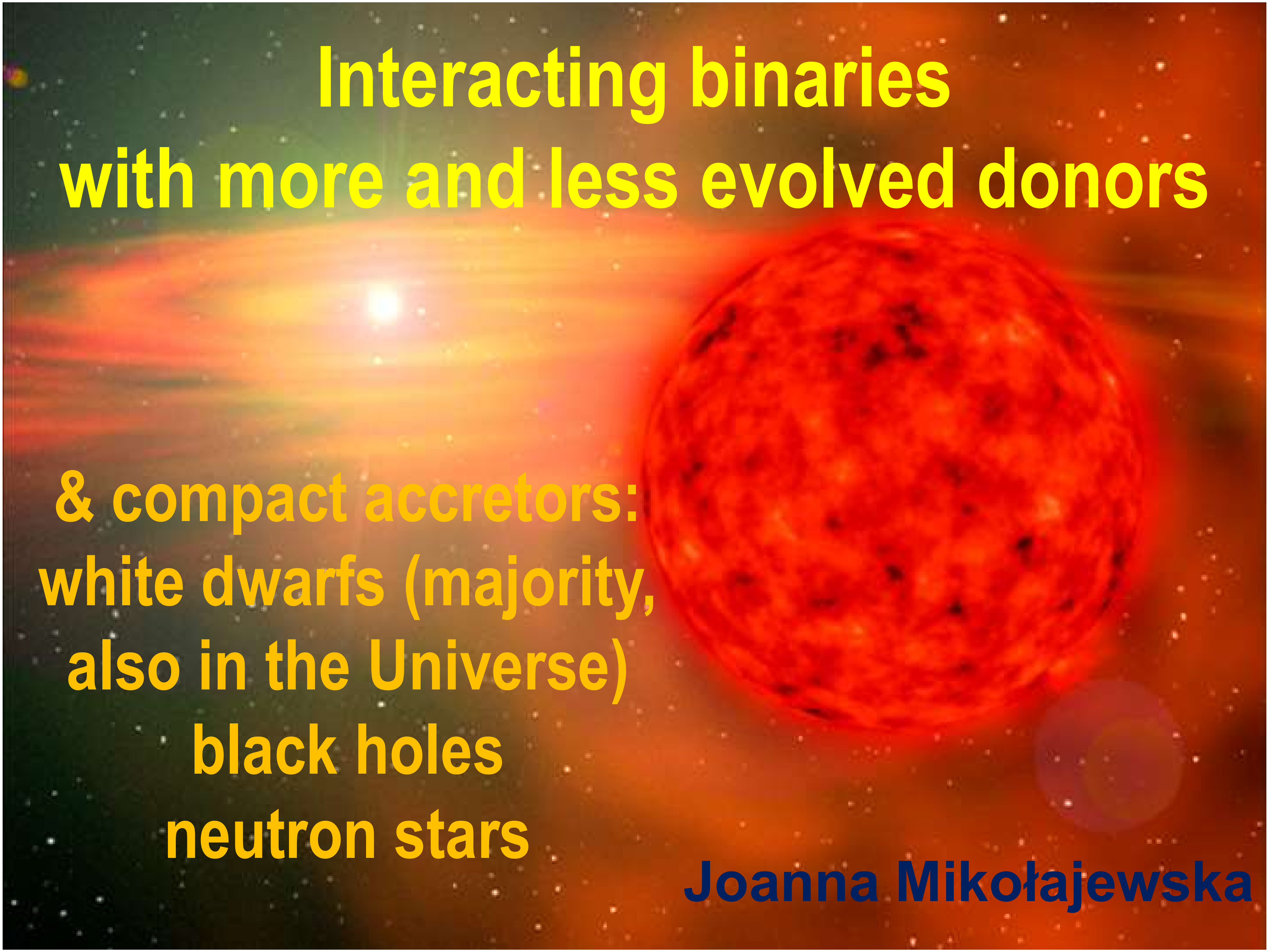

Interacting binaries
with more and less evolved donors
& compact accretors:
white dwarfs (majority,
also in the Universe)
black holes
neutron stars
Joanna Mikołajewska

Refereed papers published/accepted in 2023

1. *Recurrent mini-outbursts and a magnetic white dwarf in the symbiotic system FN Sgr,* Magdolen, J. (…) Mikołajewska, J. et al, 2023, A&A.., 675, A140
2. *Symbiotic Star T CrB as an Extreme SU UMa-type Dwarf Nova,* Iłkiewicz, K.; Mikołajewska, J.; Stoyanov, K. A., 2023, ApJL., 953, L7
3. *Catching a nova X-ray/UV flash in the visible? Early spectroscopy of the very slow Nova Velorum 2022 (Gaia22alz),* Aydi, E.; Chomiuk, L.; Mikołajewska, J. et al, 2023, MNRAS, 524, 1946
4. *Chemical abundance analysis of symbiotic giants. Metallicity and CNO abundance patterns in 14 northern S-type systems,* Gałan, C.; Mikołajewska, J. et al, 2023, MNRAS, 526, 918
5. *A 9 Month Hubble Space Telescope Near-UV Survey of M87. I. Light and Color Curves of 94 Novae, and a Redetermination of the Nova Rate,* Shara, M. M. (…) Mikolajewska, J. et al, 2023, ApJS., 269, 42
6. *Revisiting the classics: On the evolutionary origin of the 'Fe II' and 'He/N' spectral classes of novae,* Aydi, E. (…) Mikołajewska, J. et al, 2024, MNRAS, 527, 9303

Conference paper:

- *Determining the orbital parameters of binary systems with an AGB primary. The case of the R Aqr symbiotic system,* Alcolea, J.; Mikolajewska, J. (…) et al, in Highlights of Spanish Astrophysics XI, Proceedings of the XV Scientific Meeting of the Spanish Astronomical Society, M. Manteiga et al (eds.), 2023, A190

First ever full set of orbital parameters for an interacting binary from observations!

Determining the orbital parameters of b systems with an AGB primary. The cas R Aqr symbiotic system.

Table 1: Campbell's elements for the R Aqr system derived from the fitting

Parameter name	Symbol	Value	Error	Units
Revolution period	P	42.4	± 0.2	a
Periastron epoch	T	2019.9	± 0.1	BSY
Eccentricity	e	0.45	± 0.01	
Position angle of ascending node	Ω	91.4	± 0.7	deg.
Inclination	i	110.7	± 1.0	deg.
Angle of line of nodes to periastron	ω	84.8	± 2.5	deg.
Major semi-axis	a	57	± 8	mas

Alcolea, J.[1], Mikołajewska, J.[2], Gómez-Garrido, M.[1], Bujarrabal, V.[1], Iłkiewicz, K.[2], Castro-Carrizo, A.[3], Desmurs, J.-F.[1], Santander-García, M.[1], and Bachiller, R.[1]

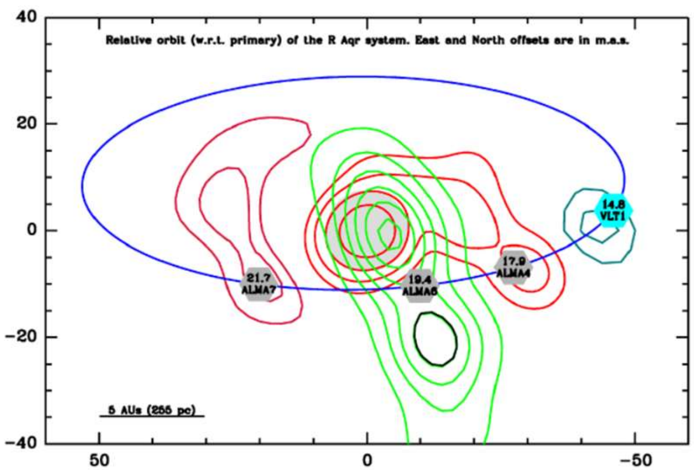
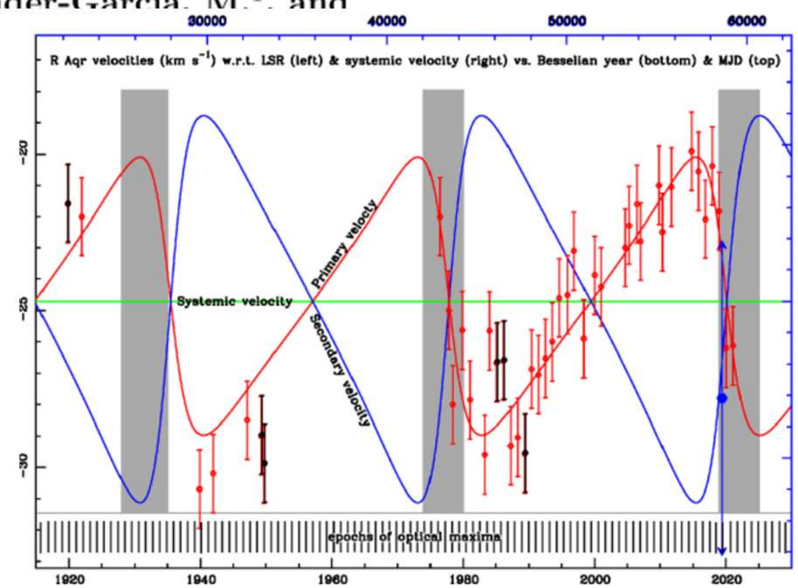


Figure 2: Relative positions of the WD secondary w.r.t. the Mira primary for the four observed epochs. We include the VLT results by [15] (2014.8, teal green contours), and ALMA 0.8 mm continuum by [3] (2017.9 red contours). For 2019.4, the secondary is assumed to be at the centre of the jet seen in H30α (green contours). For 2021.7, we assume that the secondary is at the southernmost end of the 0.8 mm continuum after removing the contribution of the primary (dark red contours). Both 2019.4 and 2021.7 positions are from unpublished ALMA observations. The position of the primary is always at the origin of the coordinates. East



he updated velocity curve of the primary, the Mira variable R Aqr-A, resented by [7], but including new values from SiO maser observations ta are averaged for each pulsation period (black lines at the bottom sho qr optical maxima according to AAVSO). Red dots show the observed (with ±1.25 km s^{-1} error bars), while the red and green lines show the fitting to the dat the systemic velocity of the centre of masses. The blue line displays the prediction f companion velocity for a mass ratio of 1.4. The blue dot (and error bar) shows de ve derived for the companion R Aqr-B for 2019.4 from the H30α line. The dark areas ma occurrence of eclipses in the system.

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A 9 Month Hubble Space Telescope Near-UV Survey of M87. I. Light and Color Curves of 94 Novae, and a Redetermination of the Nova Rate*

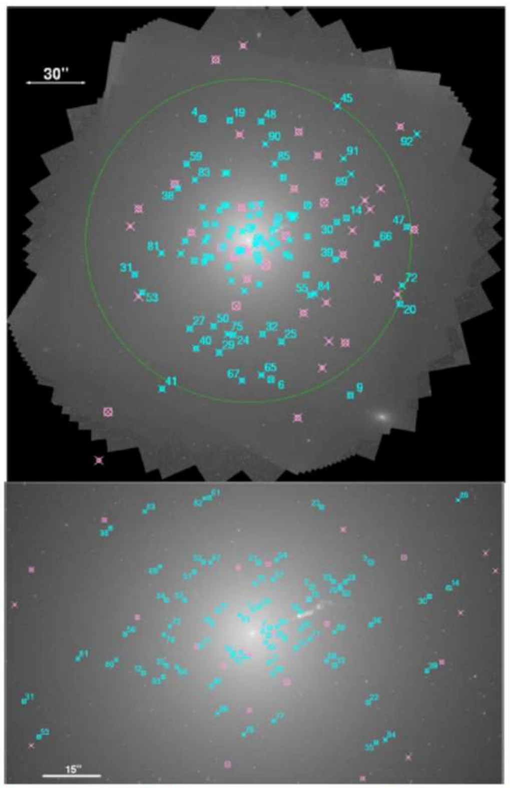

Figure 1. Top: the FOV of 53 HST pointings, and locations (cyan crosses) of all 94 novae detected in M87. North is up and east is left. Also shown as pink crosses are the 32 *certain* novae of Shara et al. (2016). The size of each nova's circle scales linearly with the brightest observed F606W magnitude of that nova. Markers for novae whose peaks were not observed do not have a circle. The region encompassed by the large green circle is the inner circle defined in Section 2 and used throughout the paper. Bottom: a close-up of the nuclear region of M87 and its novae.

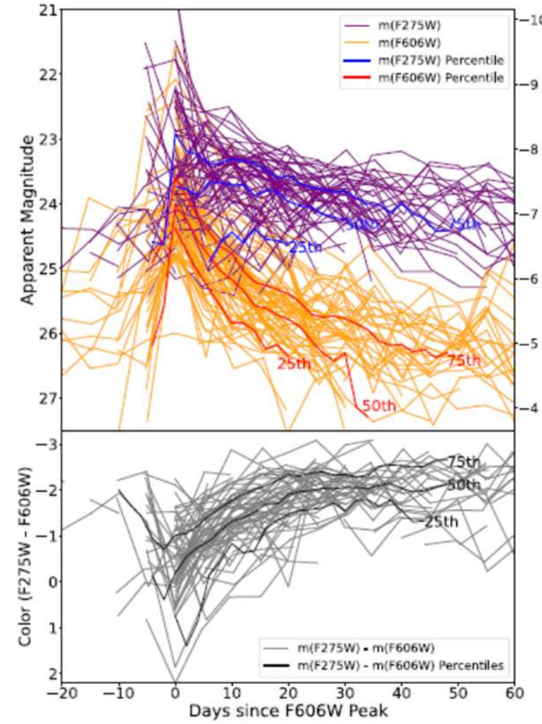

Figure 5. Top: F275W and F606W light curves (purple and orange, respectively) of 77 novae with observed brightness peaks in M87. Over-plotted are the 25th, 50th, and 75th percentiles (in order of brightness) of all of these F275W (in blue) and F606W (in red) light curves. Note that the computation of a percentile at a given time takes into account upper limit magnitude data points in individual nova light curves. To avoid clutter in this plot, those individual limit data points are not shown, but they can be seen in Table 3 and as arrows in Figure 15. The higher luminosities and slower rates of decline of novae in the NUV are apparent. Bottom: the F275W–F606W color curves of the M87 novae, as well as the 25th, 50th, and 75th percentiles of the color curves. Novae near maximum light exhibit *m*(F275W)–*m*(F606W) ~ 0 ± 1, then become increasingly blue during the ensuing ~30 days. After ~30 days they remain at *m*(F275W)–*m*(F606W) ~ −2 ± 0.5.

- **5-day cadence over a span of 9 months with UV (F275W) and optical (F606W) filters of WFC3**
- **No recurrent novae with recurrence time <130 g (theory predicts as fast as <45 days)**
- **The measured nova rate in M87:** $352^{+37}_{-37}\ \mathrm{yr}^{-1}$
- **The data indicate a luminosity-specific nova rate in all types of galaxies of** $\sim 7\text{–}10/\mathrm{yr}/10^{10} L_{\odot,K}$ i

MNRAS **524**, 1946–1964 (2023)
Advance Access publication 2023 June 27

Catching a nova X-ray/UV flash in the visible? Early very slow Nova Velorum 2022 (Gaia22alz)

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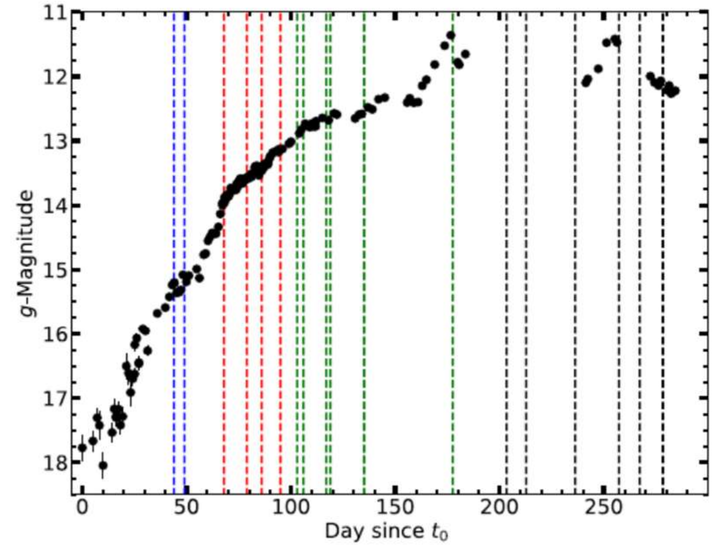
Accepted 2023 June 21. Received 2023 June 20; in original form 2023 April 12

ABSTRACT

We present early spectral observations of the very slow Galactic nova Gaia22alz, over it lasted 180 d. During the first 50 d, when the nova was only 3–4 mag above its normal brightn (FWHM ≈ 400 km s^{-1}) emission lines of H Balmer, He I, He II, and C IV but no P Cygni abs high-excitation He II and C IV lines disappeared, and P Cygni profiles of Balmer, He I, and eventua a spectrum typical of classical novae before peak. We propose that the early (first 50 d) spectr emission lines with no P Cygni profiles, are produced in the white dwarf's optically thin envelop ultraviolet and potentially X-ray emission from the white dwarf after a dramatic increase in the during a phase known as the 'early X-ray/UV flash'. If true, this would be one of the rare tim the early X-ray/UV flash has been detected. While this phase might last only a few hours in missed, it was possible to detect in Gaia22alz due to its very slow and gradual rise and thanks surveys in detecting transients on their rise. We also consider alternative scenarios that could ex of Gaia22alz and its gradual rise.



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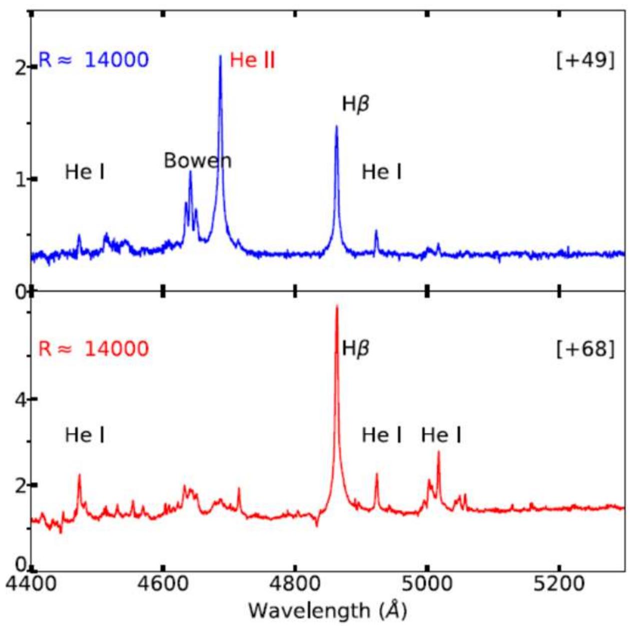

Figure 4. The spectral evolution during the first two spectral epochs, but focusing on the evolution of He II 4686 Å and Hβ emission lines. The spectra shows the fading/disappearance of the He II line and Bowen line between early- and mid-rise.

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Astronomy & Astrophysic

Recurrent mini-outbursts and a magnetic white dwarf in the symbiotic system FN Sgr

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ABSTRACT

Aims. We investigated the optical variability of the symbiotic binary FN Sgr with photometric monitoring over a period of ≃55 years and with a high-cadence *Kepler* light curve lasting 81 days.
Methods. The data obtained in the *V* and *I* bands were reduced with standard photometric methods. The *Kepler* data were divided into subsamples and were analysed with the Lomb-Scargle algorithm.
Results. The *V* and *I* band light curves show a phenomenon never before observed with such recurrence in any symbiotic system, namely short outbursts starting between orbital phases 0.3 and 0.5 and lasting about 1 month, with a fast rise, a slower decline, and
... s with sidebands. We attribute a stable frequency
... suggest that this detection probably implies that
... mall outbursts may be ascribed to the stream–disc

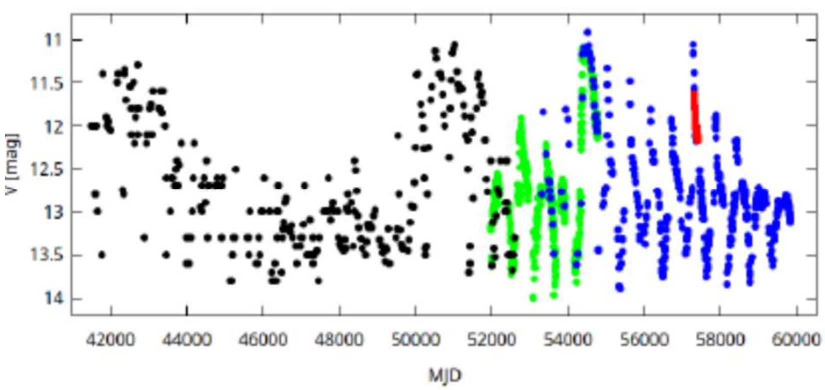
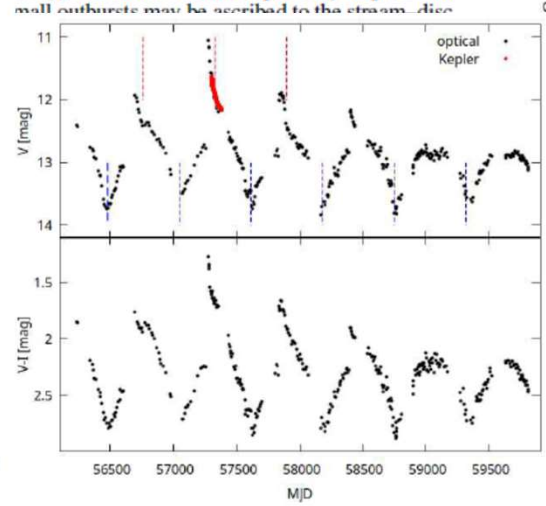
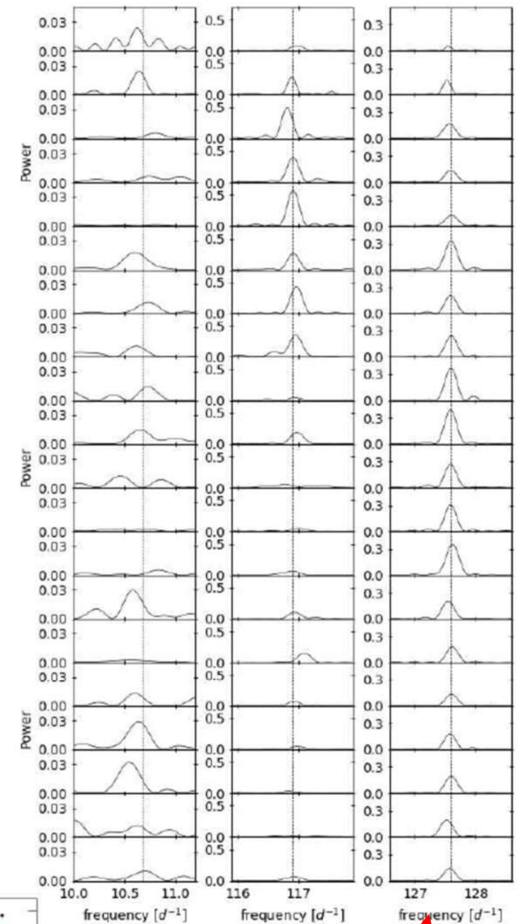


Fig. 1. Optical light curve of FN Sgr. Data from (Brandi et al. 2005) are shown in black, the ASAS data in green, and our new data in blue. The Kepler light curve is also shown in red, offset vertically by 12 mag for comparison with the V-band data.





. LS periodogram per portion, obtained by dividing the *Kepler* curve into 20 equally spaced sub-samples. The first column represents f_0, the second f_1, and the third f_2. The vertical lines indicate the value of f_1 and f_2, or Δ when f_0 was computed as the difference between the two frequencies.

WD rotation with P=11.3 min

CHARLES UNIVERSITY
Faculty of mathematics
and physics

IMPORTANT DATES

Abstract submission:
15 February, 2024

Early bird registration:
29 February 2024

The conference – 3-7 June, 2024