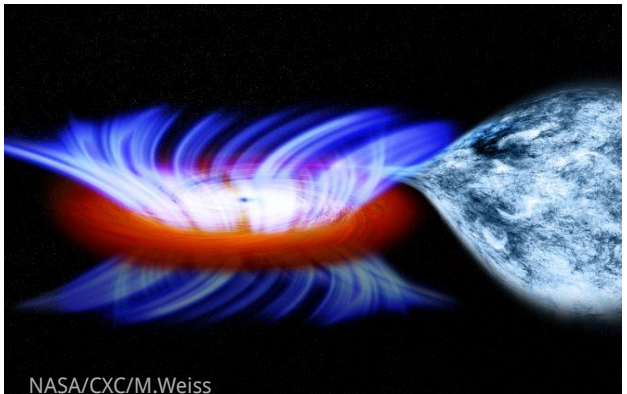
47 Tuc X-9 & extragalactic friend RZ2109

47 Tuc X-9

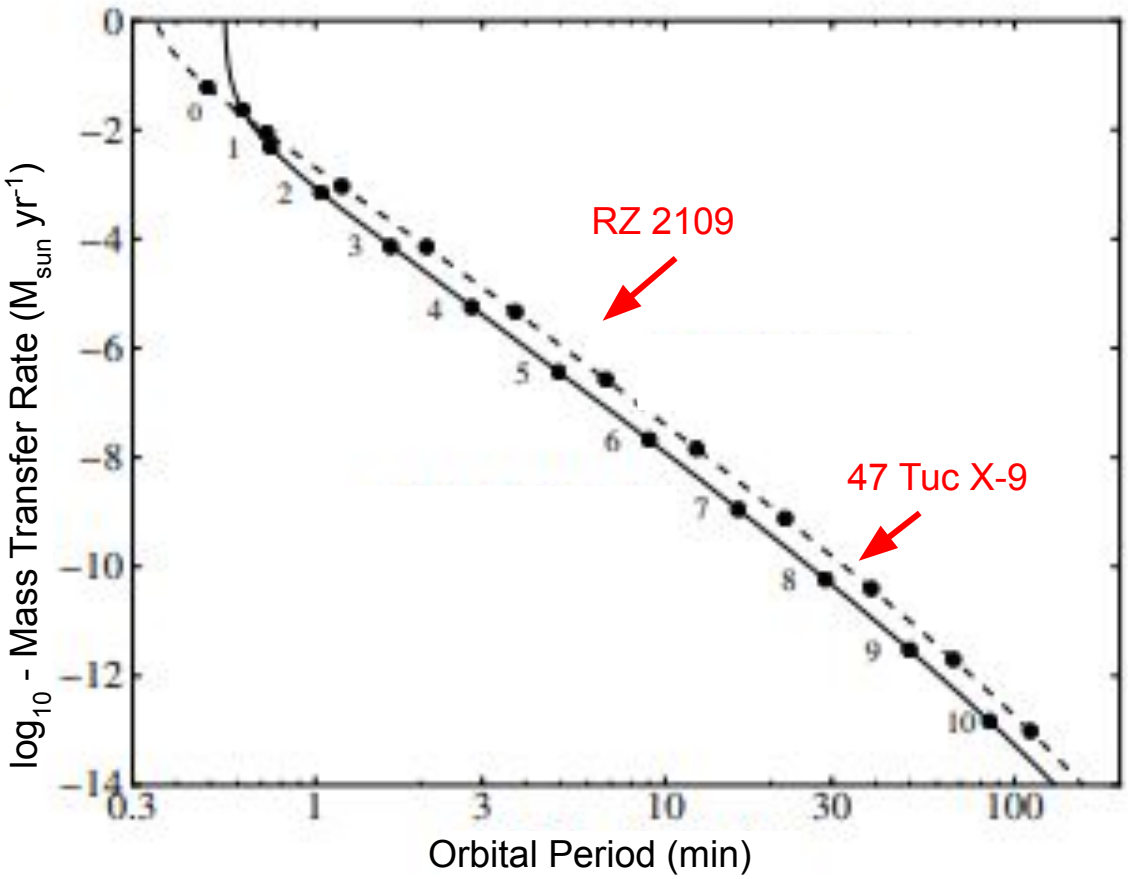
- BH? (*Miller-Jones+2015*)
- O_{VII} and O_{VIII} emission (*Bahramian+2017*)
- No H emission (*Tudor+2018*)
- Variability on ~days (Bahramian+2017)
- Unusually FUV bright (*Knigge +2007*)
- L_X ~ 10^{33}erg/s (*Grindlay+2001*)

RZ2109

- BH? (*Maccarone+2007*)
- O[III] emission (*Zepf+2007*)
- No H emission (*Steele+2011*)
- Variability on ~days (in prep)
- Unusually NUV bright (in prep)
- L_X ~ 10^{39}erg/s (*Maccarone+2007*)

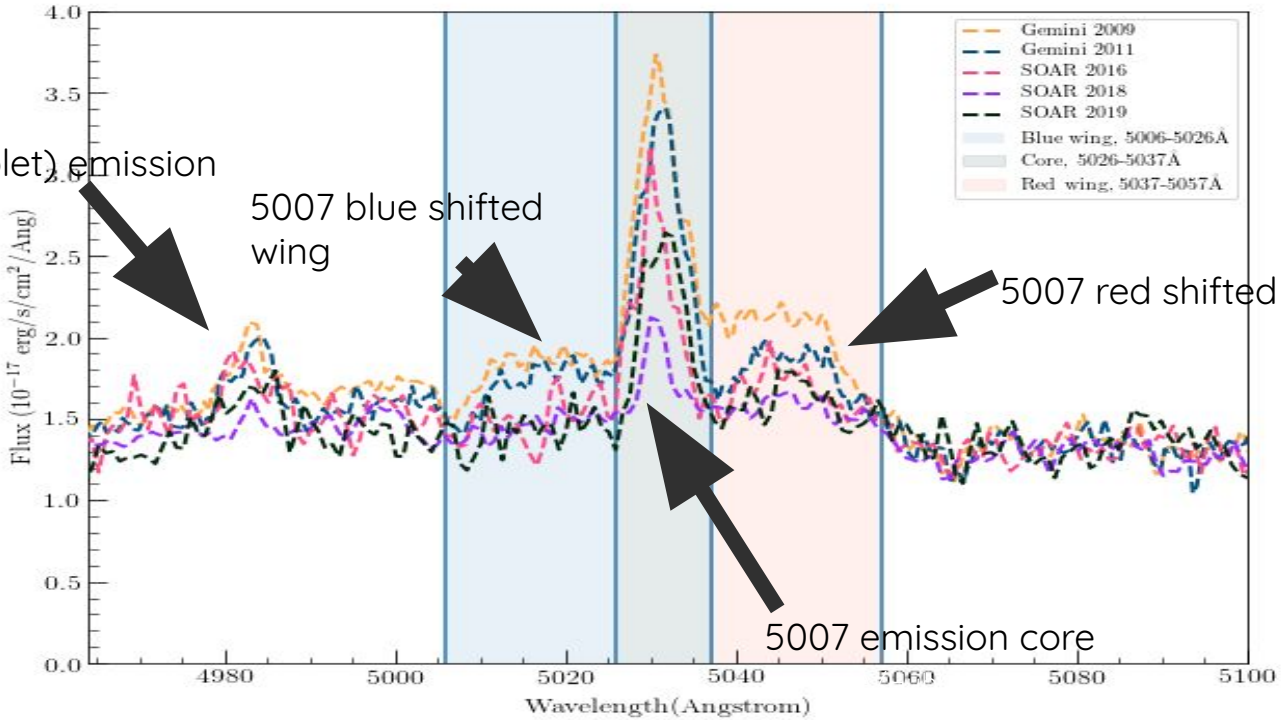


Higher mass transfer rate sources (visible in X-ray) produce optical emission lines which we can search for with optical telescopes.



Adapted from van Haaften+ 2012

super Eddington outflows



4959 (doublet) emission

5007 blue shifted wing

5007 red shifted wing

5007 emission core

(Dage et al, 2019b)

How can we find more?

We can find GC ULX sources by matching optically known GCs to sources with high X-ray luminosity.

Follow-up optical spectroscopy will reveal emission lines caused by super-Eddington outflows.