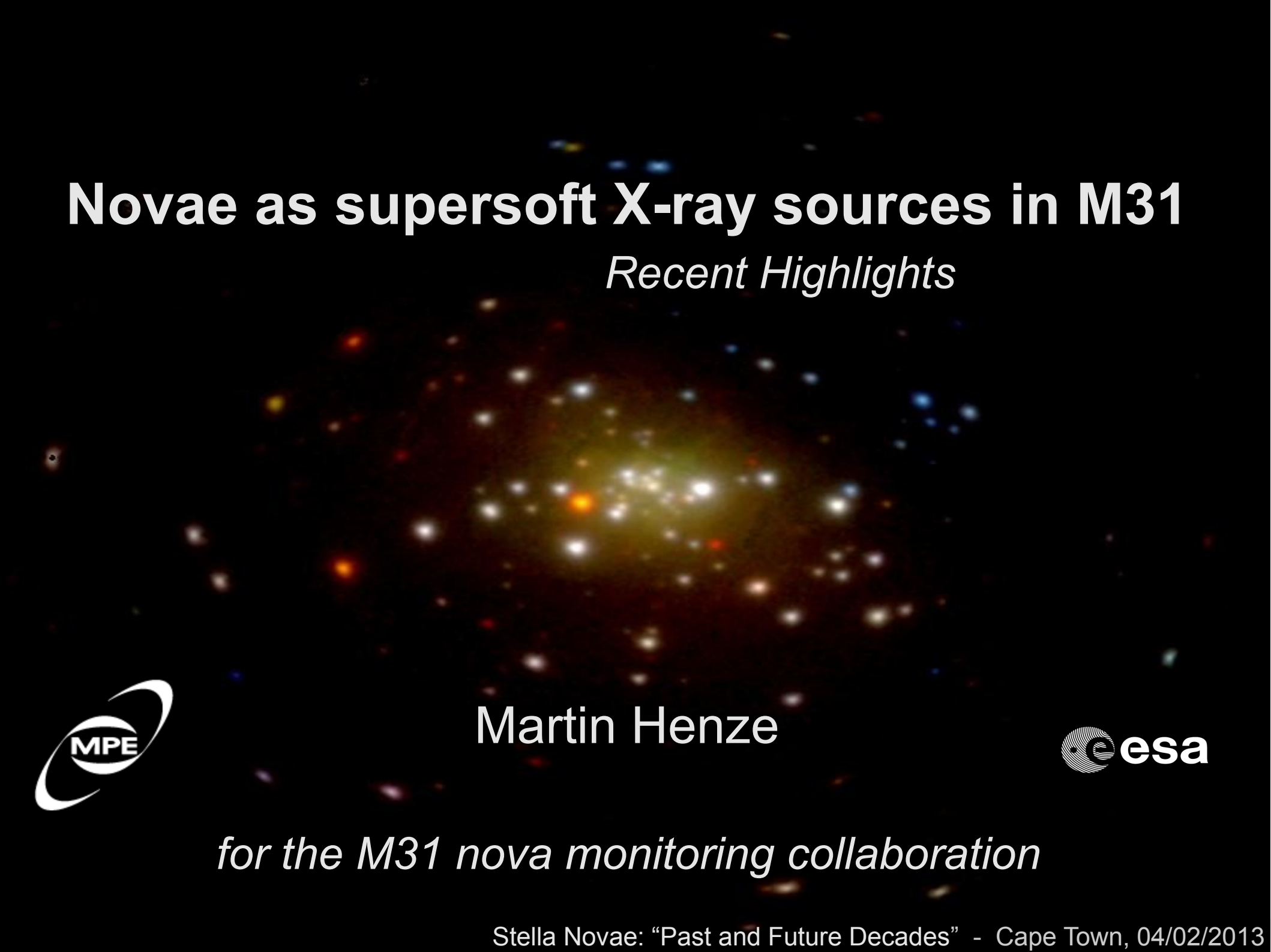
Novae as supersoft X-ray sources in M31

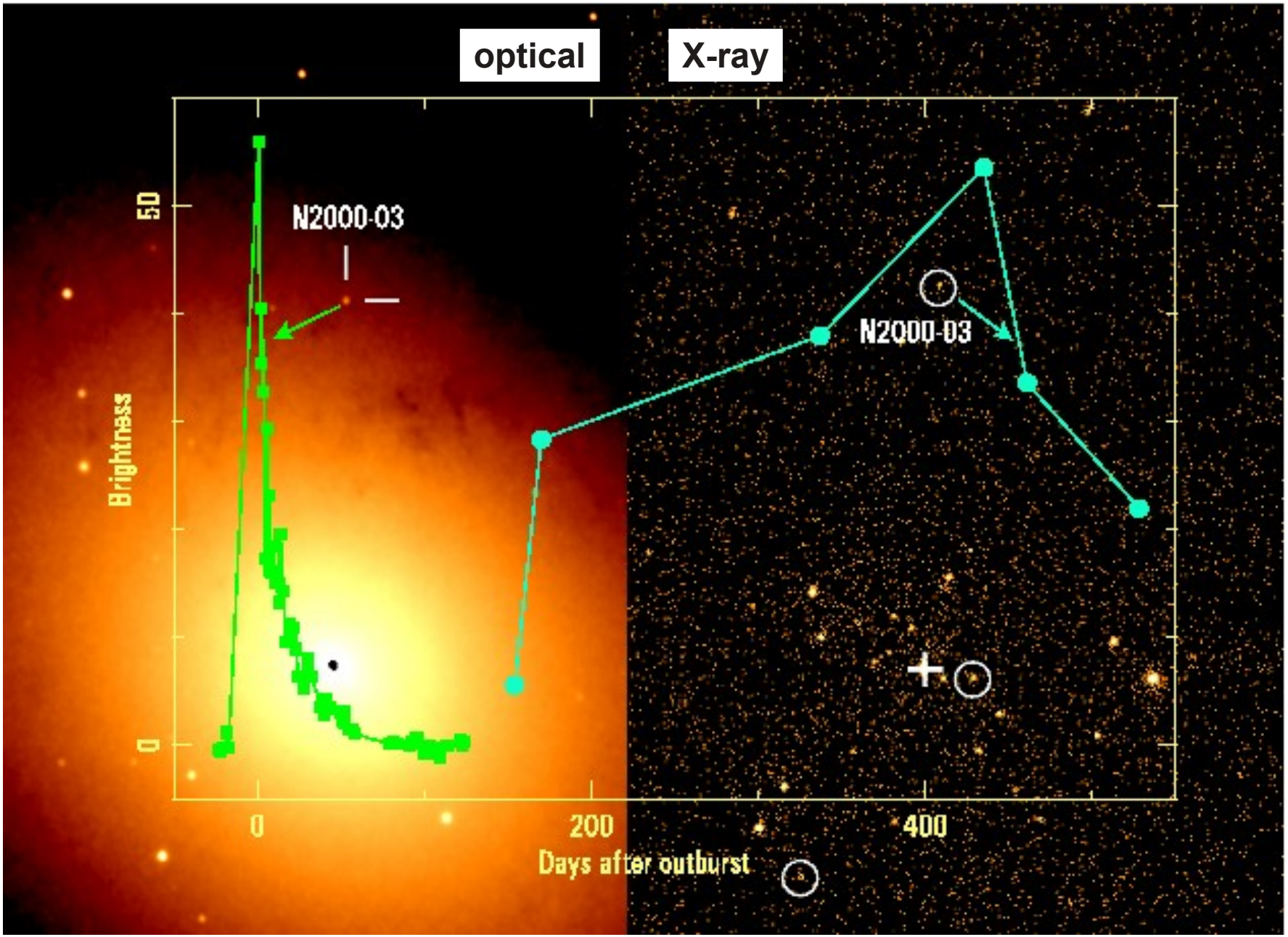
Recent Highlights



Martin Henze

for the M31 nova monitoring collaboration

Novae as supersoft X-ray sources (SSS)



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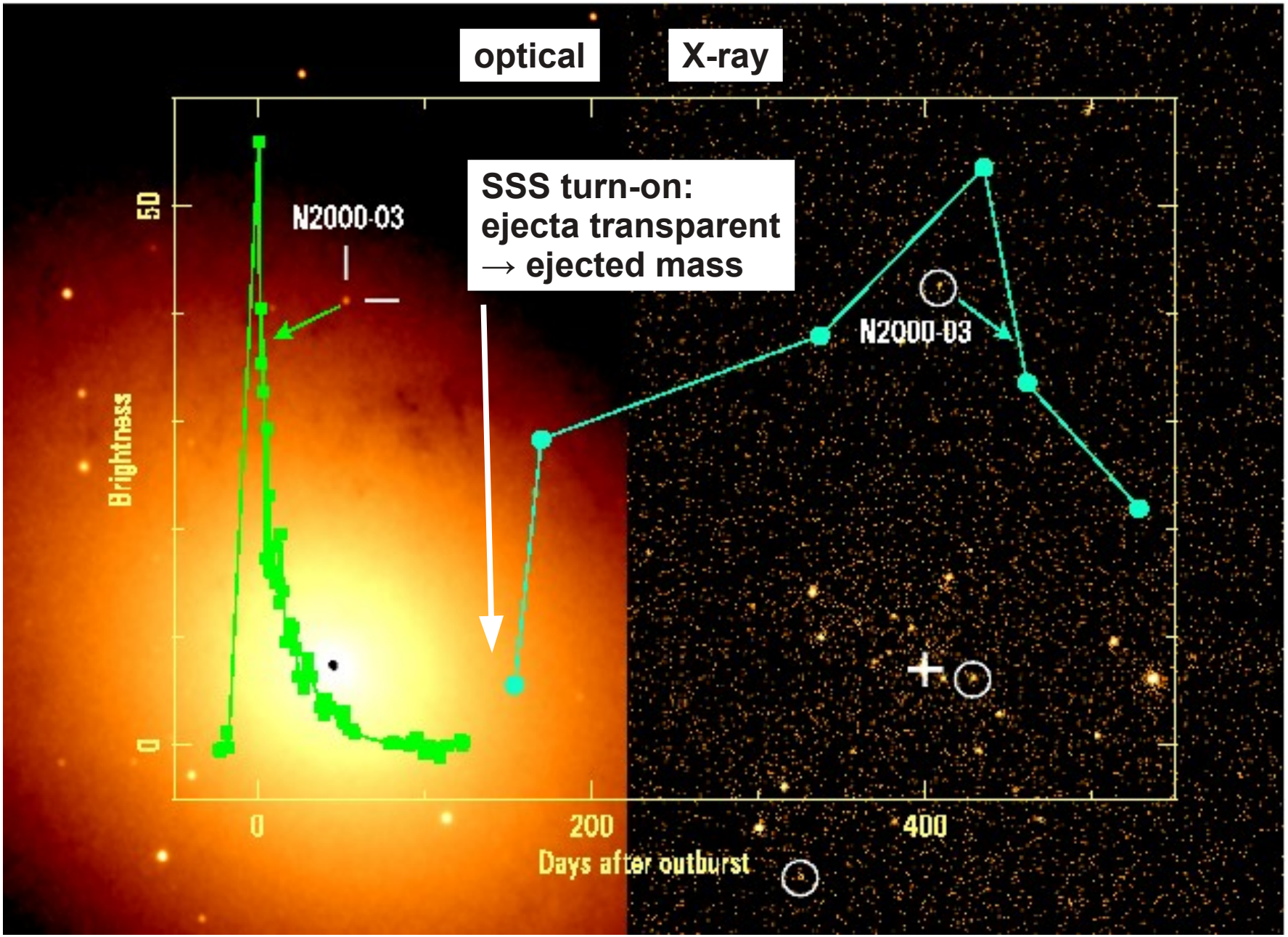

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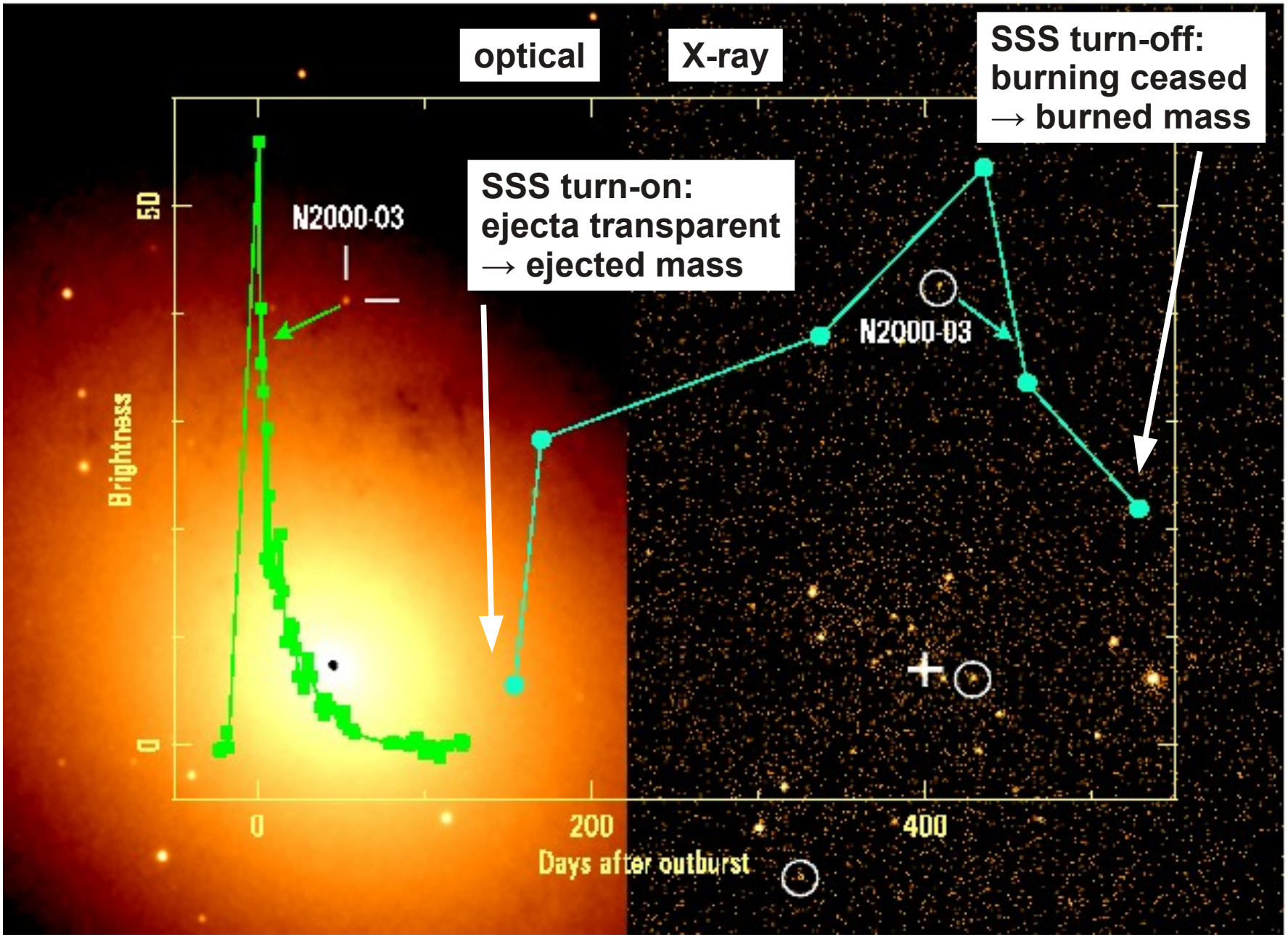

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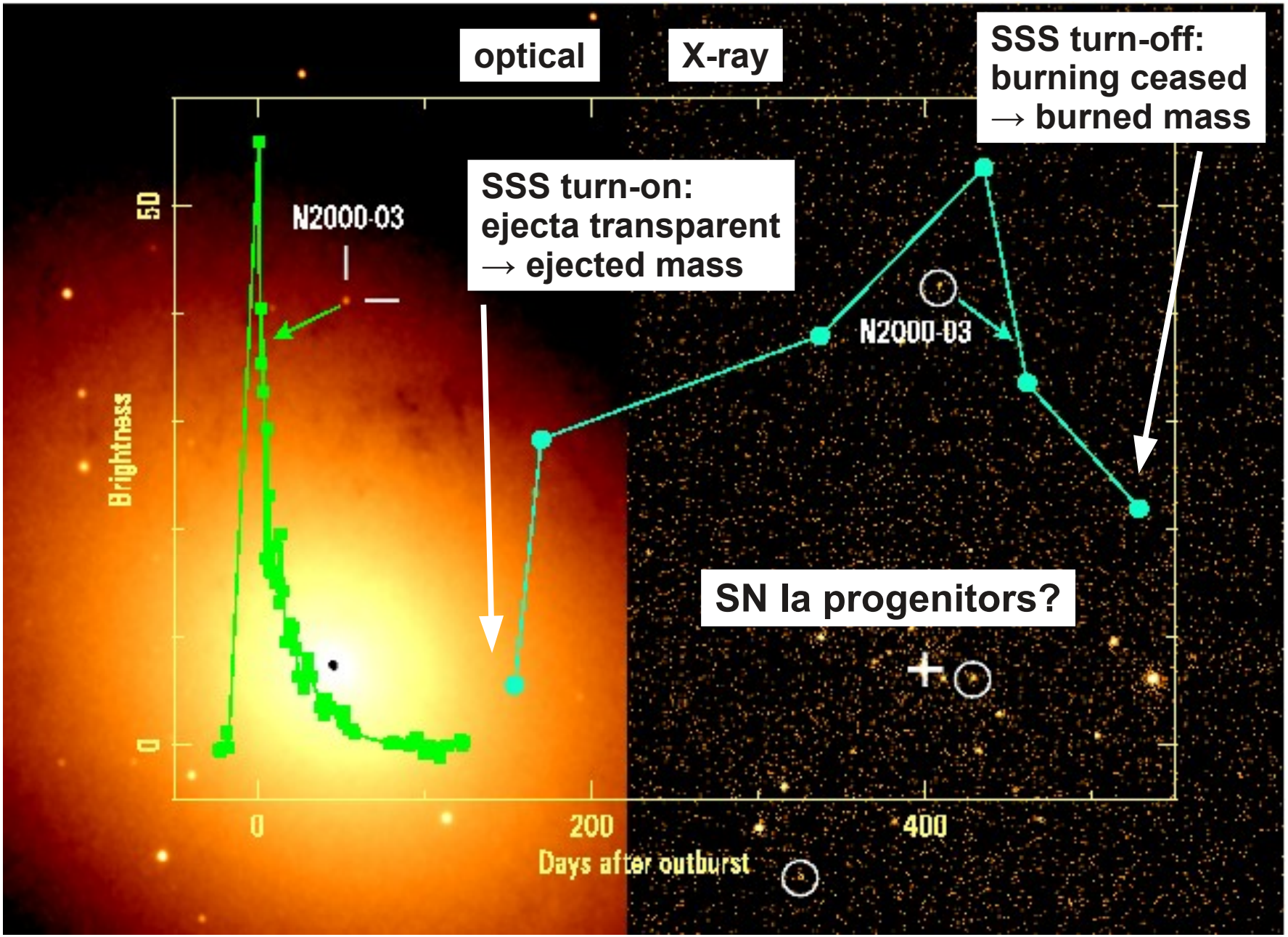
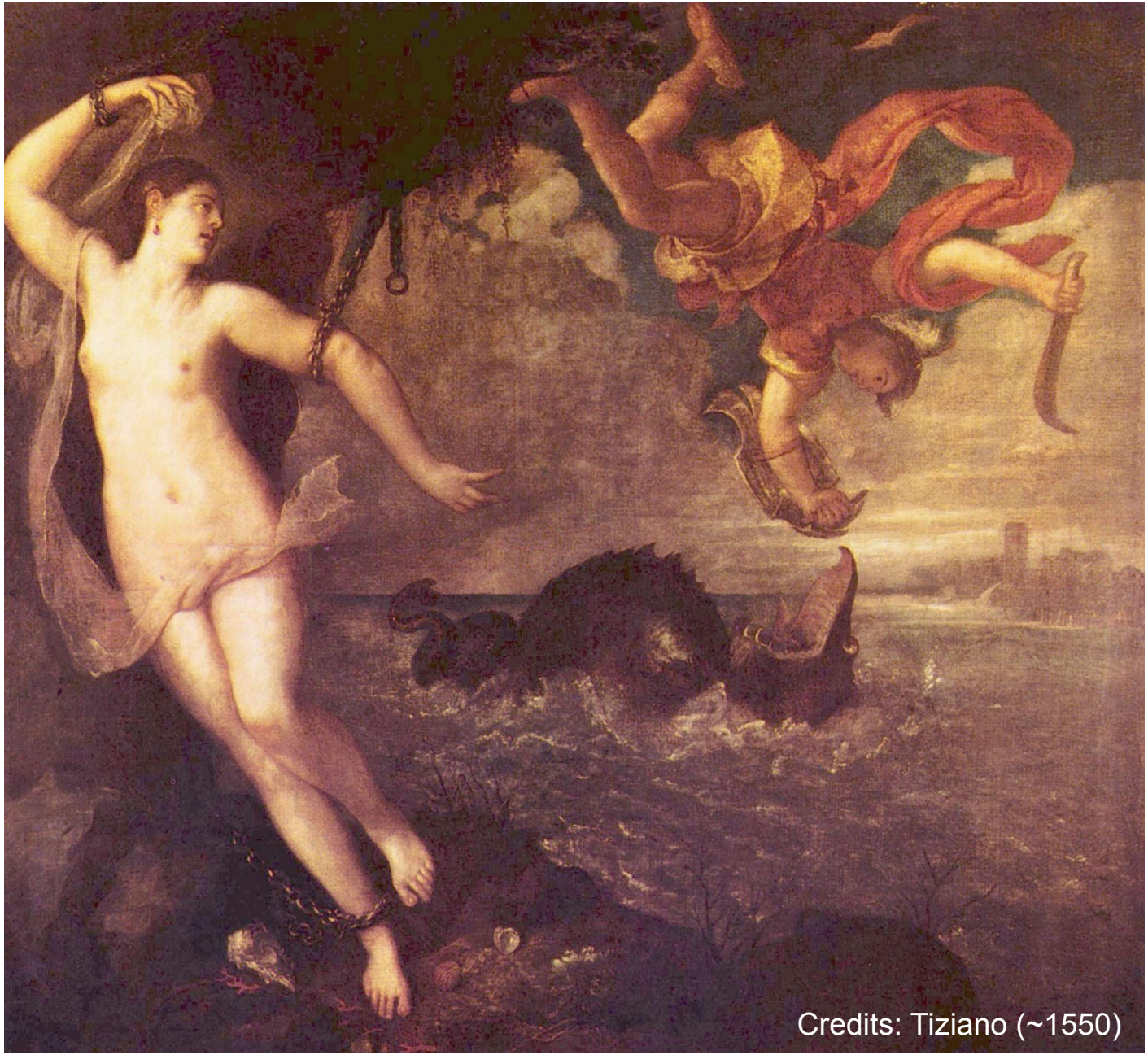


Introducing Andromeda



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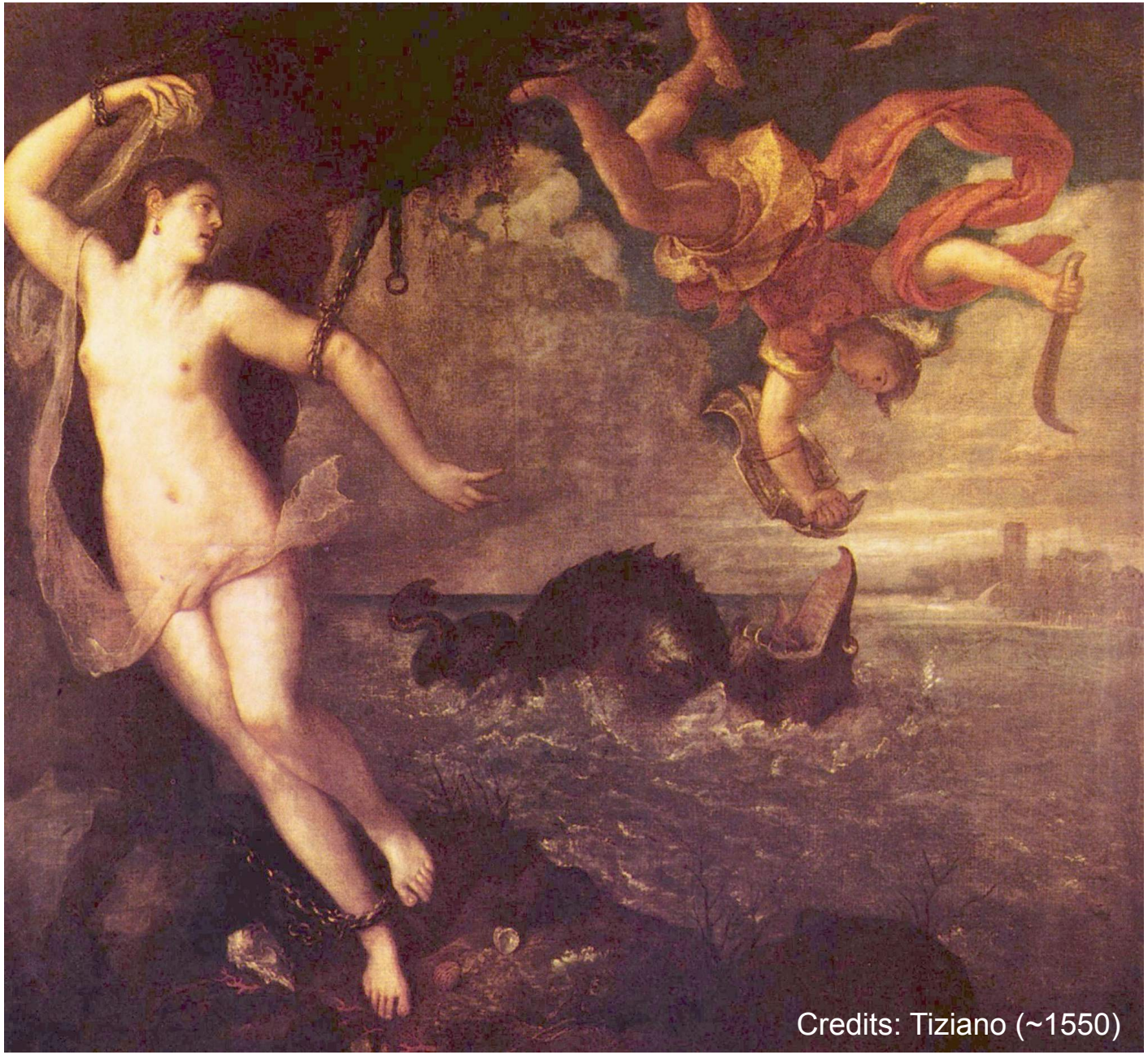

Artist's impression

M31 – the ideal target

Nearest big spiral galaxy

www.mpe.mpg/~m31novae/opt/m31/index.php

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Nearest big spiral galaxy

- large stellar mass

→ high nova rate

(~65/yr, ~60% in the bulge; Darnley+ 2006)

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Earliest target for extragalactic nova surveys

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→ Earliest target for extragalactic nova surveys

~930 novae in ~100 yr
> 150 novae in last 5 yr

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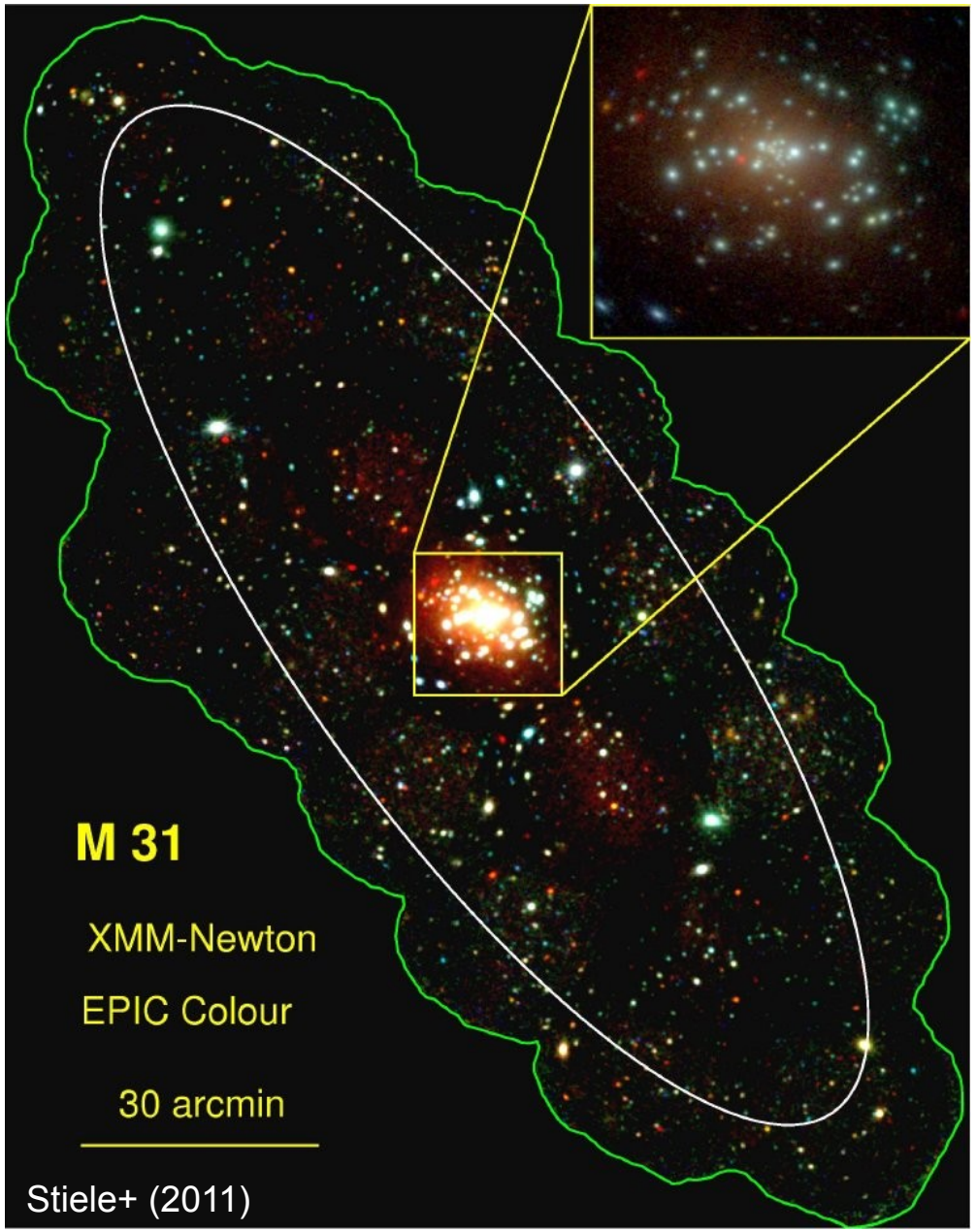

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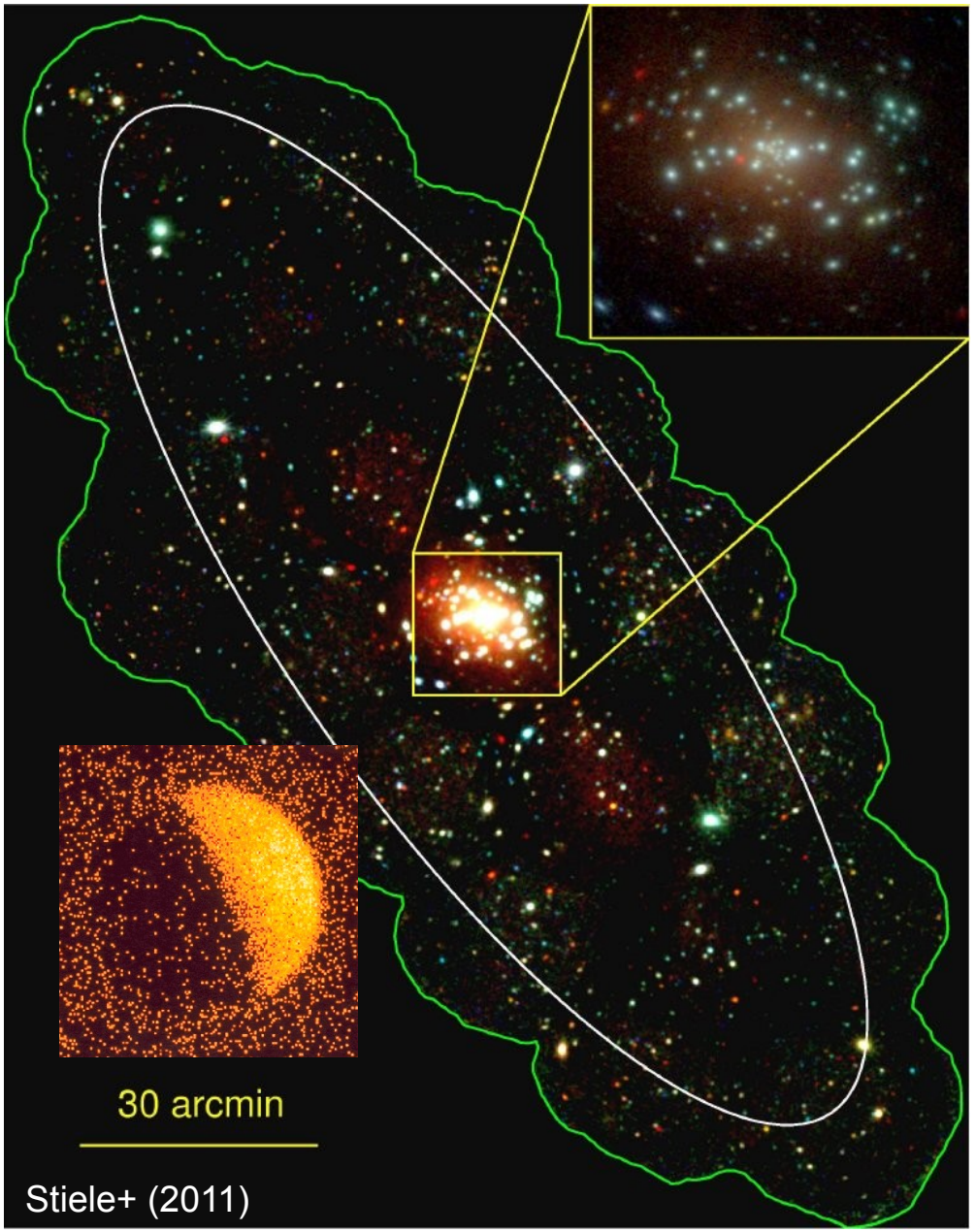


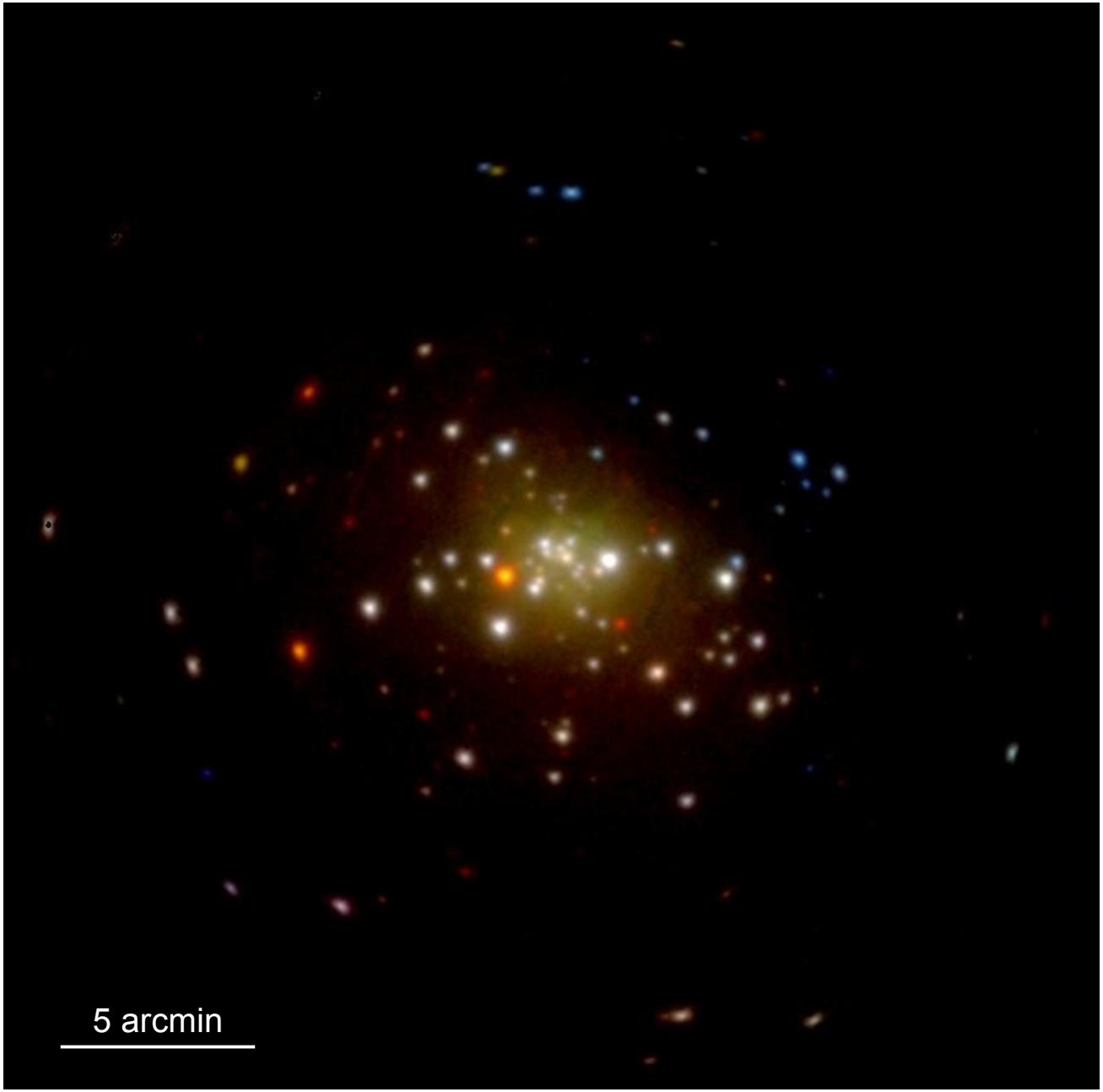
X-ray monitoring of the M31 central region

2006 – 2012:

70 pointings

XMM: ~600 ks
Chandra: ~800 ks

→ 38 novae



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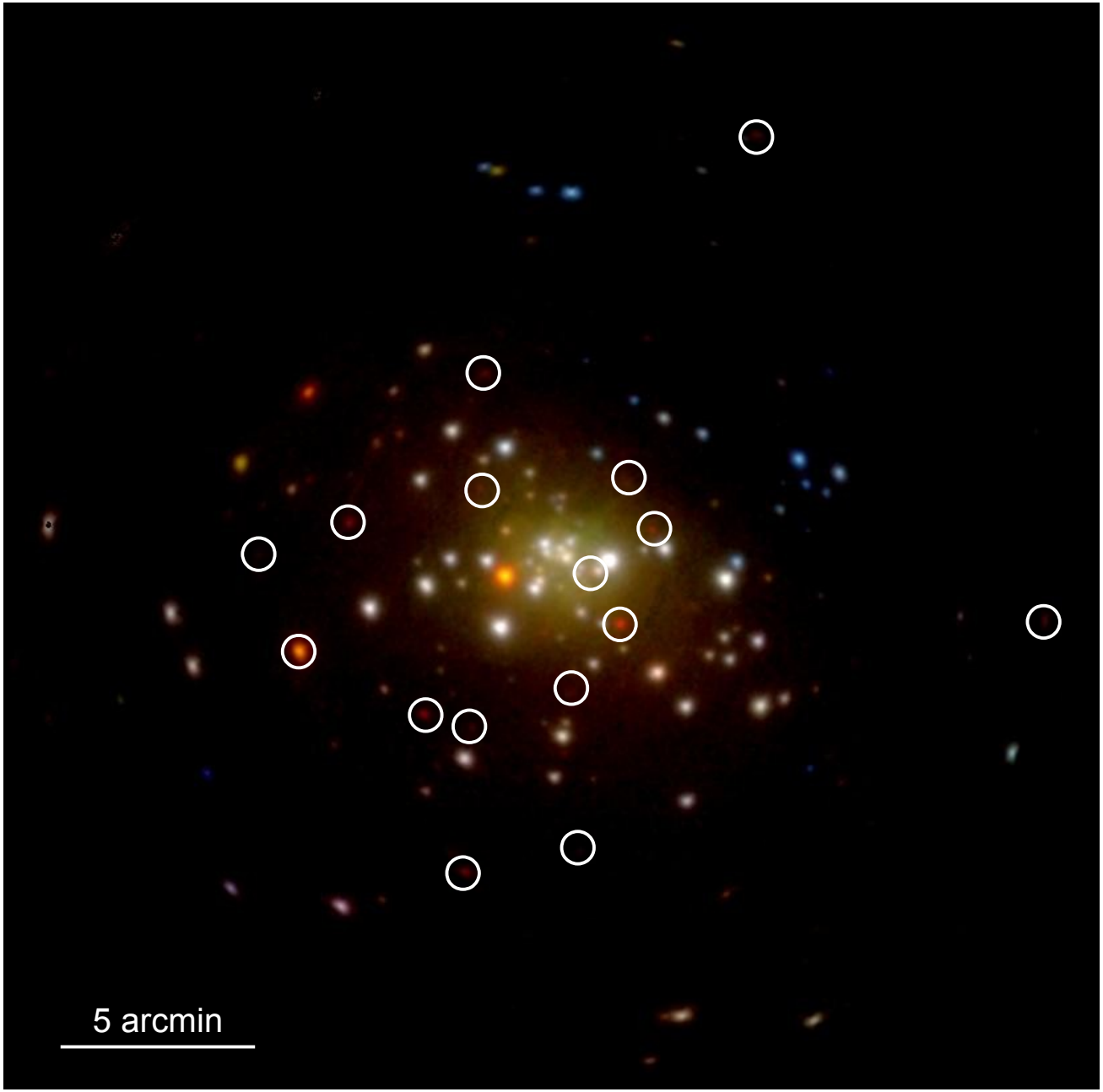
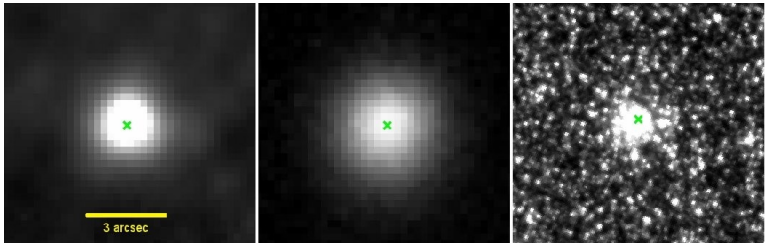
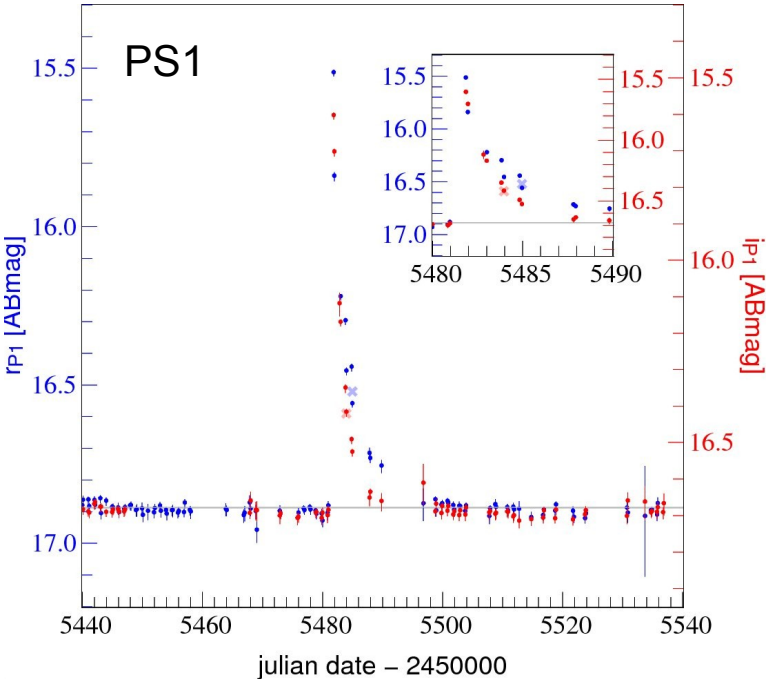
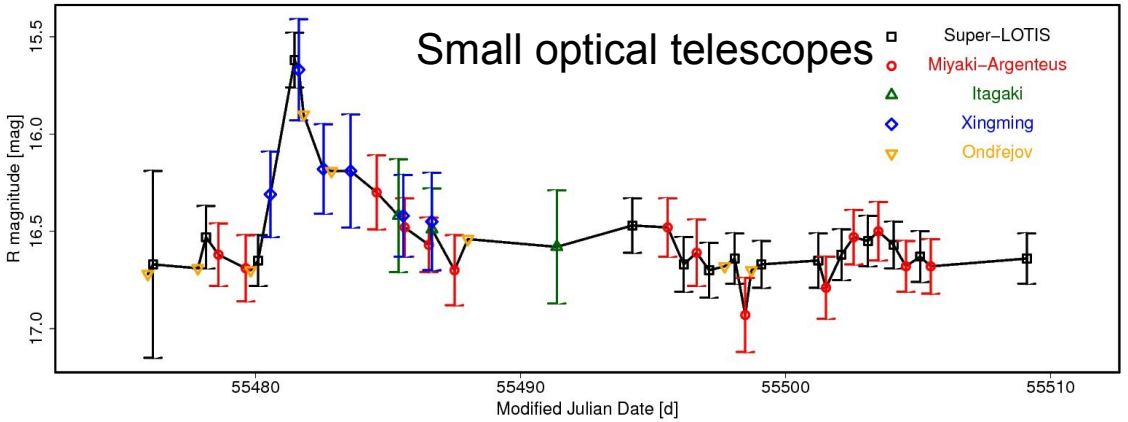


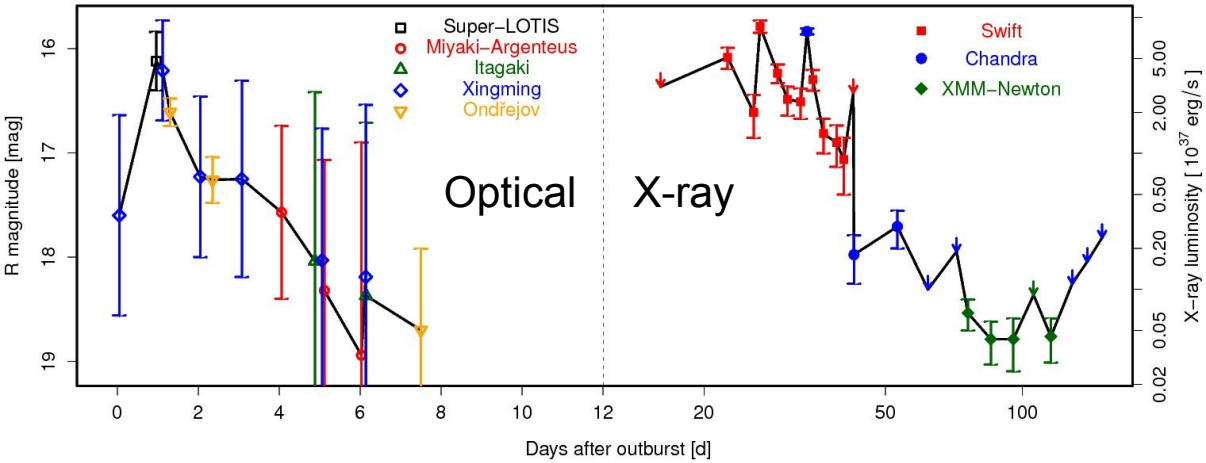
Globular cluster nova M31N 2010-10f

(Henze et al. 2013, A&A, 549, A120)









Extremely rare – 4th nova in any GC of any galaxy

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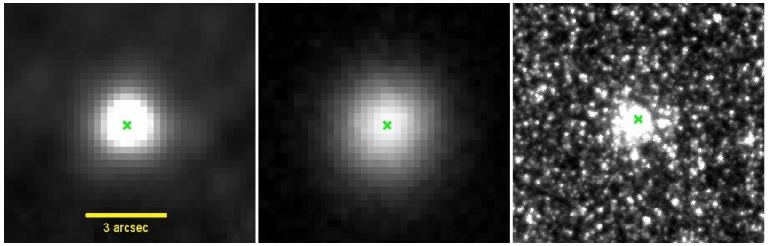

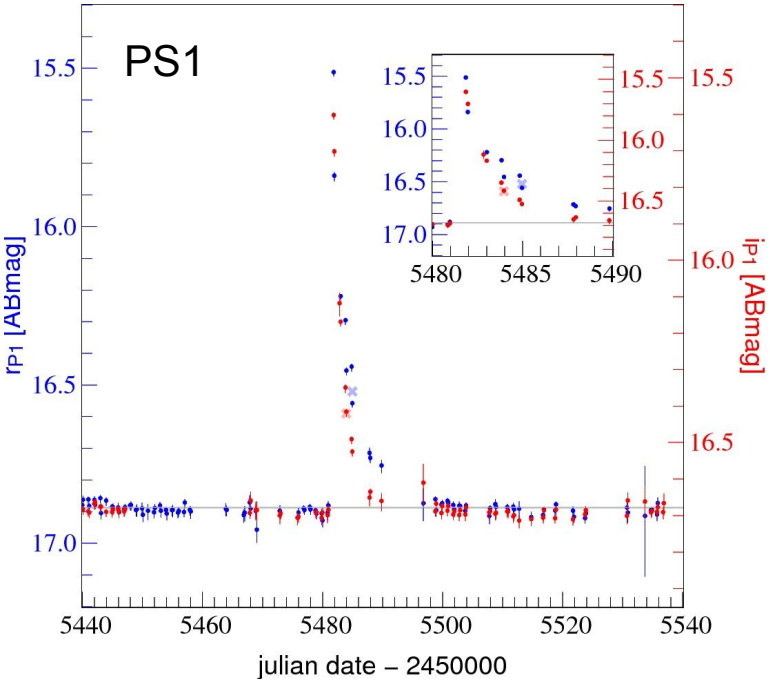

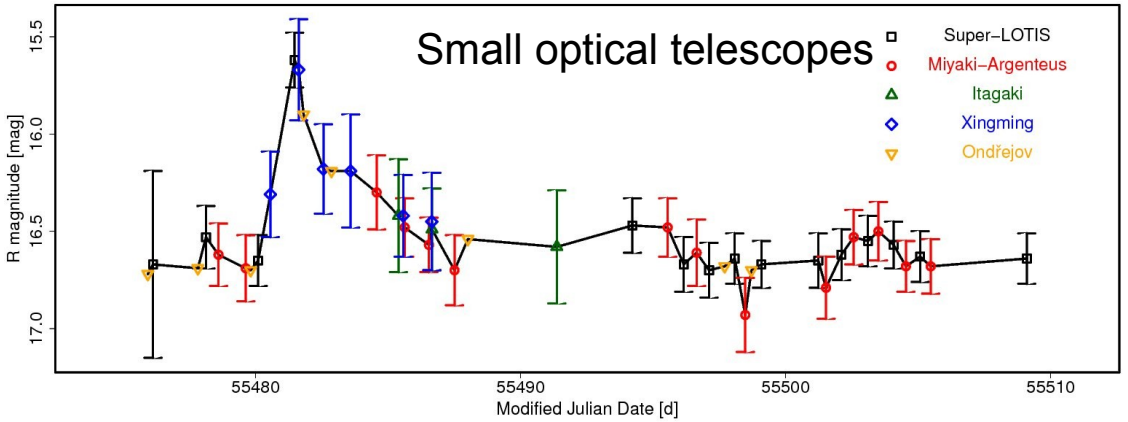

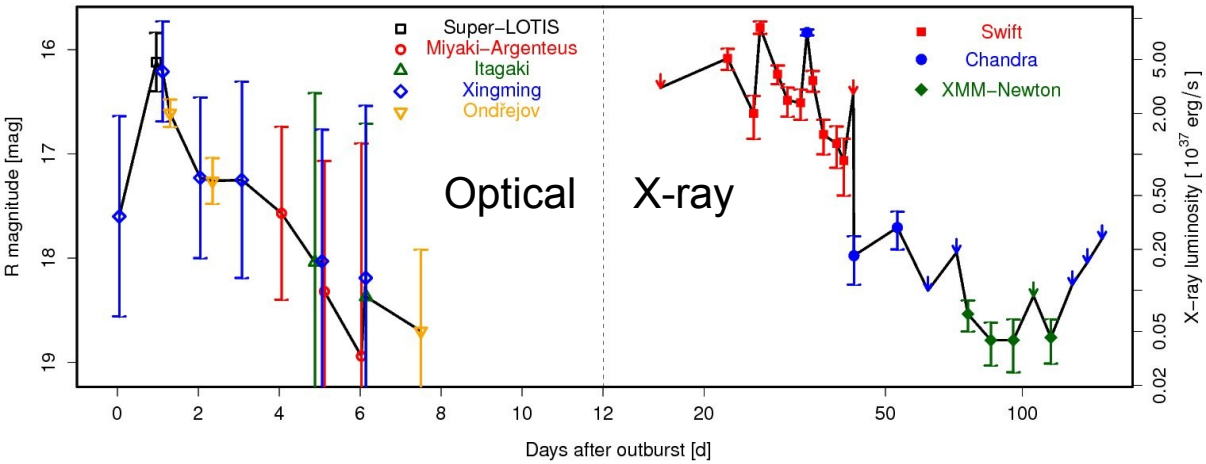

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Fast and hot SSS → “young” nova in old population (same as 1st M31 GC nova; Henze+ 09)

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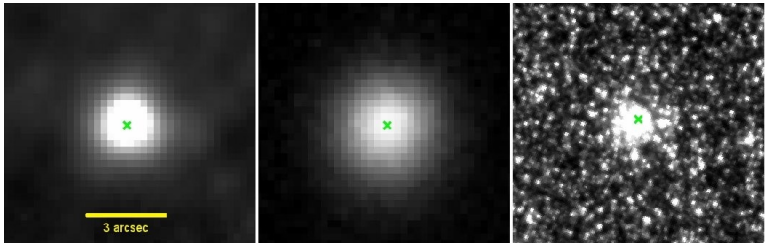
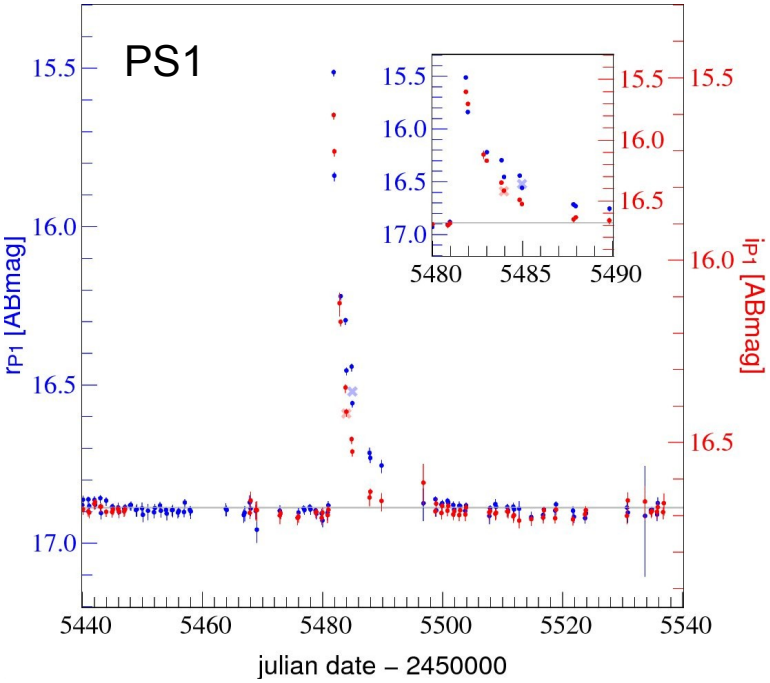
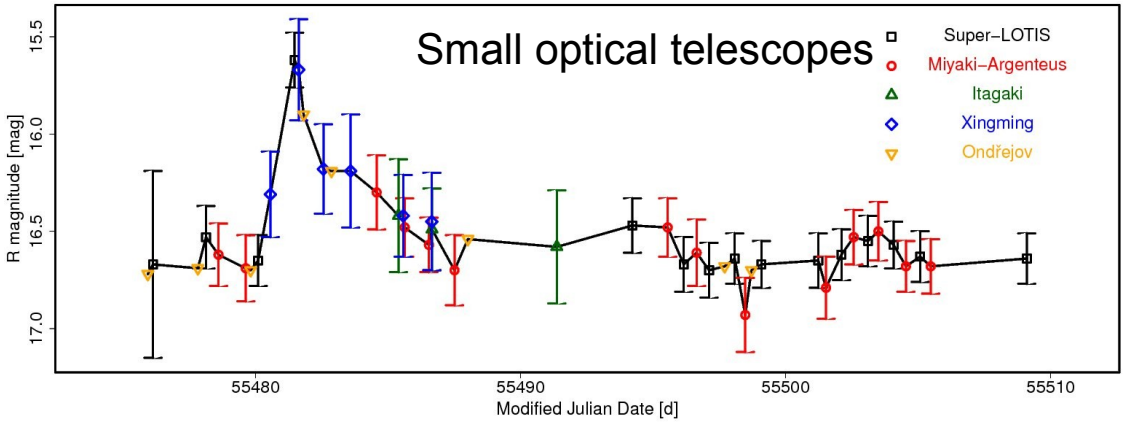
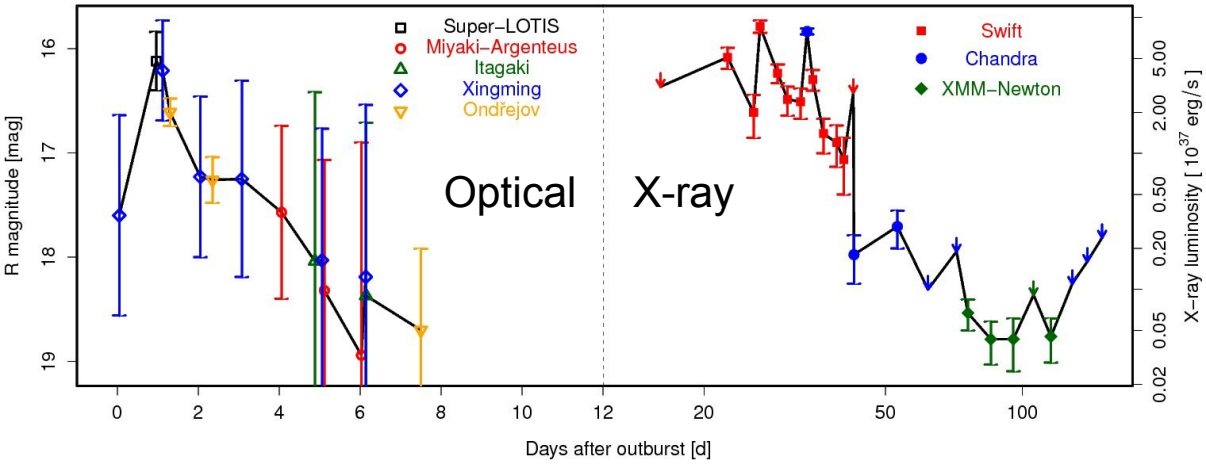






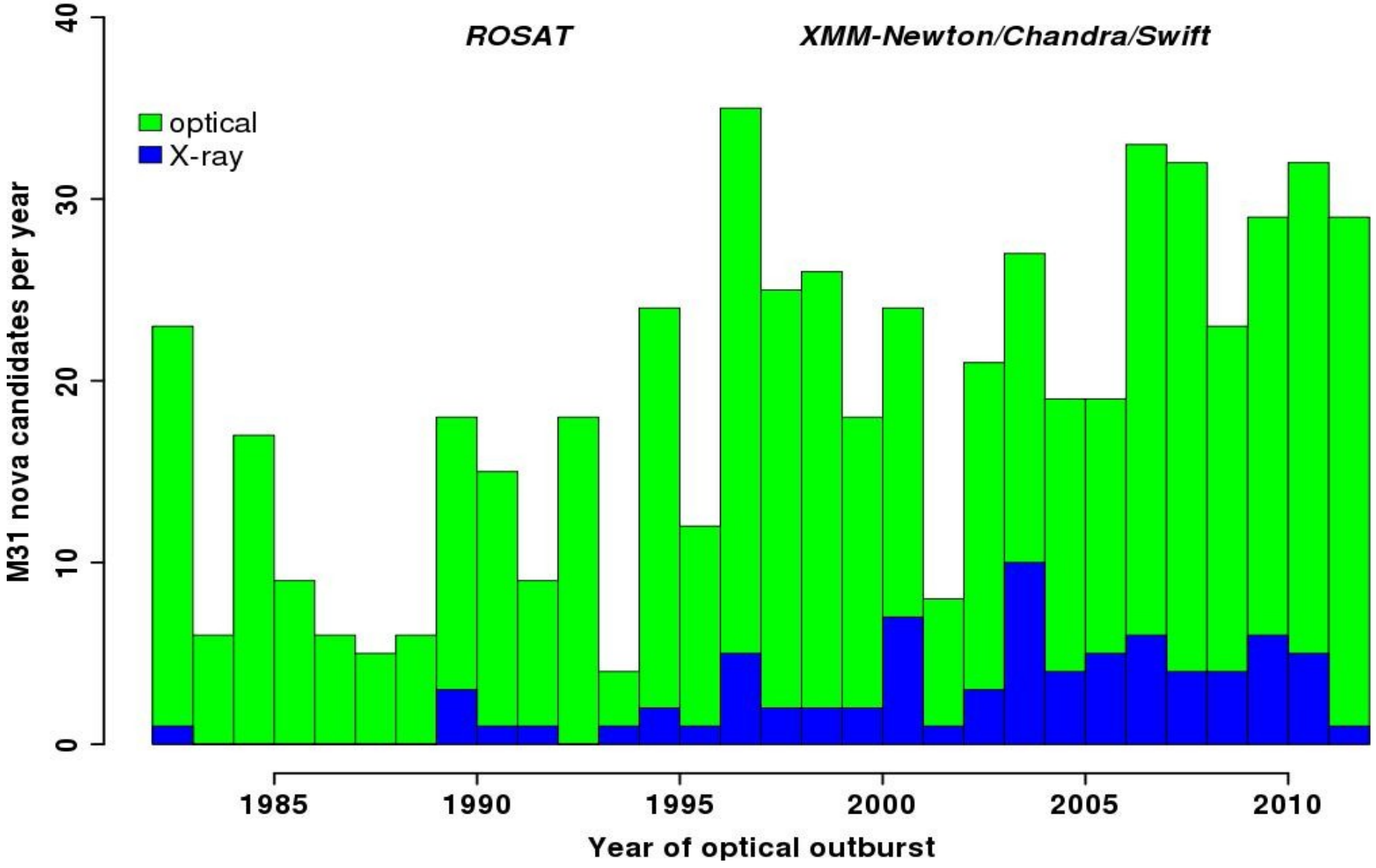


Extremely rare – 4th nova in any GC of any galaxy

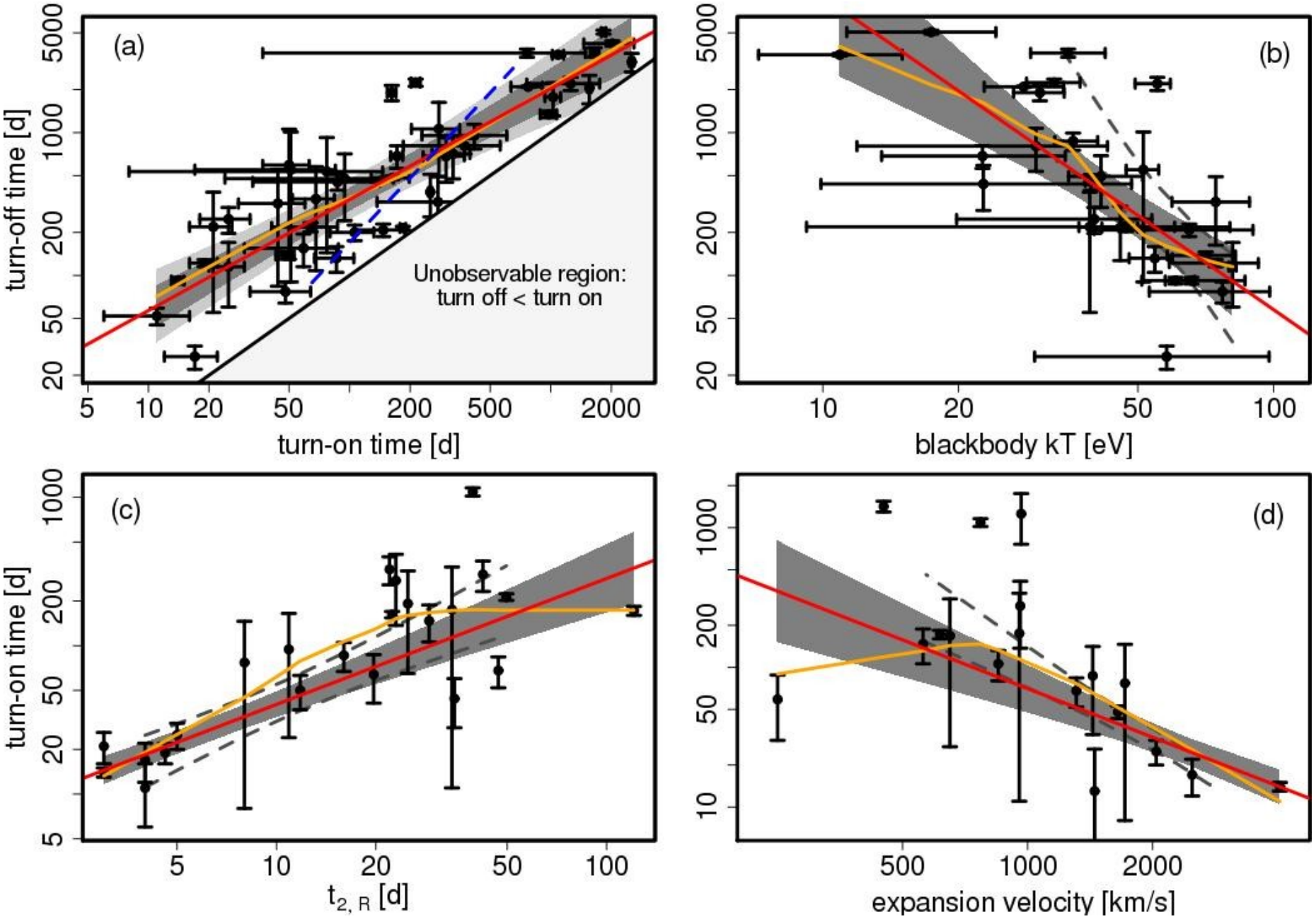
Fast and hot SSS → "young" nova in old population (same as 1st M31 GC nova; Henze+ 09)

X-ray monitoring → enhanced nova rate in M31 GCs → dynamical formation? ICM accretion?

The catalogue: 78 novae



Correlations between nova parameters



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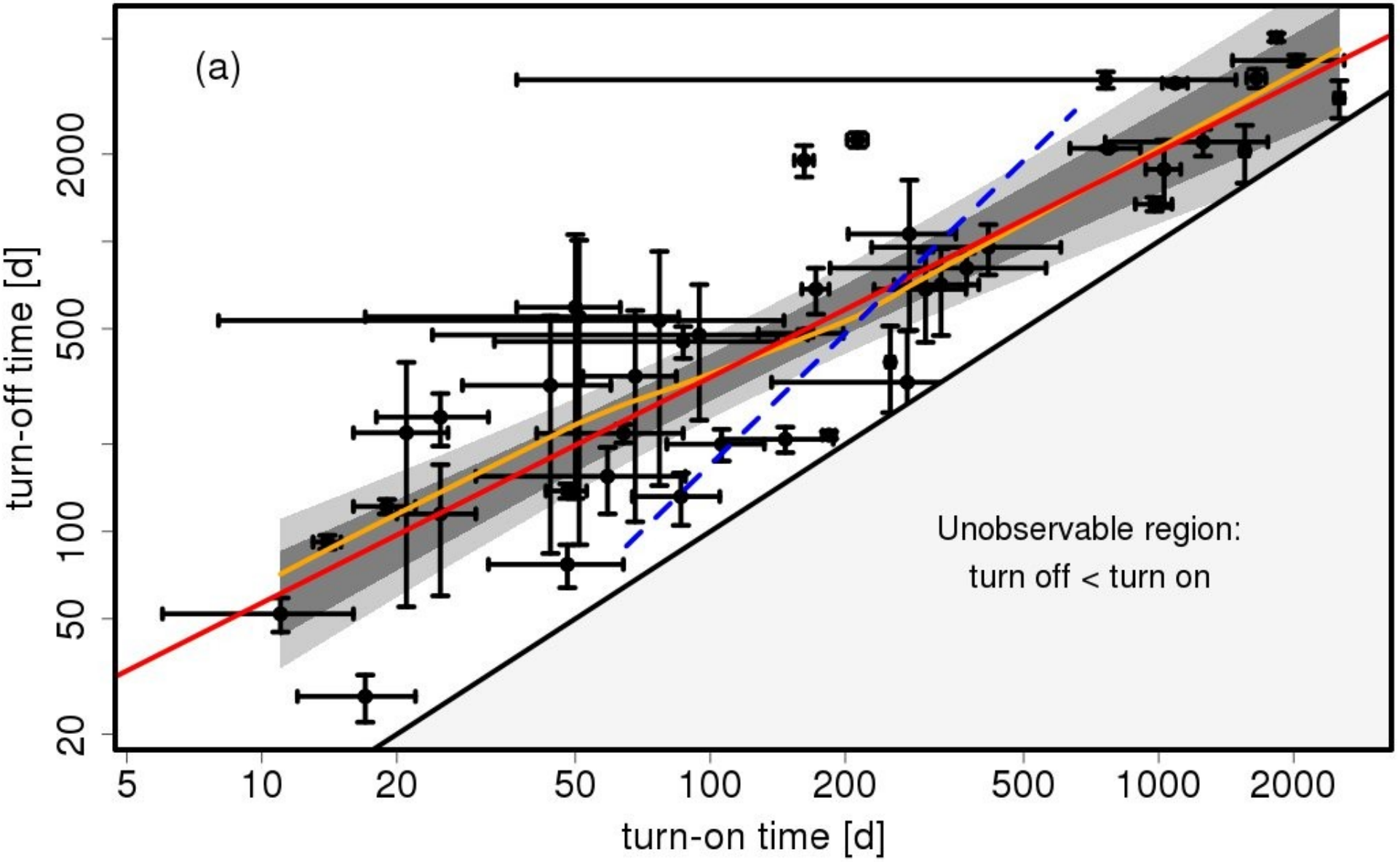

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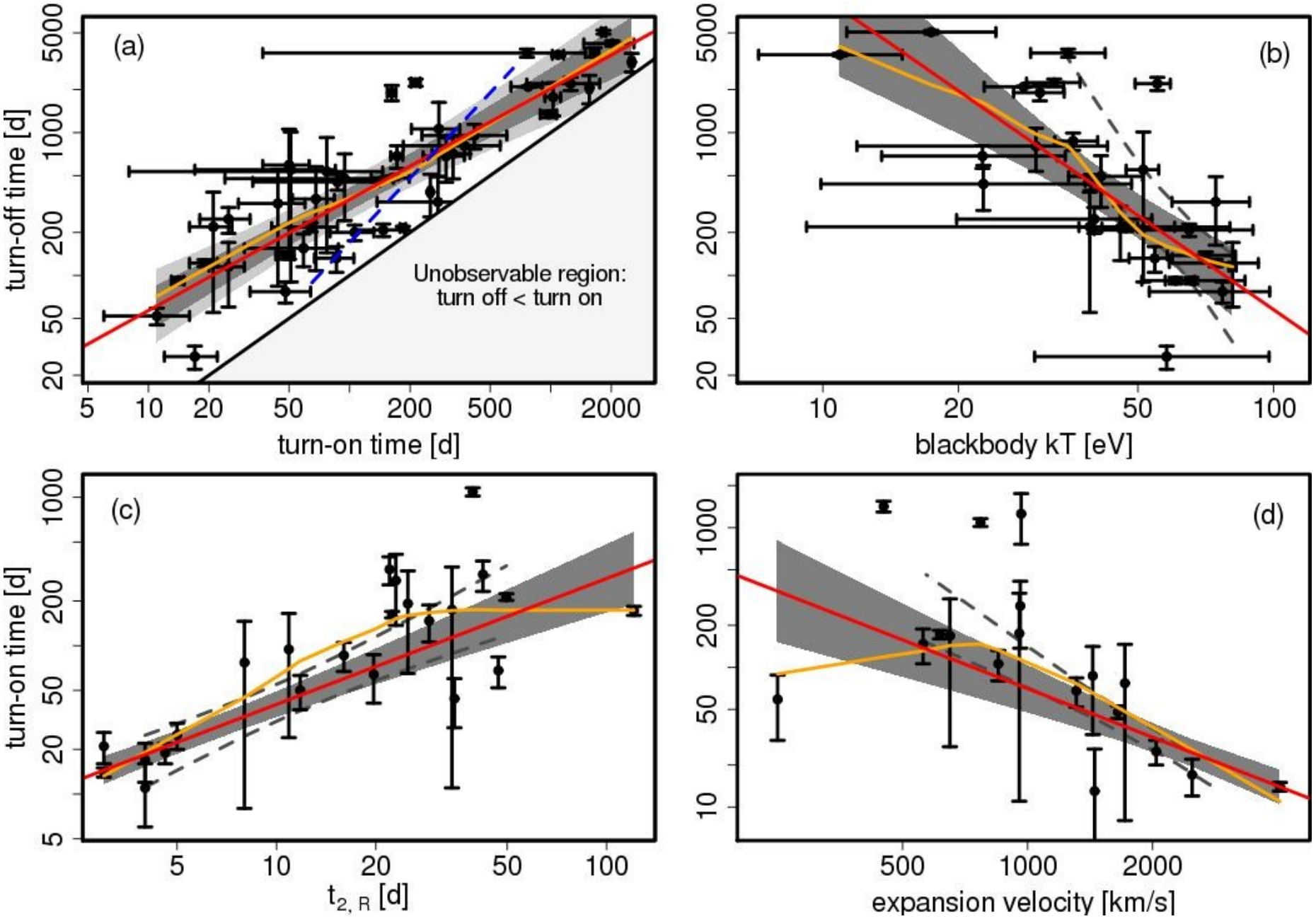

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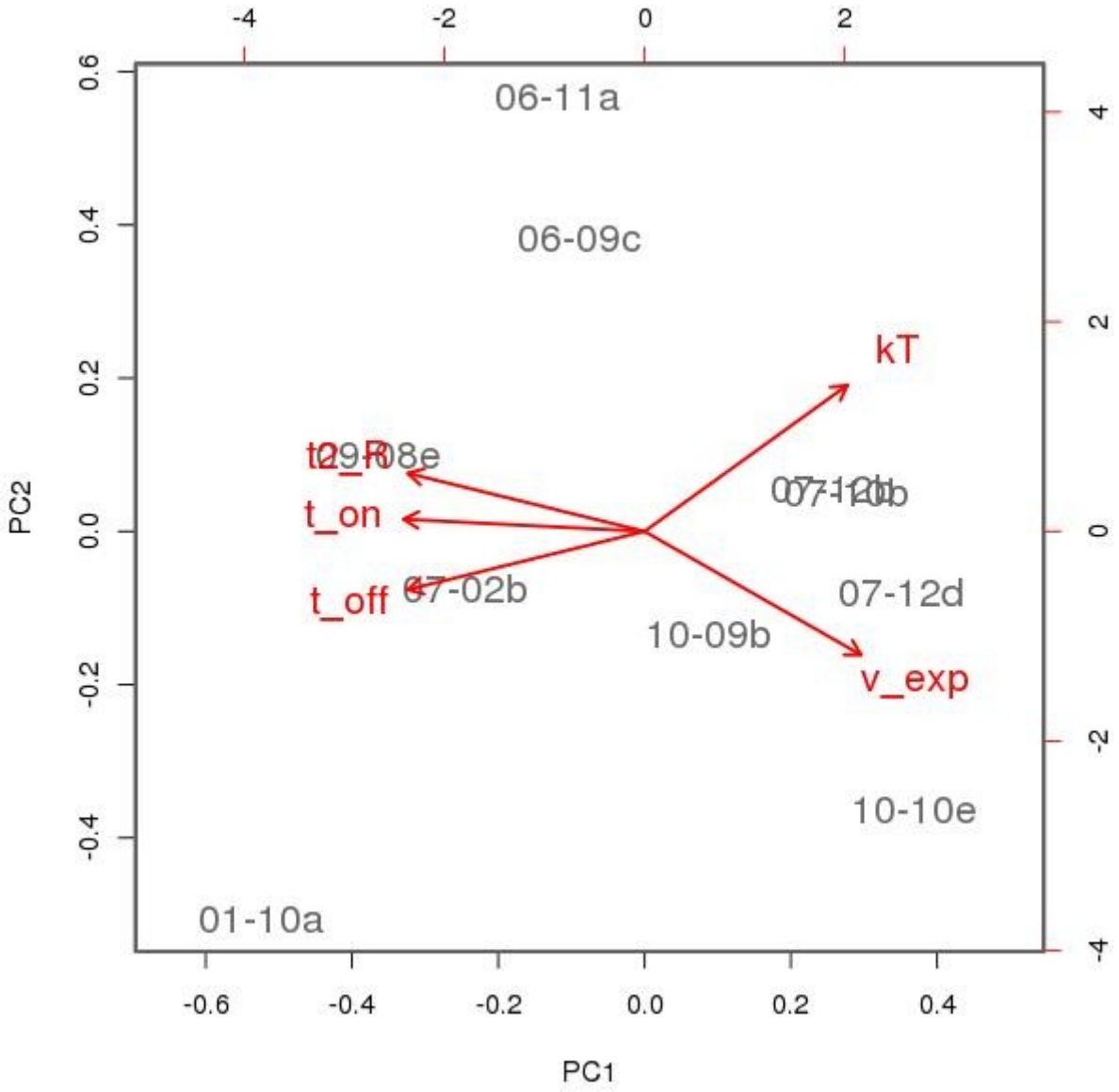
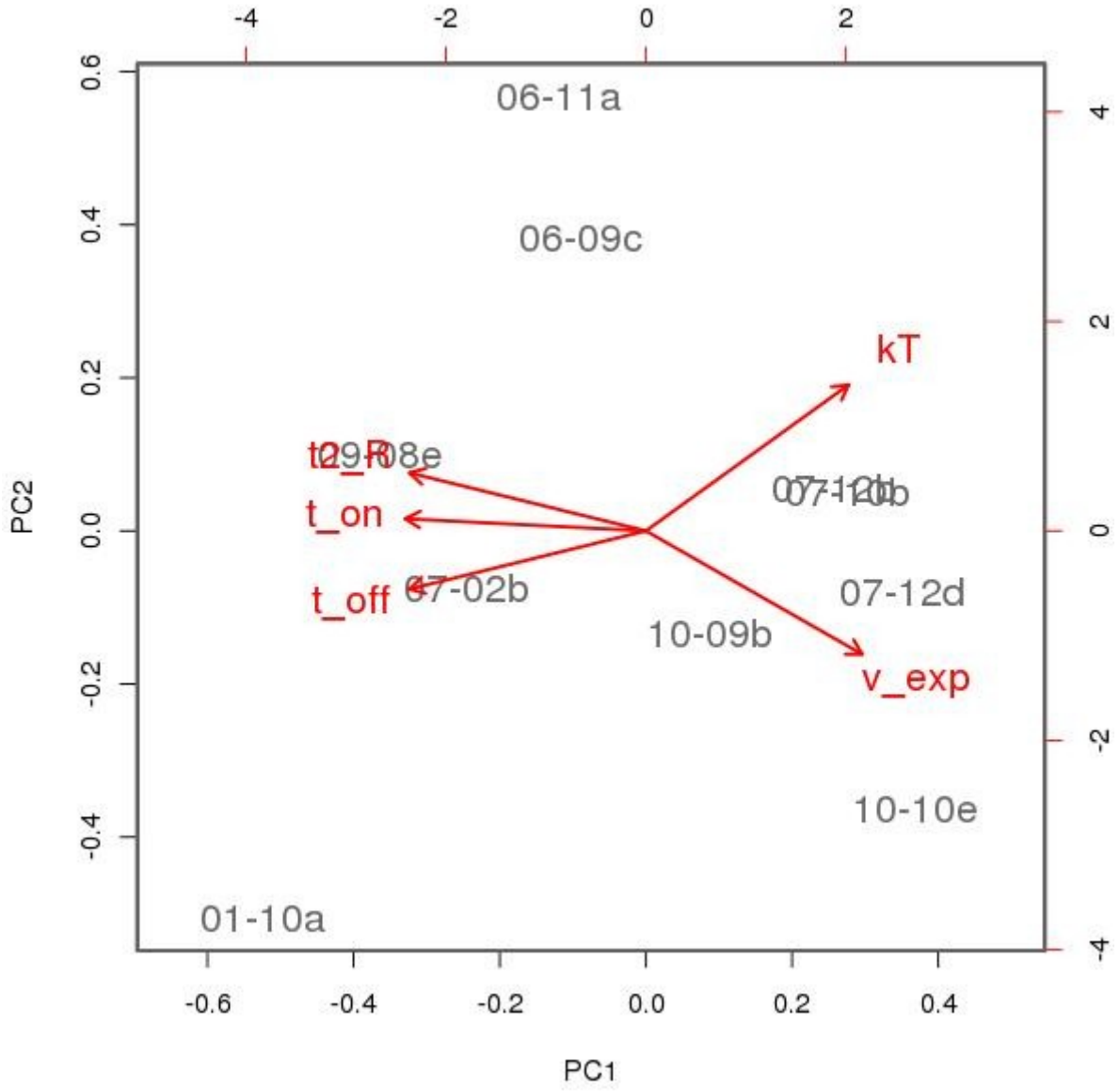


Principal component analysis:

Correlations between nova parameters



Principal component analysis:

80% of variance in PC1

Hidden variable WD mass?

Correlations between nova parameters

$$N_H(\mathrm{cm}^{-2}) = M_{\mathrm{ej,H}} / (\frac{4}{3}\pi \cdot m_H \cdot v_{\mathrm{exp}}^2 \cdot t^2 \cdot f')$$

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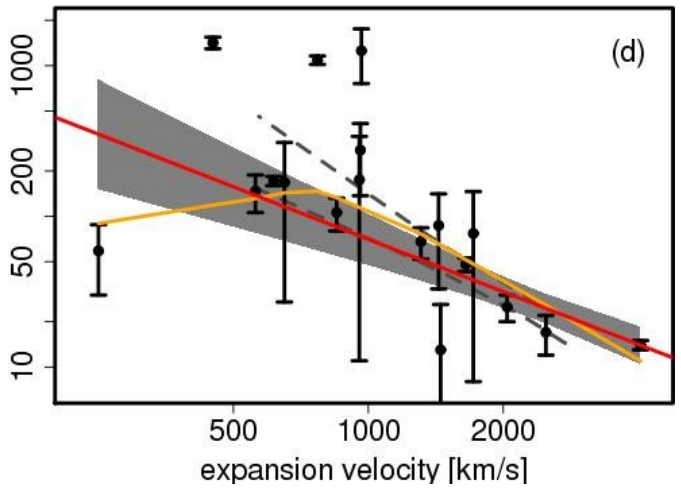

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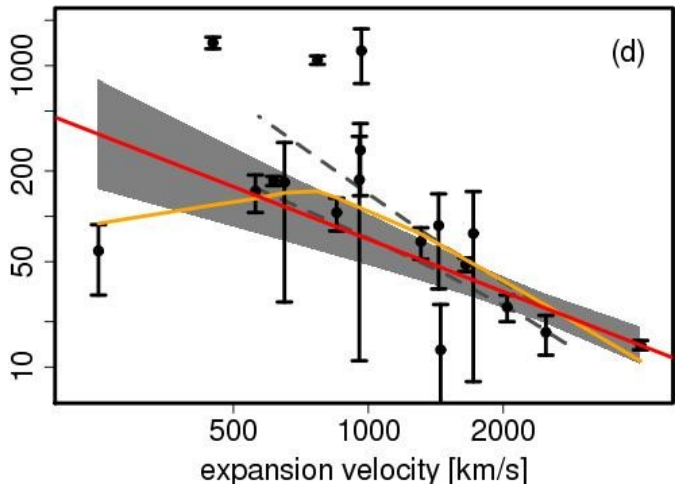

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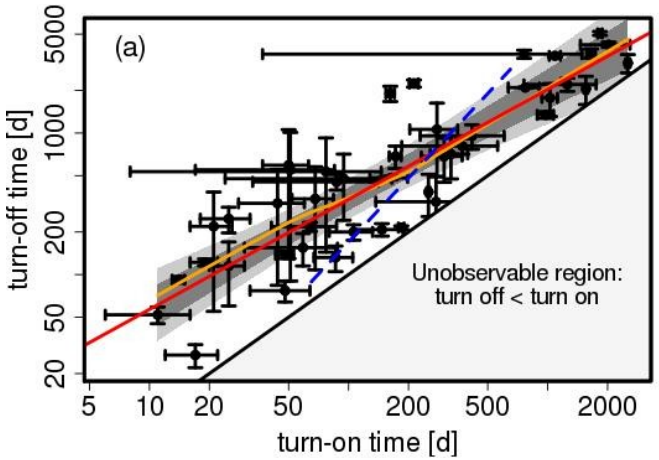

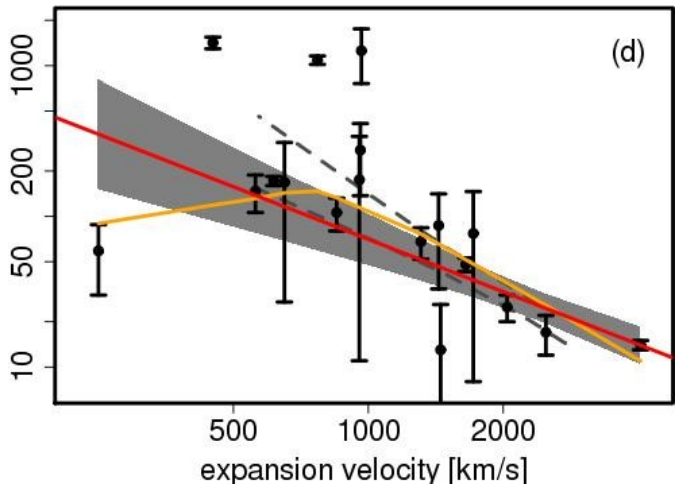

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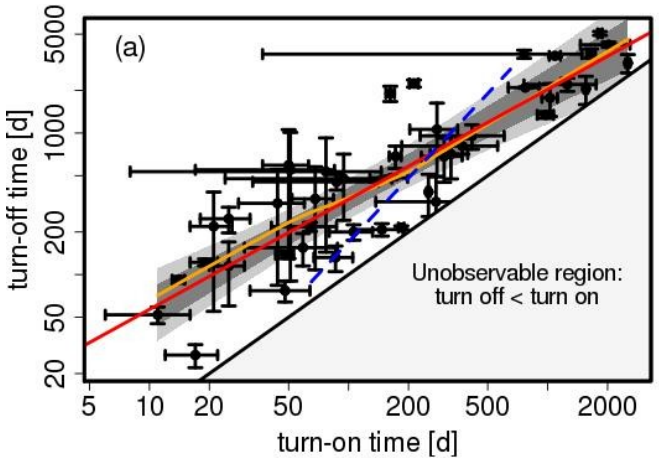
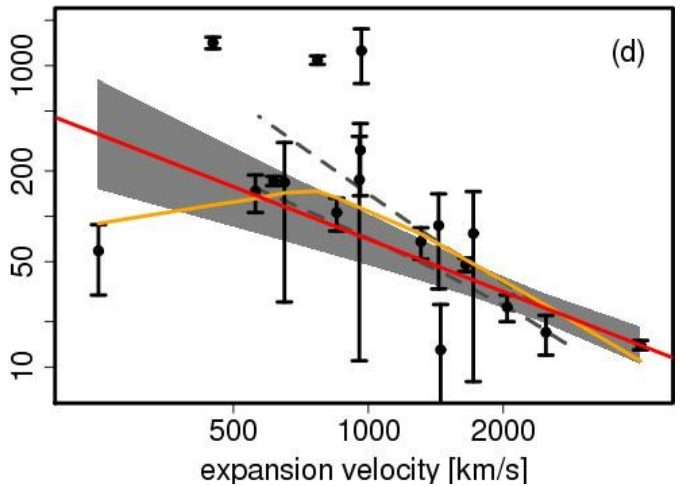
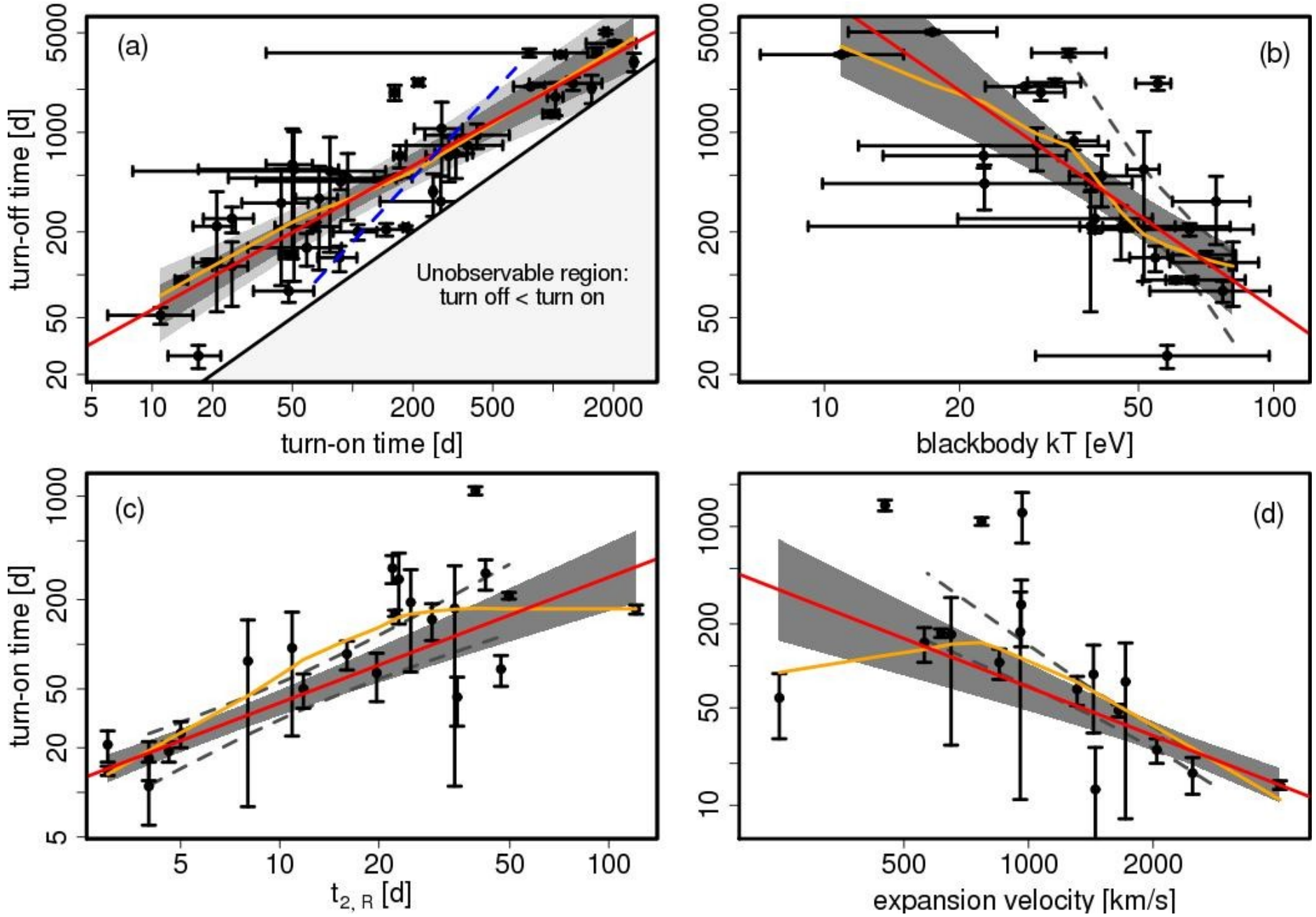




Population studies



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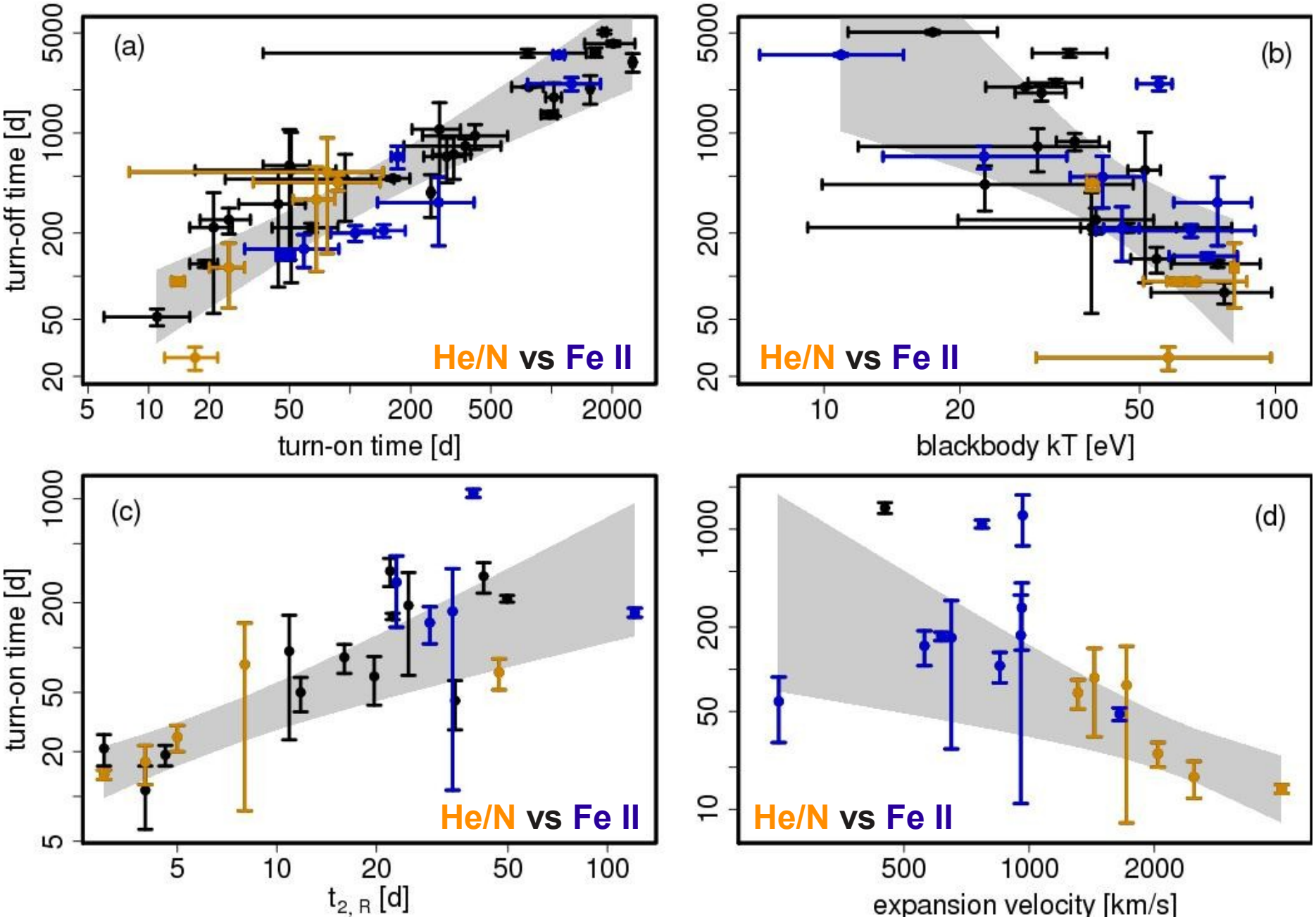

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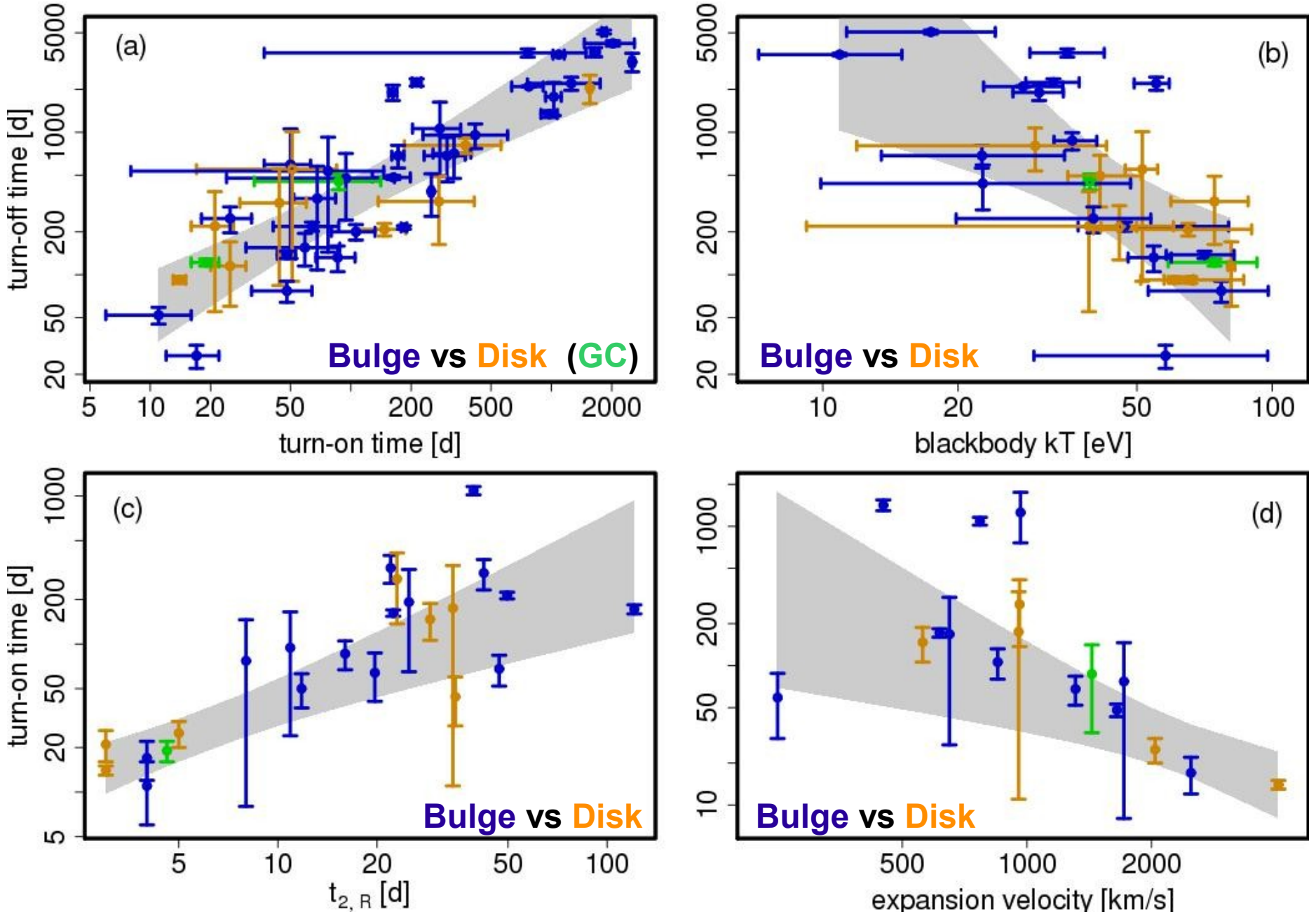

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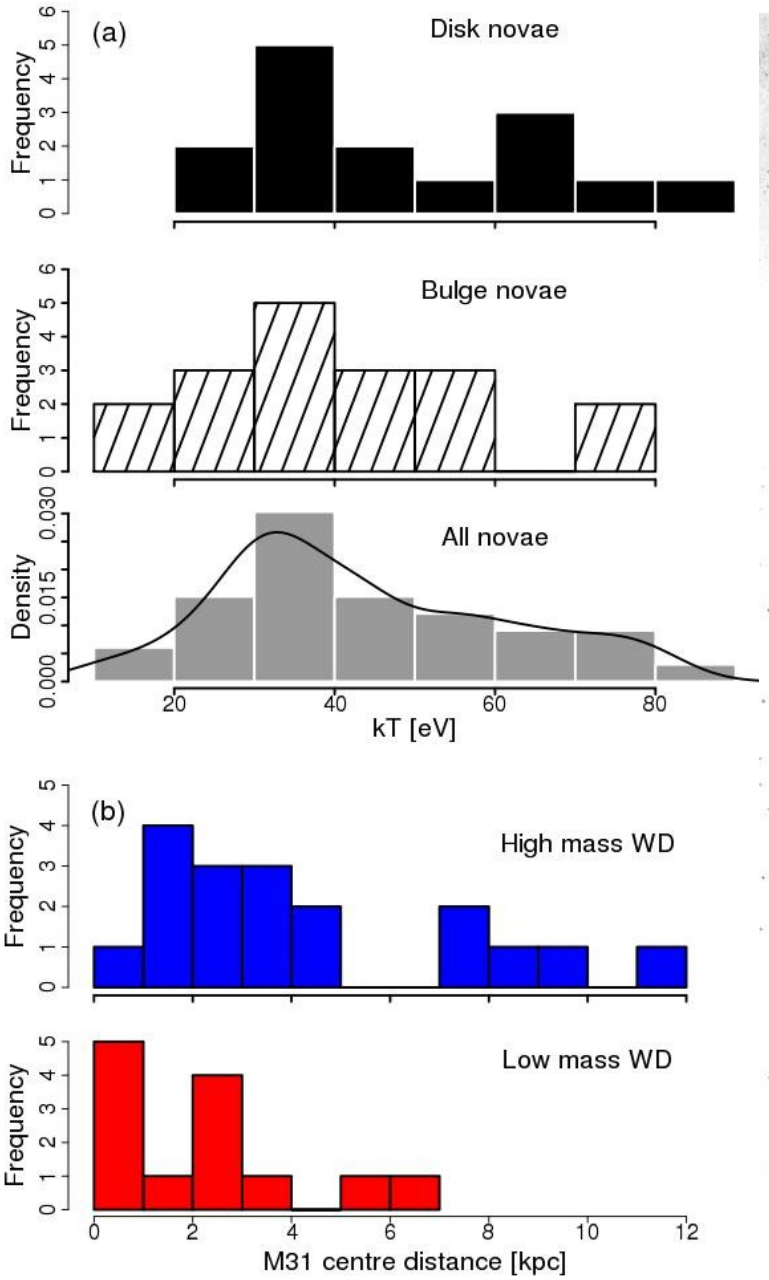

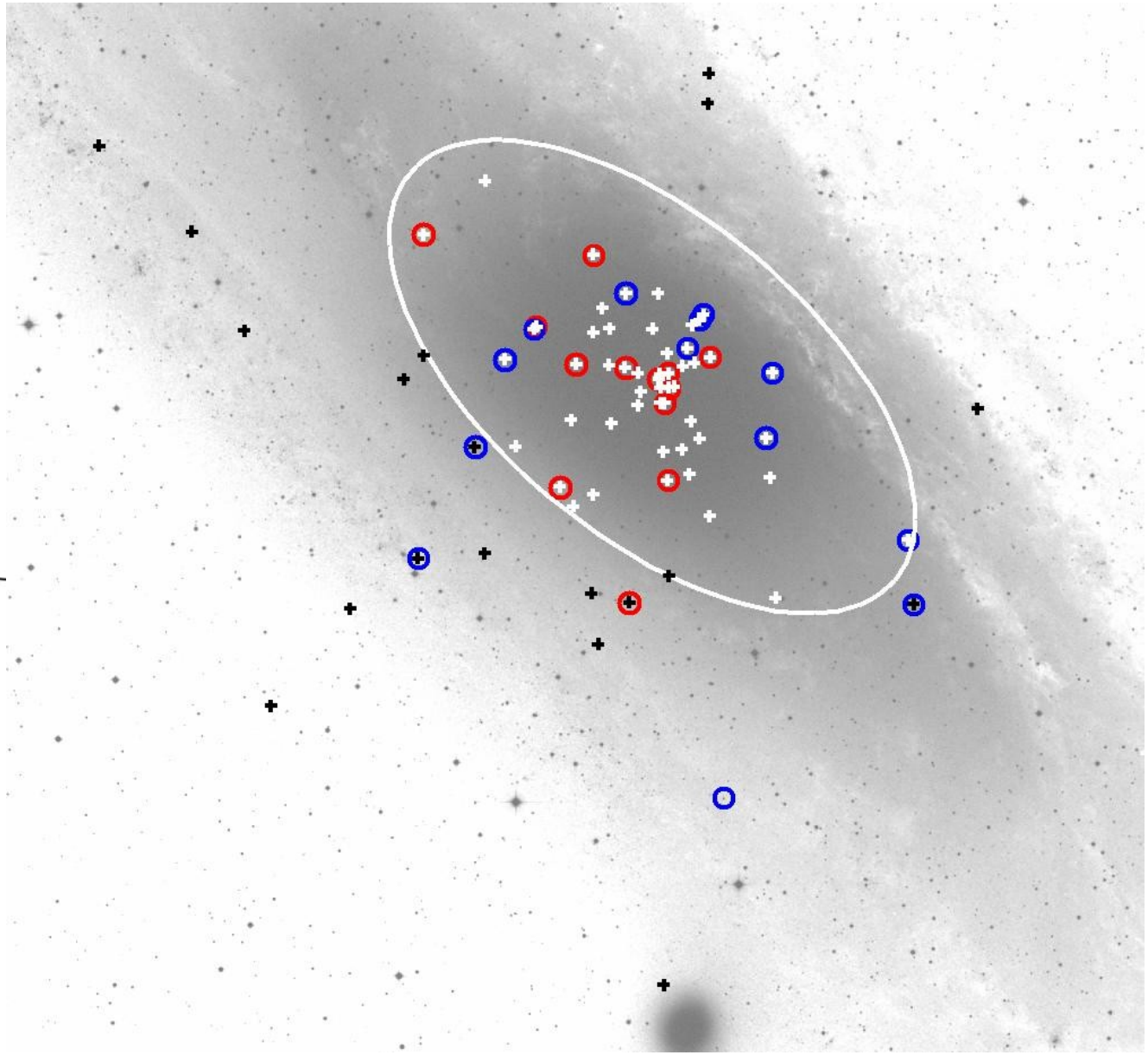

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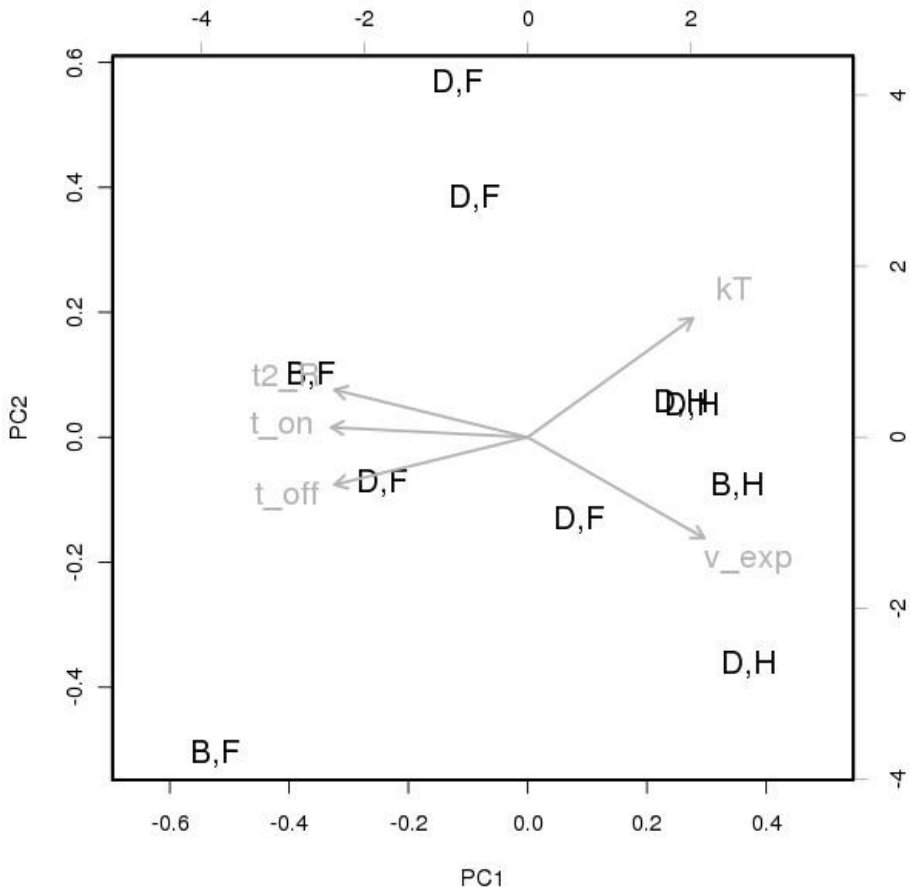

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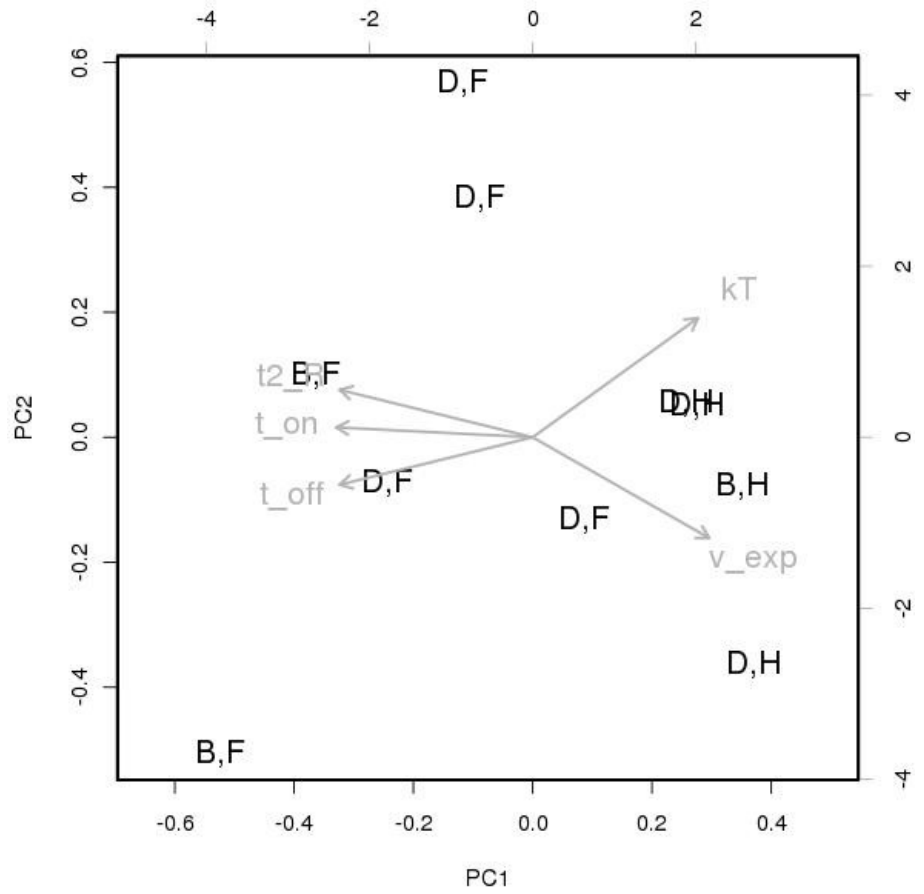

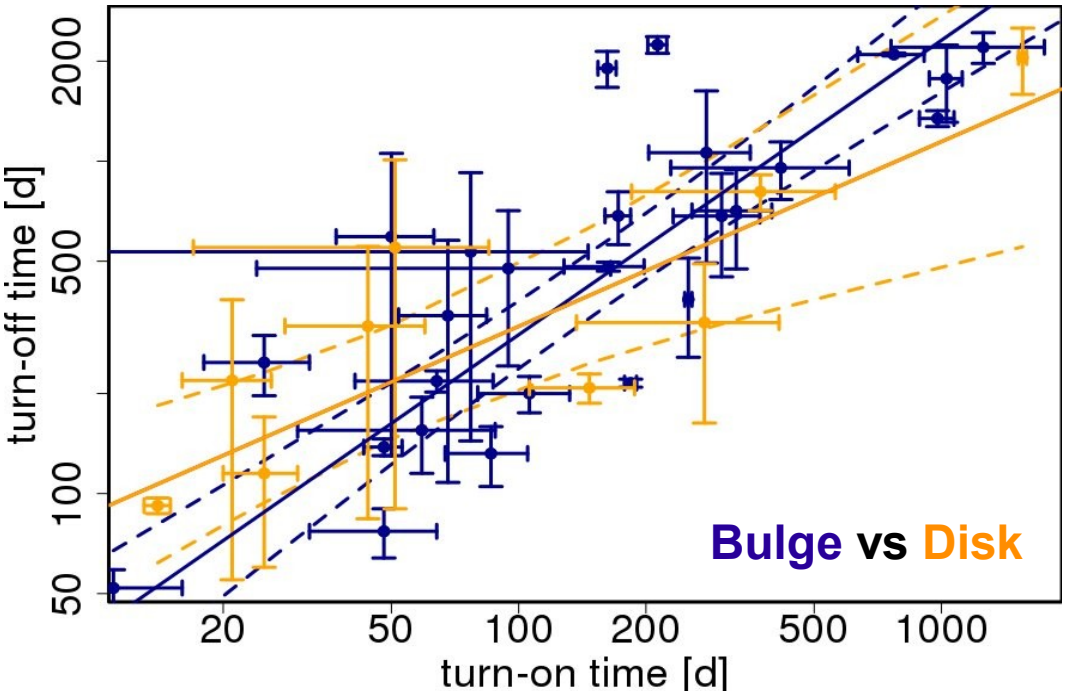

ANOVA: difference on 95% level

Thanks very much! - BBQ time now :-)

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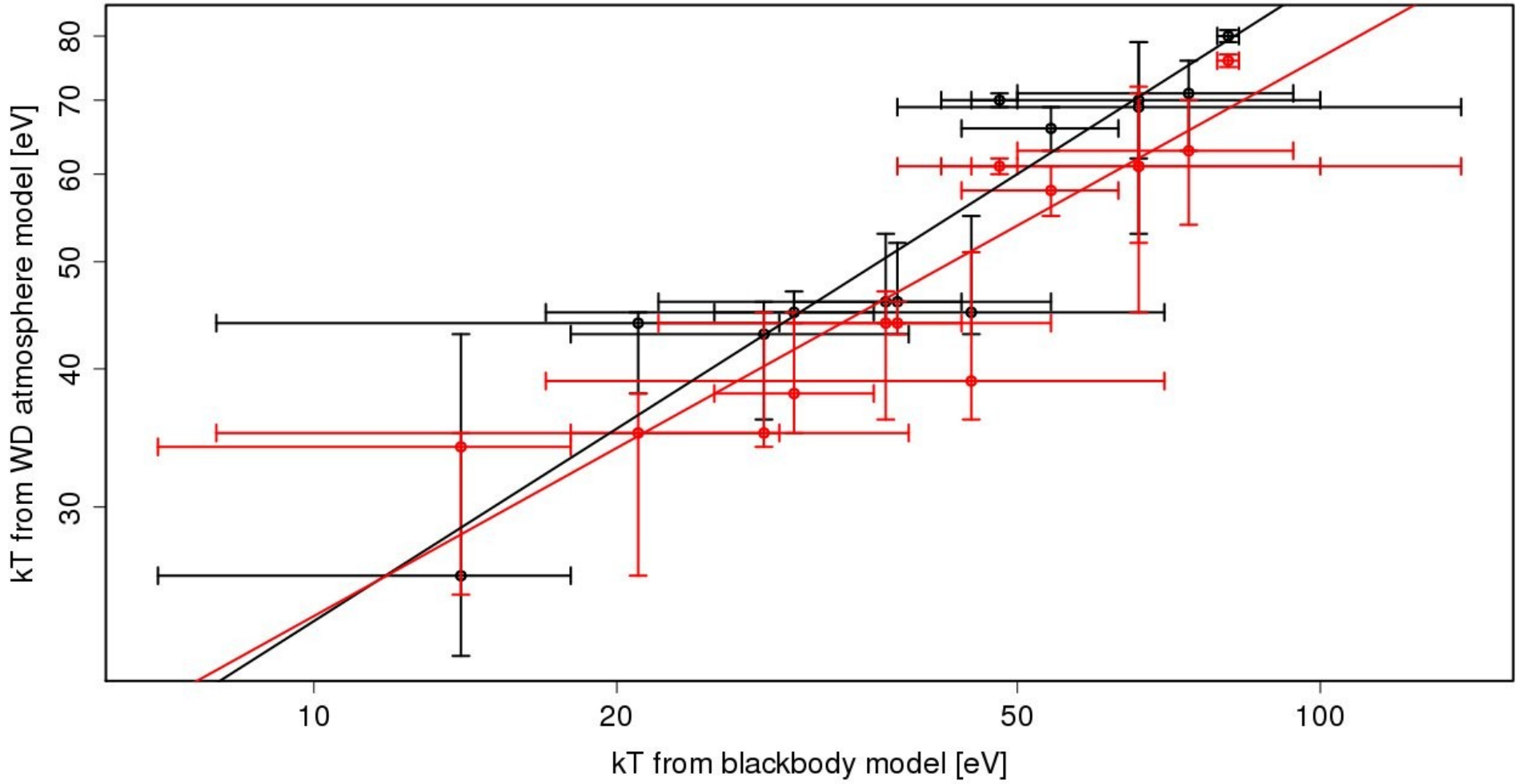
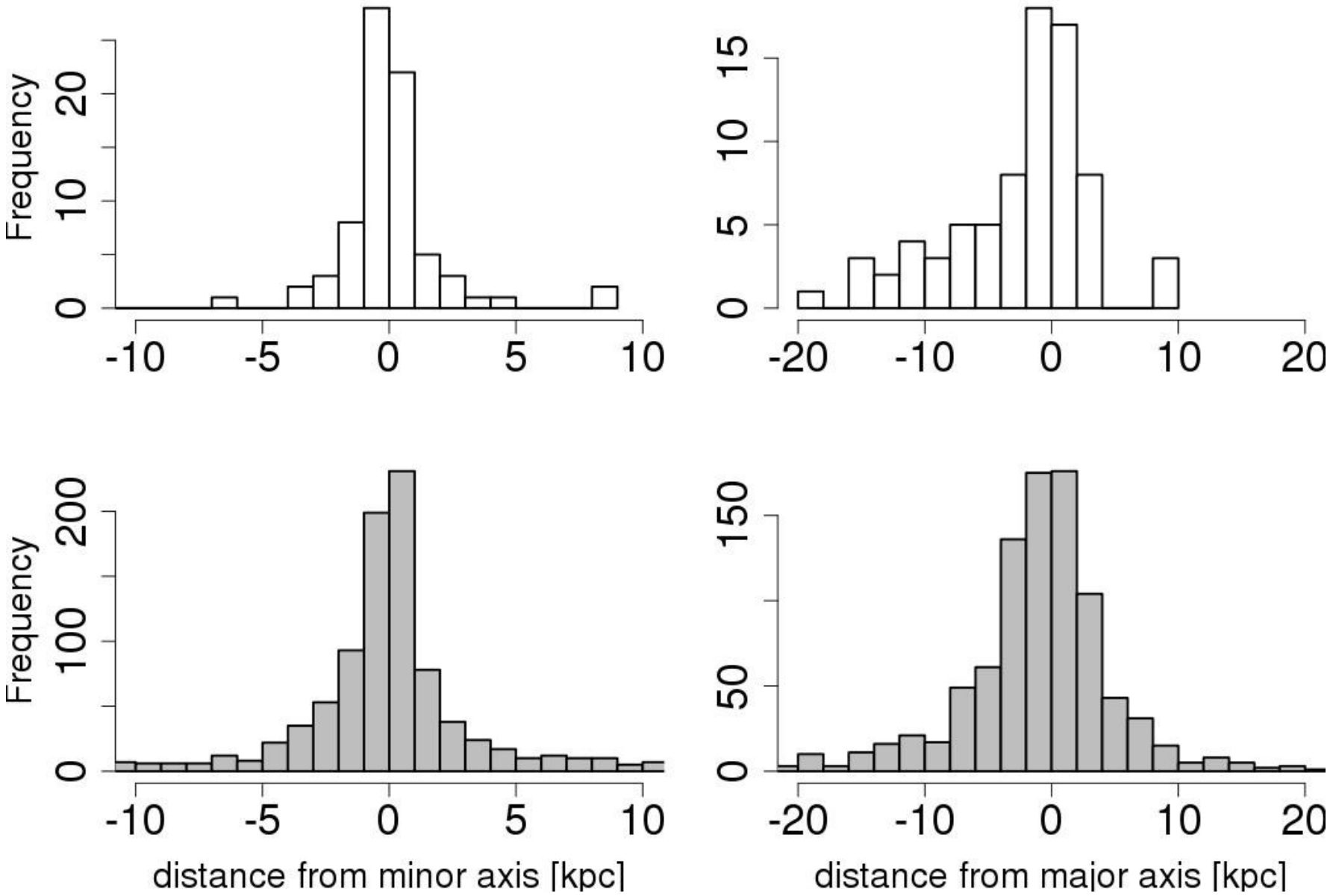
Frequently answered questions

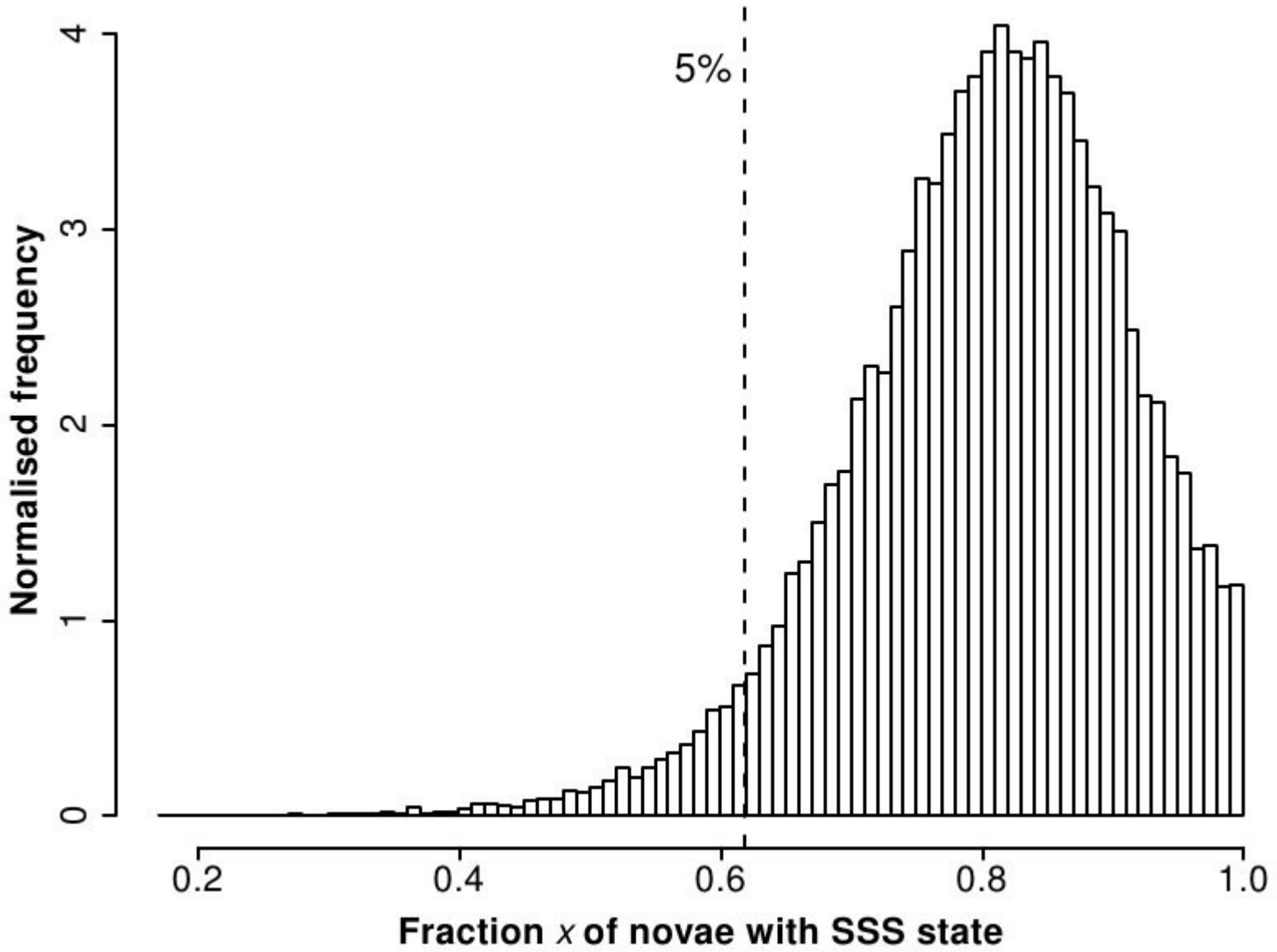
Blackbody fits – the good, the bad & the ugly



Asymmetric distribution – extinction effect?



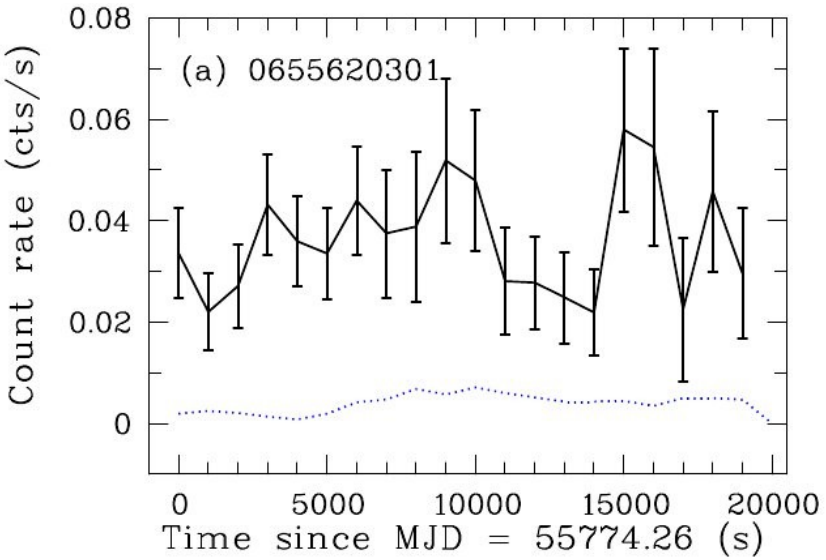
Completeness simulation

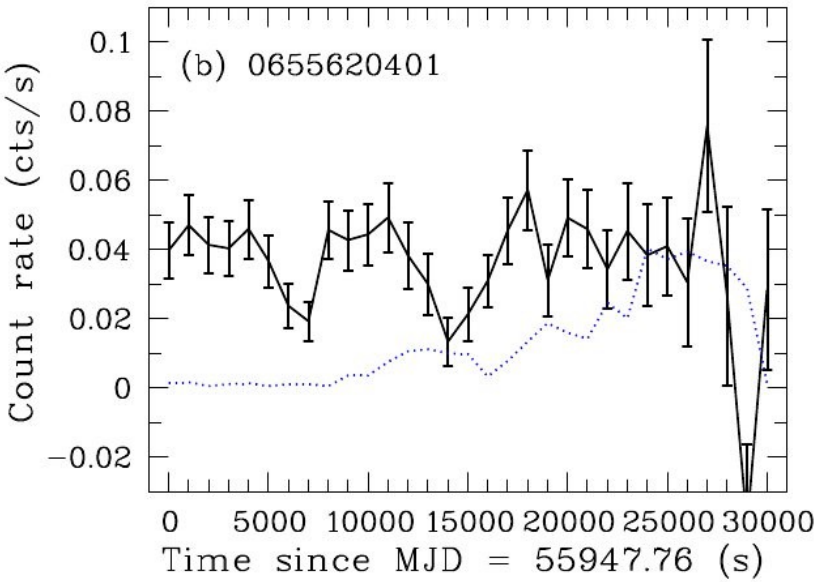


X-ray dipping disk nova M31N 2008-05d

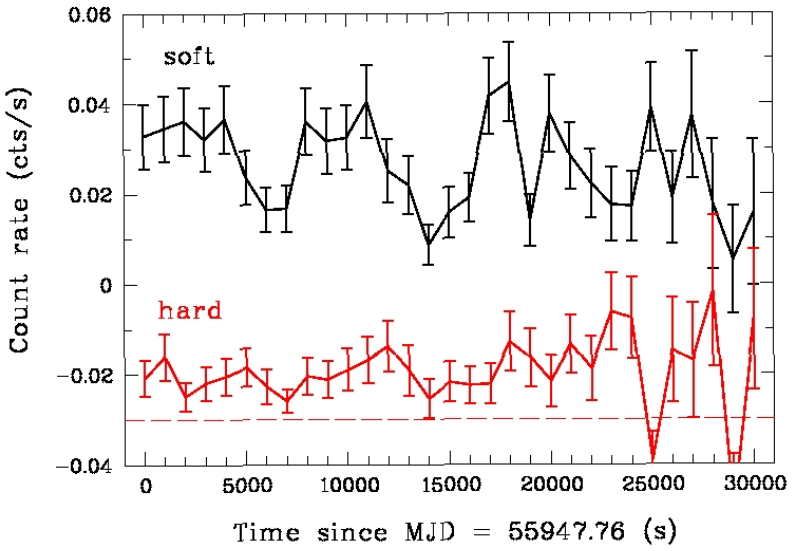
(Henze et al. 2012, A&A, 544, A44)

XMM light curves:





2 bands



U Sco (Ness+ 2012):