Recent MAGIC results on Galactic binaries

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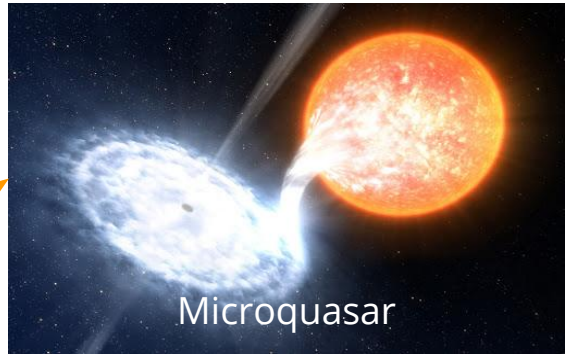
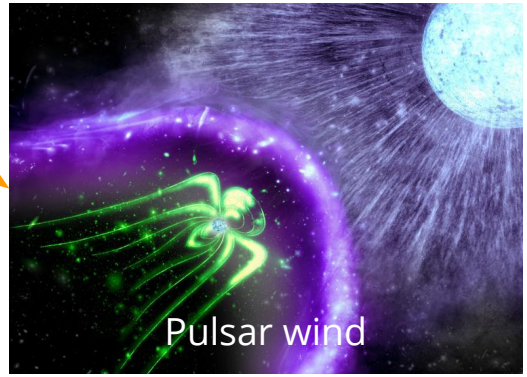
X-ray and gamma-ray binaries

- Systems consisting of a compact object and a companion star.
- Typically show broadband emission from radio up to X-rays and gamma rays.
- Two main scenarios to explain the observed emission.
    - Microquasar: compact object + star
    - Pulsar wind: non-accreting pulsar + massive star





The MAGIC telescopes

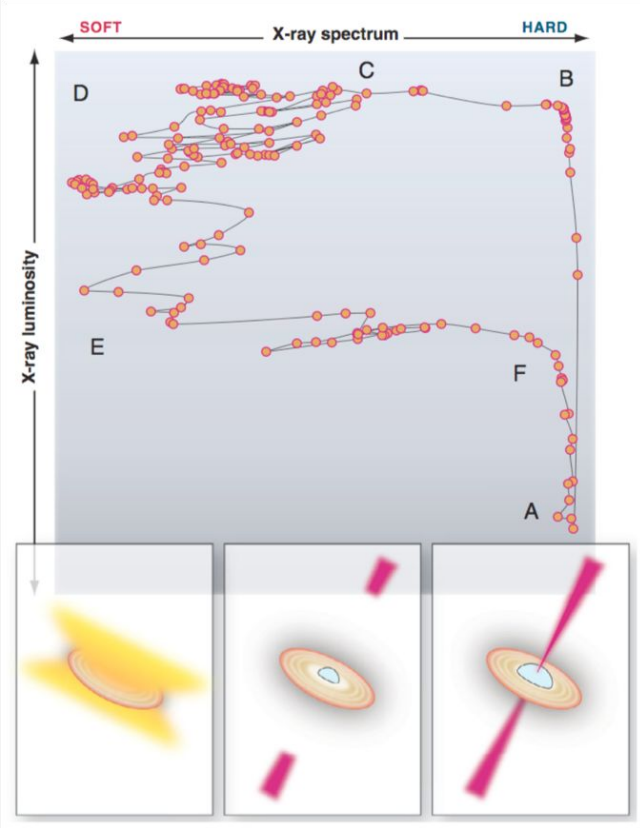
- Two 17-m Cherenkov telescopes located in the island of La Palma, Spain.
- PMT cameras with a ~ 3.5º FoV.
- Energy range: ~ 30 GeV - 100 TeV.
- Integral sensitivity above 100 GeV: ~ 1.5% of Crab Nebula in 50 h.
- Energy resolution: 15 - 23%.
- Angular resolution: ~ 0.09º at 100 GeV.

Aleksic+16

https://magic.mpp.mpg.de/

MAXI J1820+070

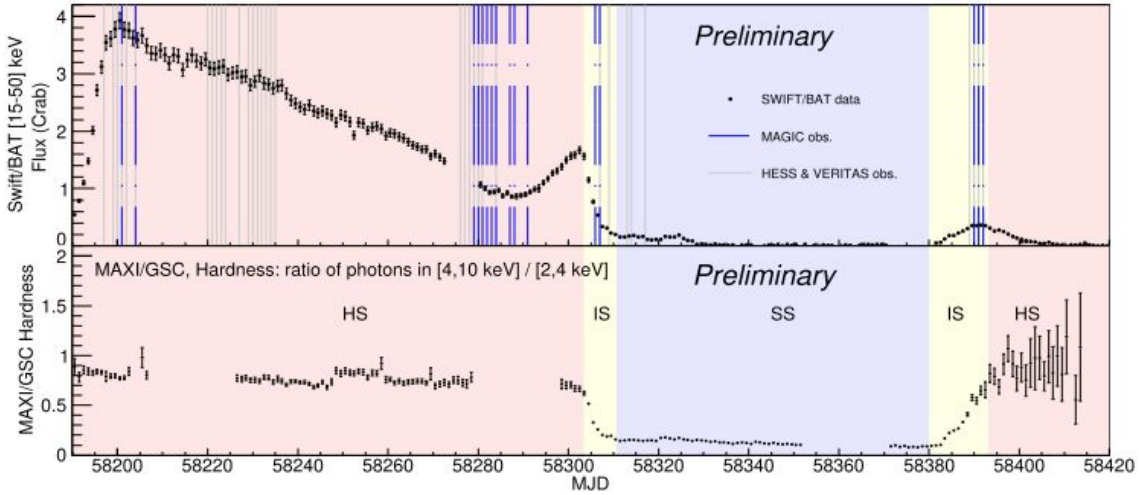
- Low-mass microquasar with a BH discovered in 2018 during a very bright X-ray outburst peaking at ~ 4 Crab in the 15-50 keV band. ATel 11399; Shidatsu+18
- Distance: ~ 3 kpc Atri+20
- Orbital period: ~ 16.5 h Torres+19
- Broadband emission detected from radio to hard X-rays.
- From March to October 2018, it follows the typical X-ray state evolution of BH low-mass microquasars in outburst.



Fender+12

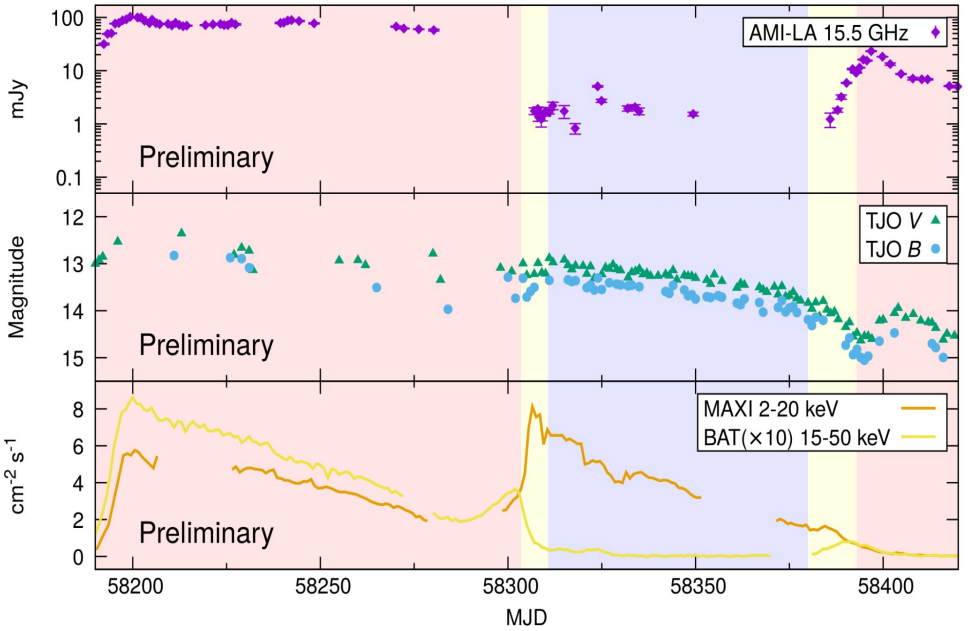
MAXI J1820+070

- Observed by MAGIC for 22.5h between March and September 2018, in a joint campaign with H.E.S.S. and VERITAS.
  - MAGIC observations cover the hard state (HS) and the state transitions.
  - The source is not detected. Full sample integral flux upper limit from MAGIC data above 200 GeV of **2.2×10^{-12} cm^{-2} s^{-1}**.
  - Upcoming publication with a joint analysis of MAGIC, H.E.S.S. and VERITAS data. Multiwavelength data are also included.



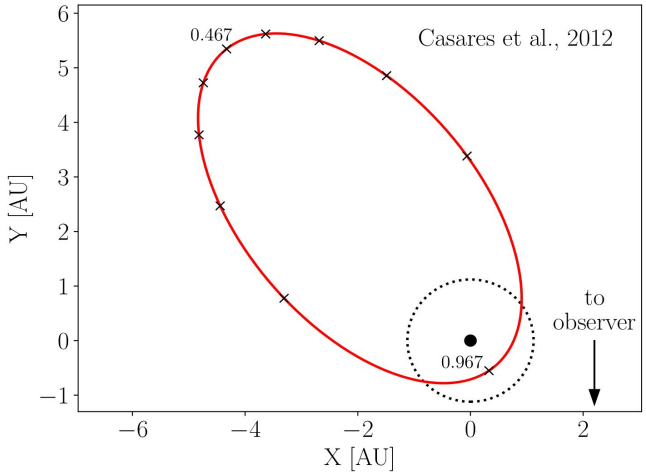
MAXI J1820+070

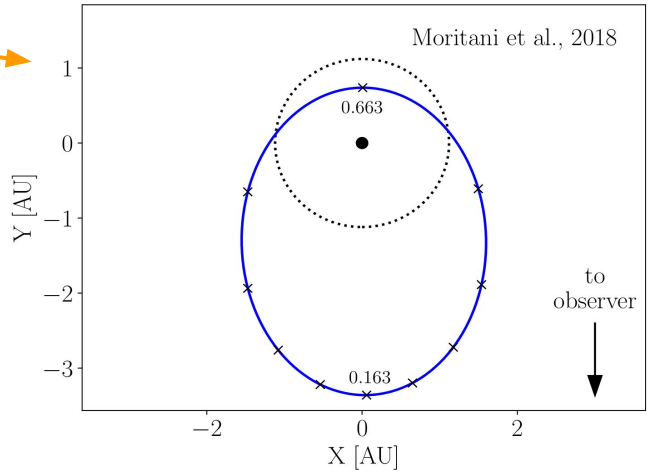
- Radio and X-ray light curves consistent with the standard picture of BH microquasars.
- Optical fluxes dominated by the accretion disk.
    - The star contribution is negligible during the outburst (G ~17.4 mag before the outburst).



HESS J0632+057

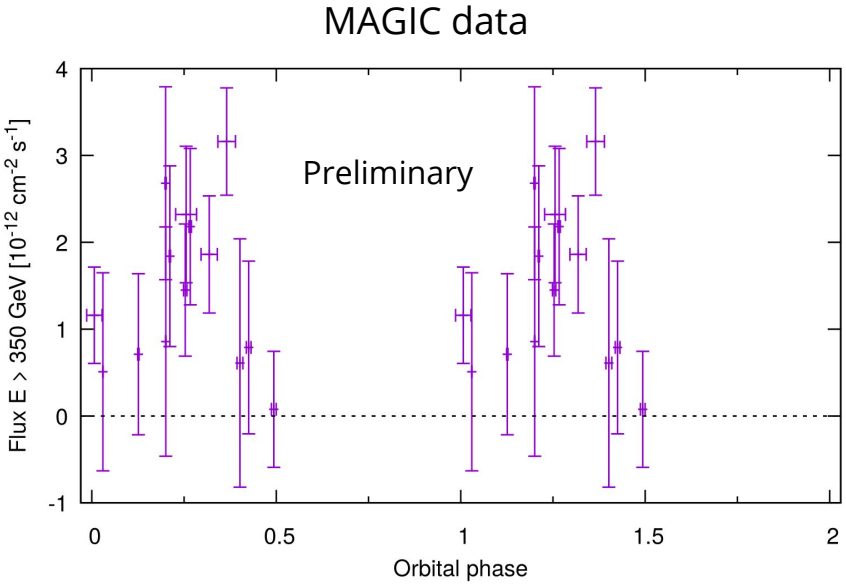
- Gamma-ray binary with a compact object and a massive Be star.
- Distance: 1.1 - 1.7 kpc Aragona+10
- X-ray period: ~ 315 days Aliu+14
  - Two orbital solutions proposed.
- Broadband emission from radio to gamma rays.
- Pulsar-wind scenario proposed, although microquasar scenario cannot be ruled out.





HESS J0632+057

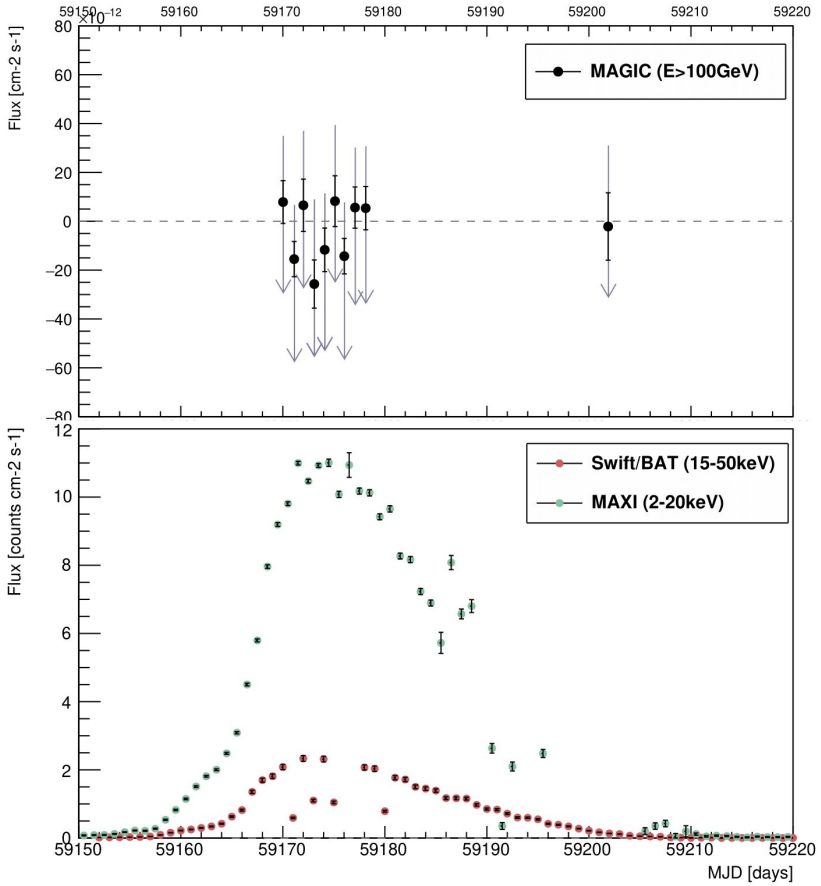
- Observed by MAGIC for 57.4 h under dark and moon conditions.
    - Part of a joint campaign with H.E.S.S. and VERITAS for a total of 440 h of data, between 2004 and 2019. Forthcoming publication.
- First-time determination of the period from VHE data.
    - No super-orbital modulation detected.
- Clear correlation between the VHE and X-ray LC. Leptonic emission scenario.



Archer+20; Tokayer+21

1A 0535+262

- X-ray binary with a pulsar and a Be star.
- Distance: ~ 2.1 kpc Treuz+18
- Orbital period: ~ 111 days Priedhorsky+83
- In November 2020, it underwent its brightest recorded X-ray flare peaking at ~ 12 Crab in 15-50 keV.
- First-time radio detection indicating the presence of non-thermal emission. ATel 14193
- No detection found by MAGIC for 8.2 h of data during the outburst.



Summary

- Recent MAGIC observations of 3 Galactic binaries are reported.
- MAXI J1820+070:
  - Non-detection at VHE: Flux UL > 200 GeV of **2.2×10^{-12} cm^{-2} s^{-1}**.
  - MWL study consistent with the standard BH microquasar picture.
- HESS J0632+057:
  - First-time determination of the period from VHE data. Strong correlation with X-rays.
  - No super-orbital periodicity detected.
- 1A 0535+262:
  - No VHE detection after the brightest X-ray flare ever detected.

Stay tuned for the upcoming MAGIC+H.E.S.S.+VERITAS publications