The vertical structure of the accretion disc in LMXBs

Felipe Jiménez-Ibarra
Teo Muñoz-Darias and Jorge Casares

Low Mass X-ray Binary

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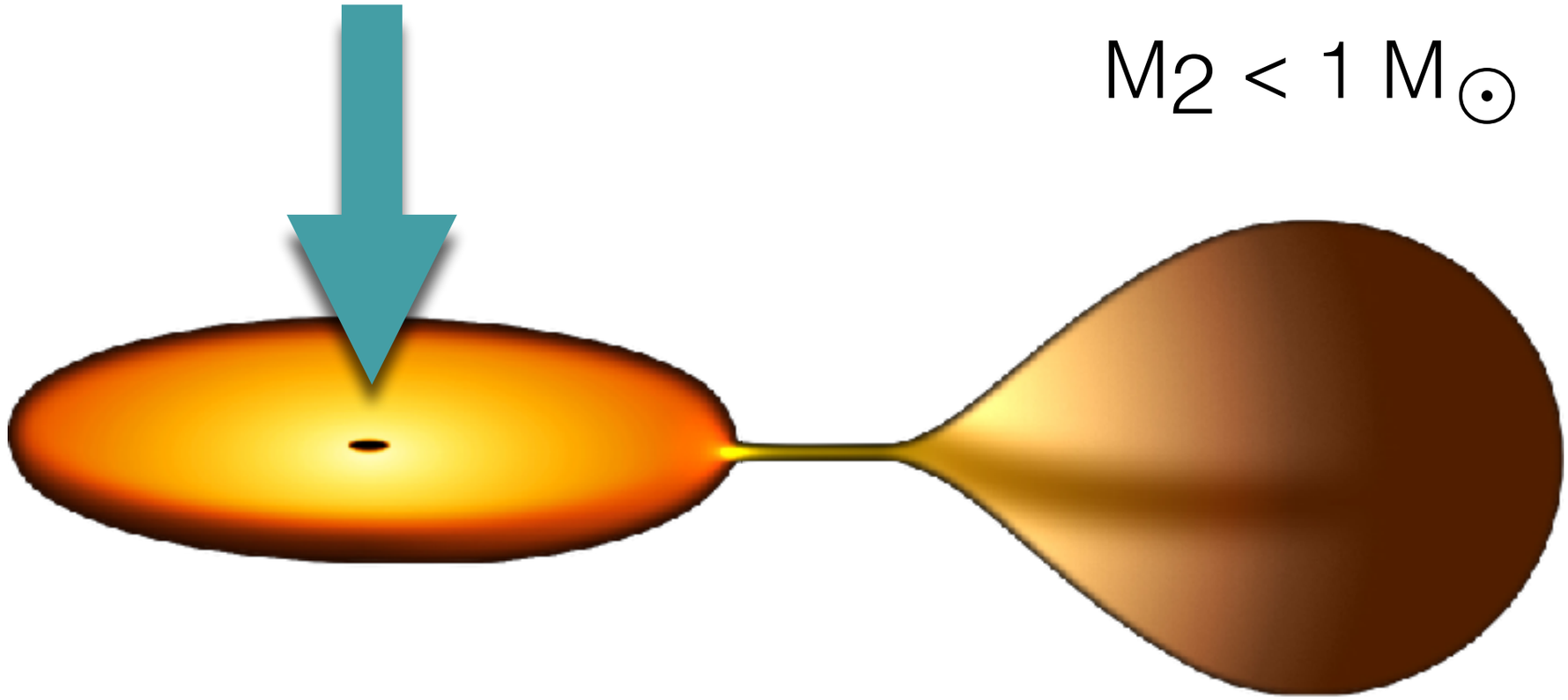
M_1: BH or NS

$M_2 < 1\ M_\odot$



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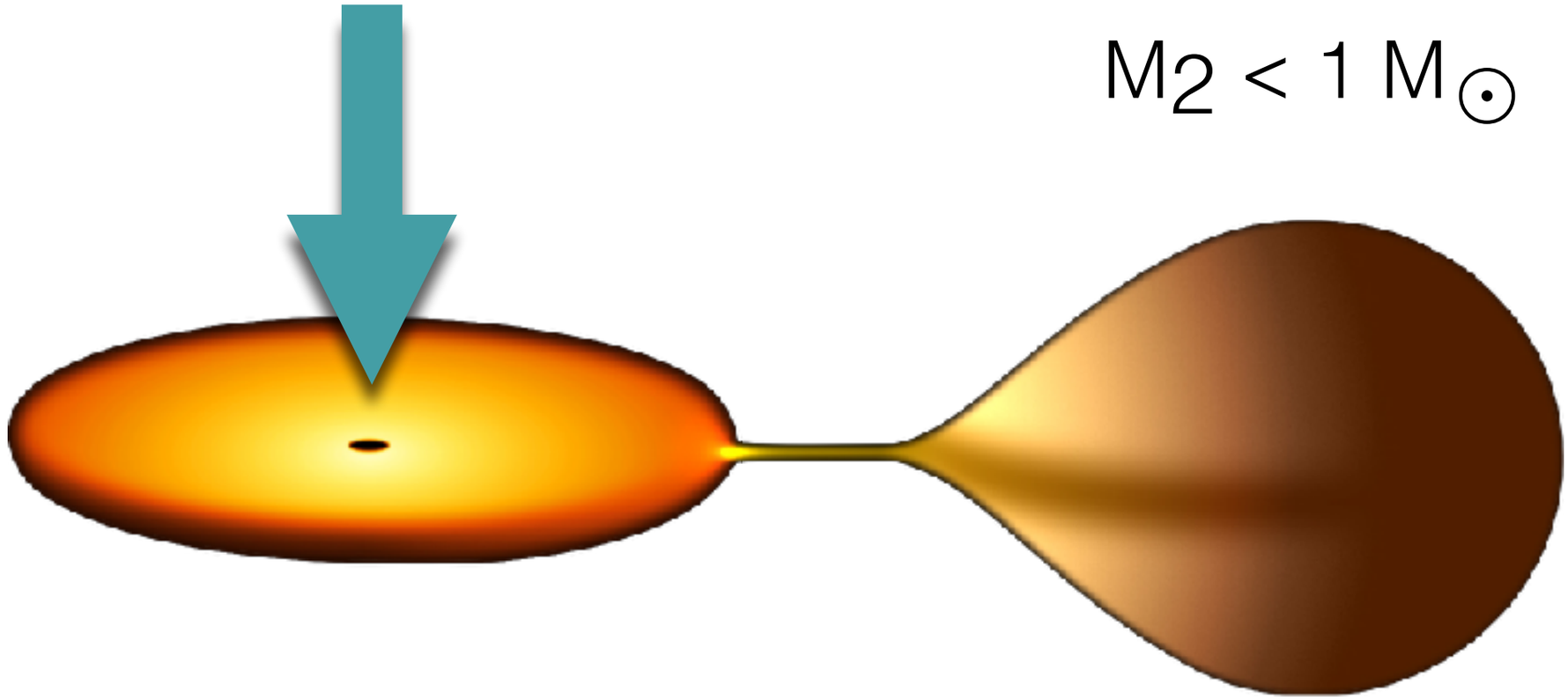

Persistents

Transients

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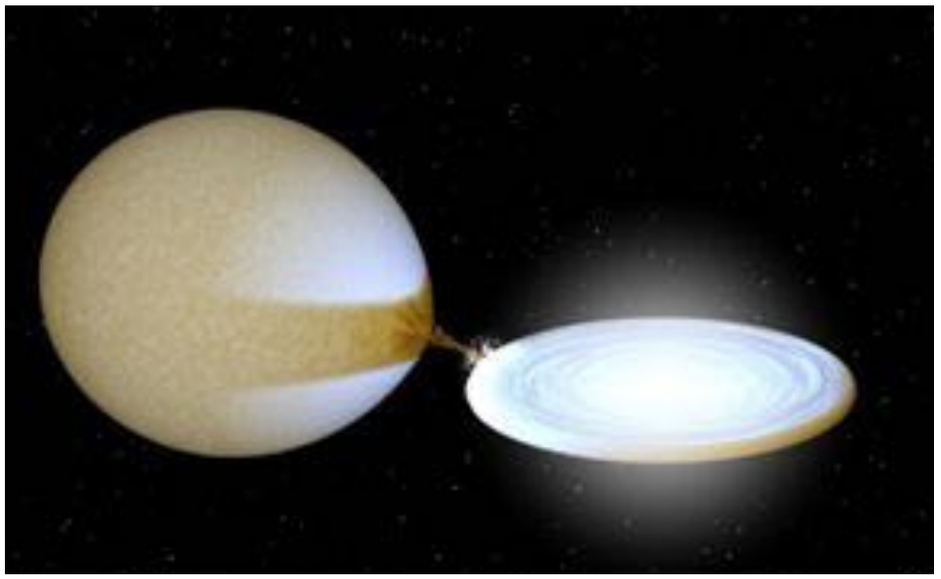

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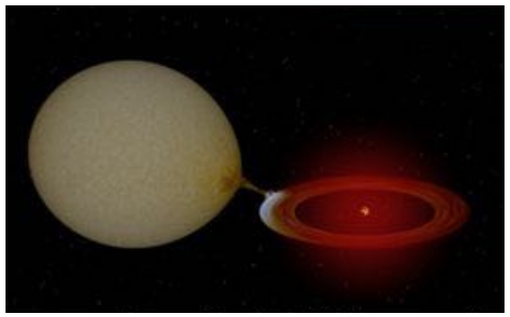

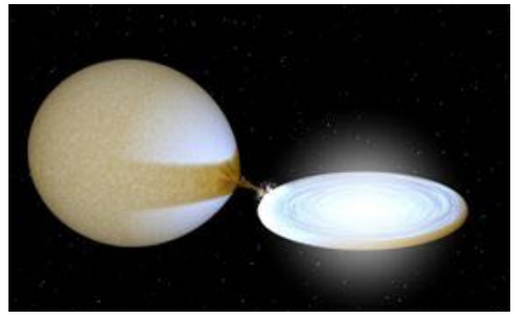

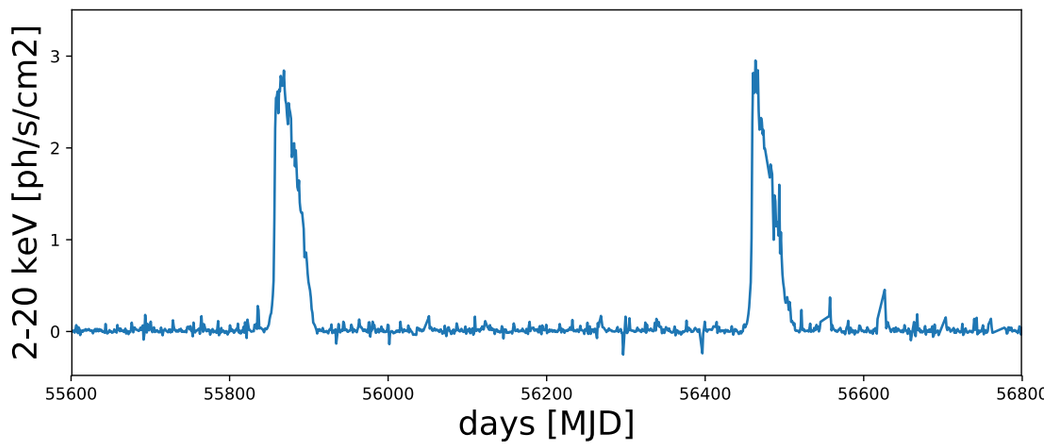

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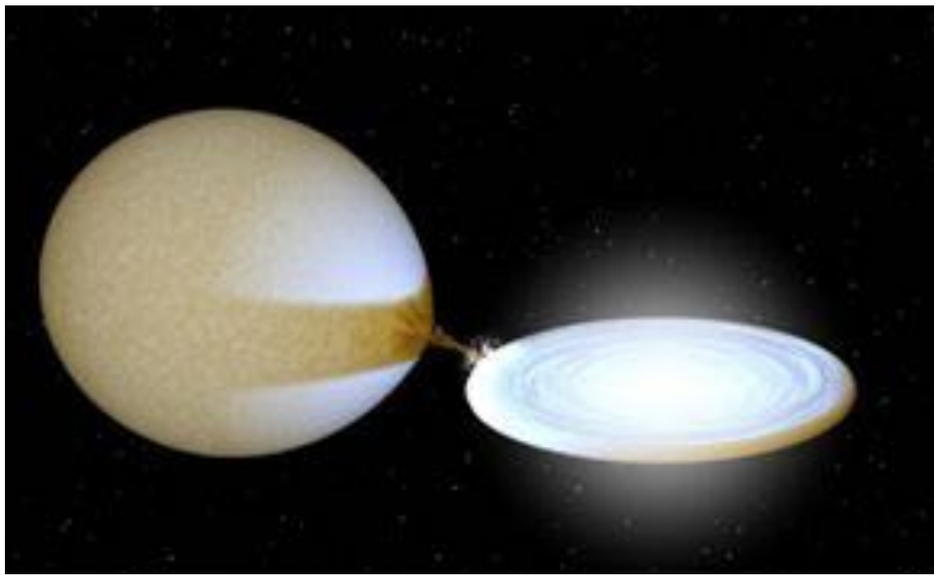

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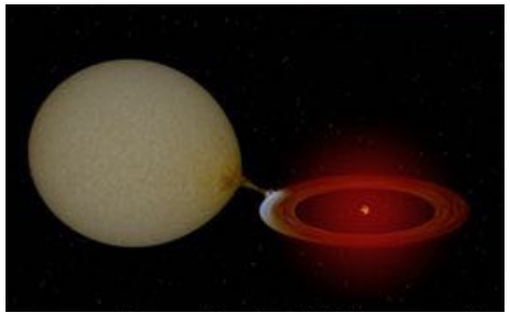
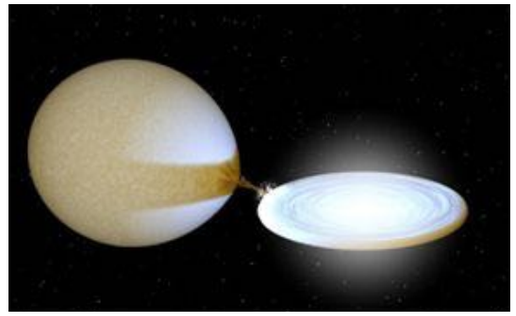
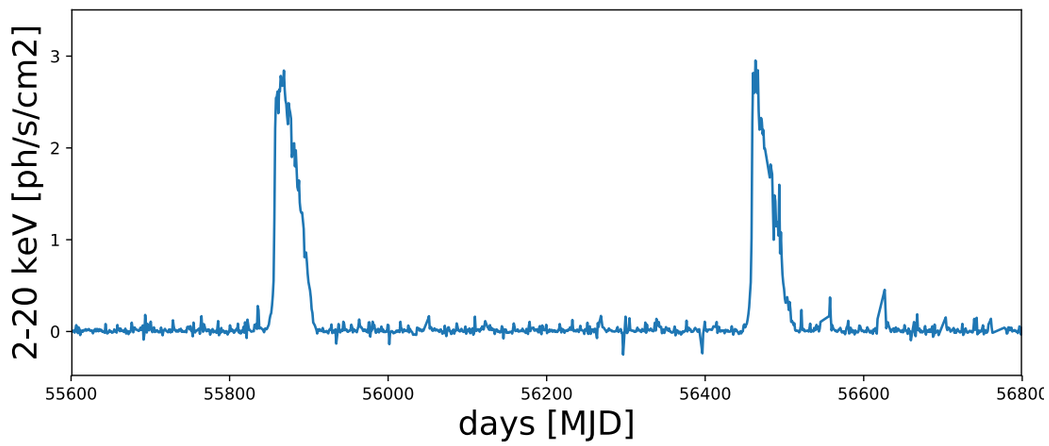
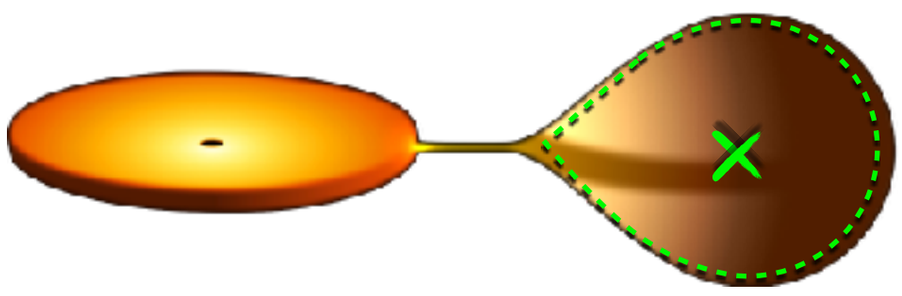
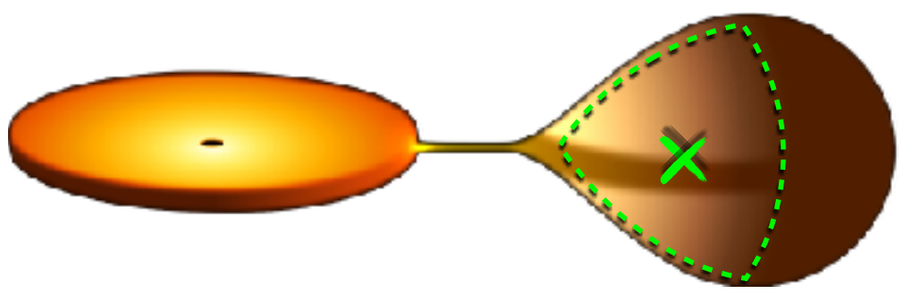




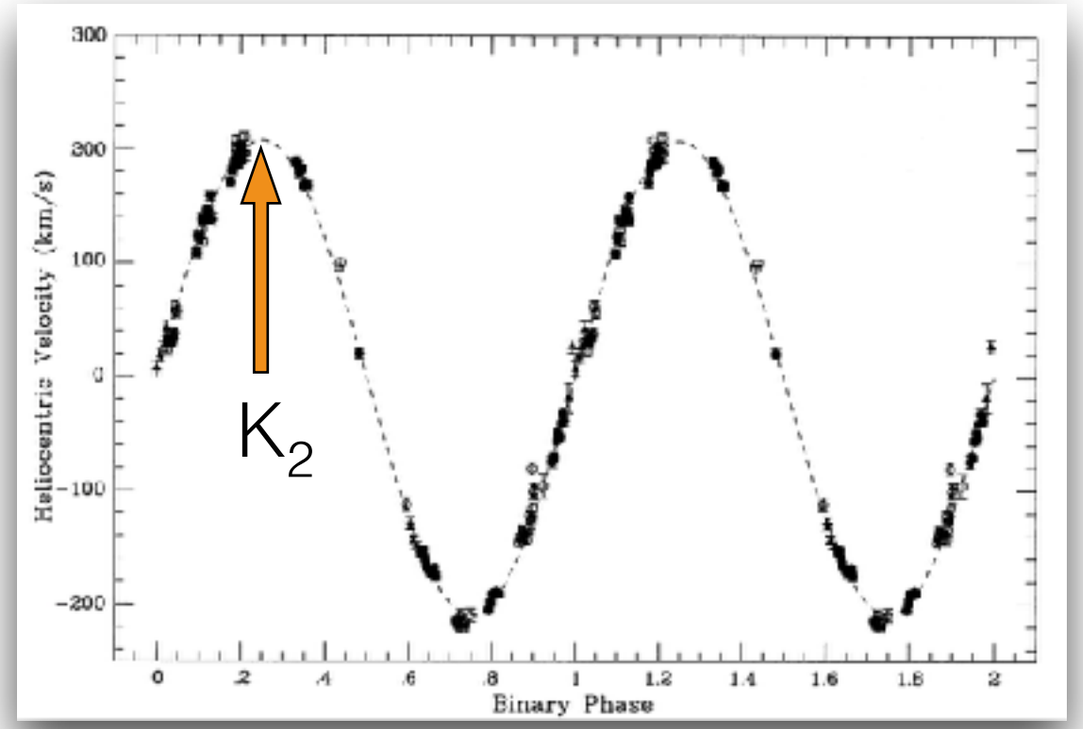






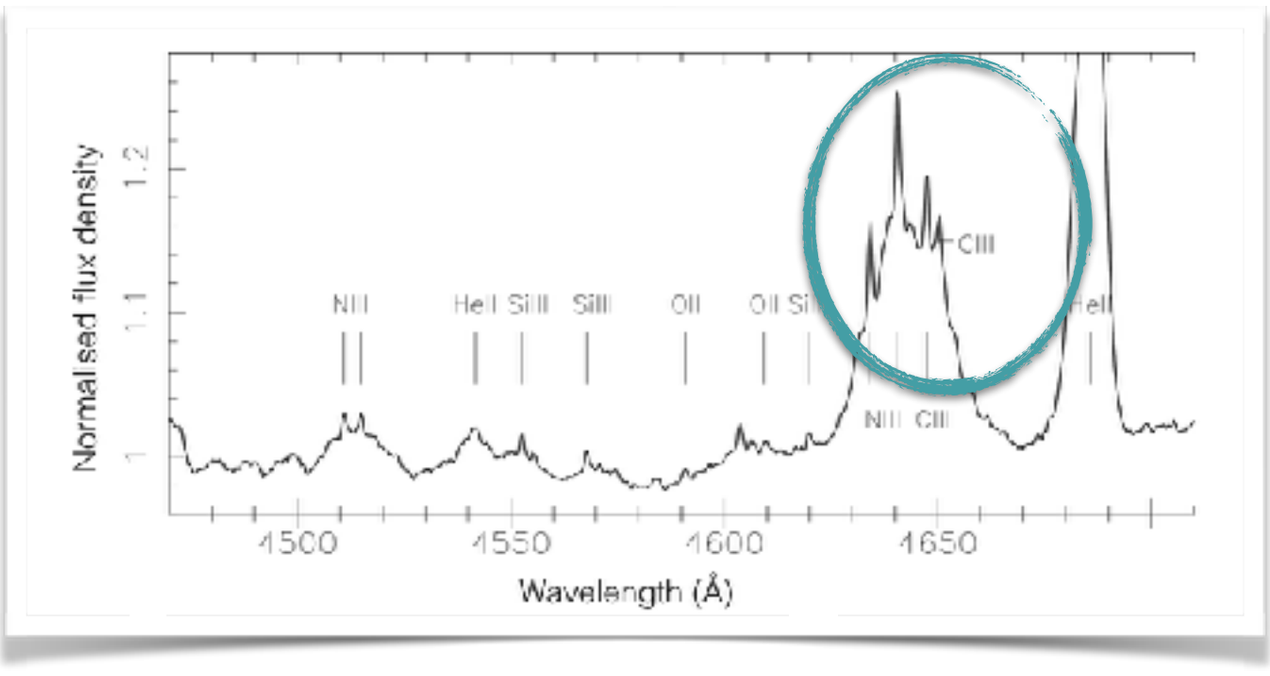
K_2

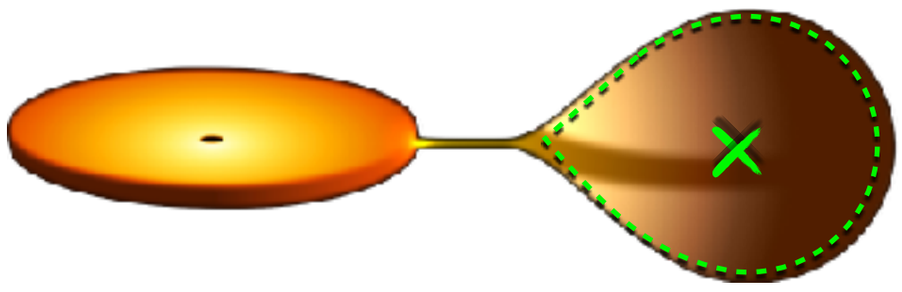
* Casares and Charles 1994

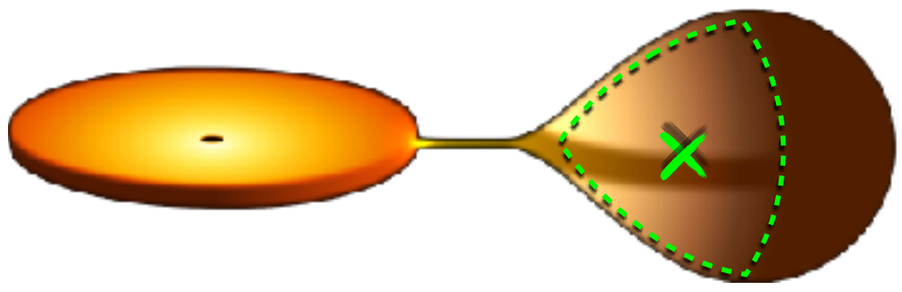


K emission

* Steeghs and Casares 2002







K_2

$K_{emission}$

K correction

$$K_{em} / K_2 = K_c\,(\boldsymbol{\alpha}, M_2/M_1)$$

Muñoz-Darias et al. (2005)

K correction

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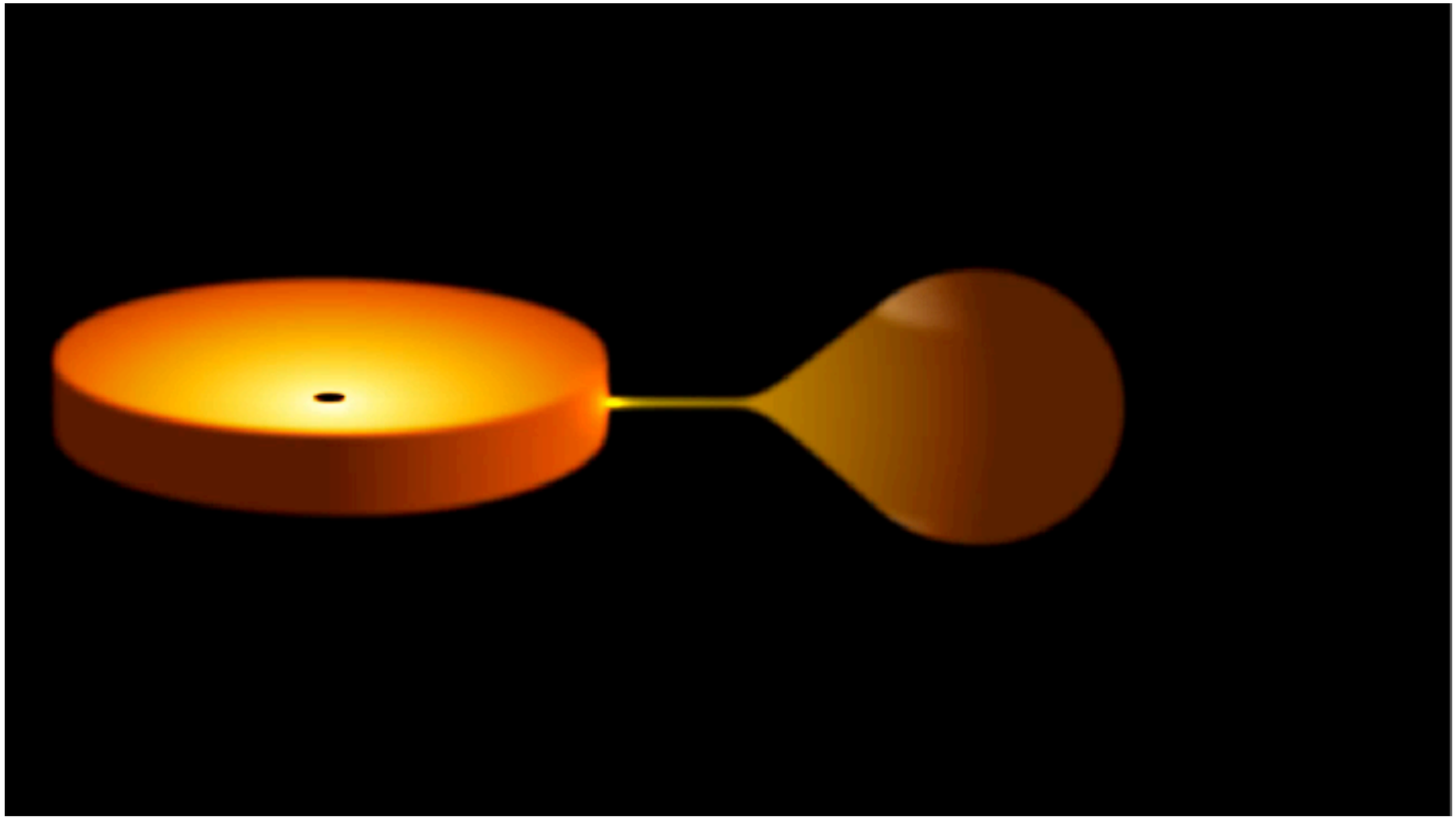

K correction

Aquila X-1

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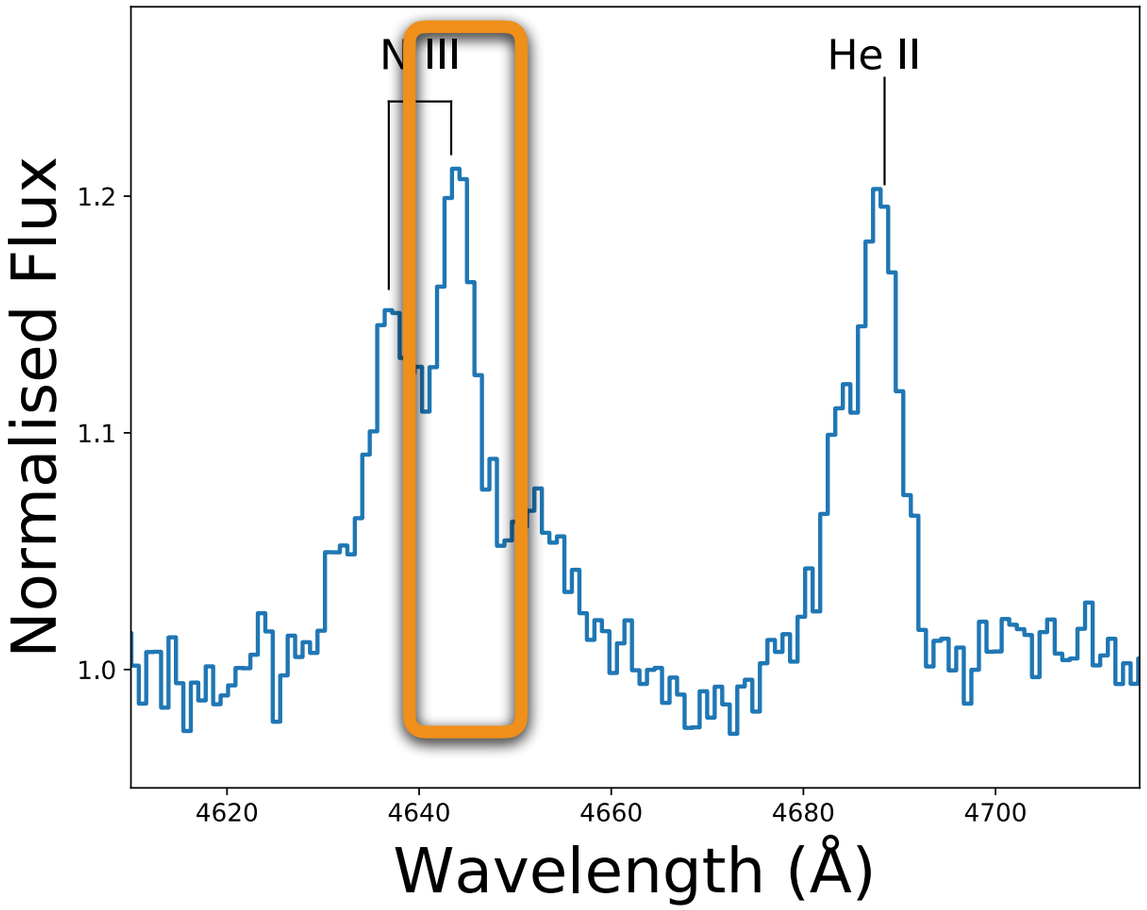
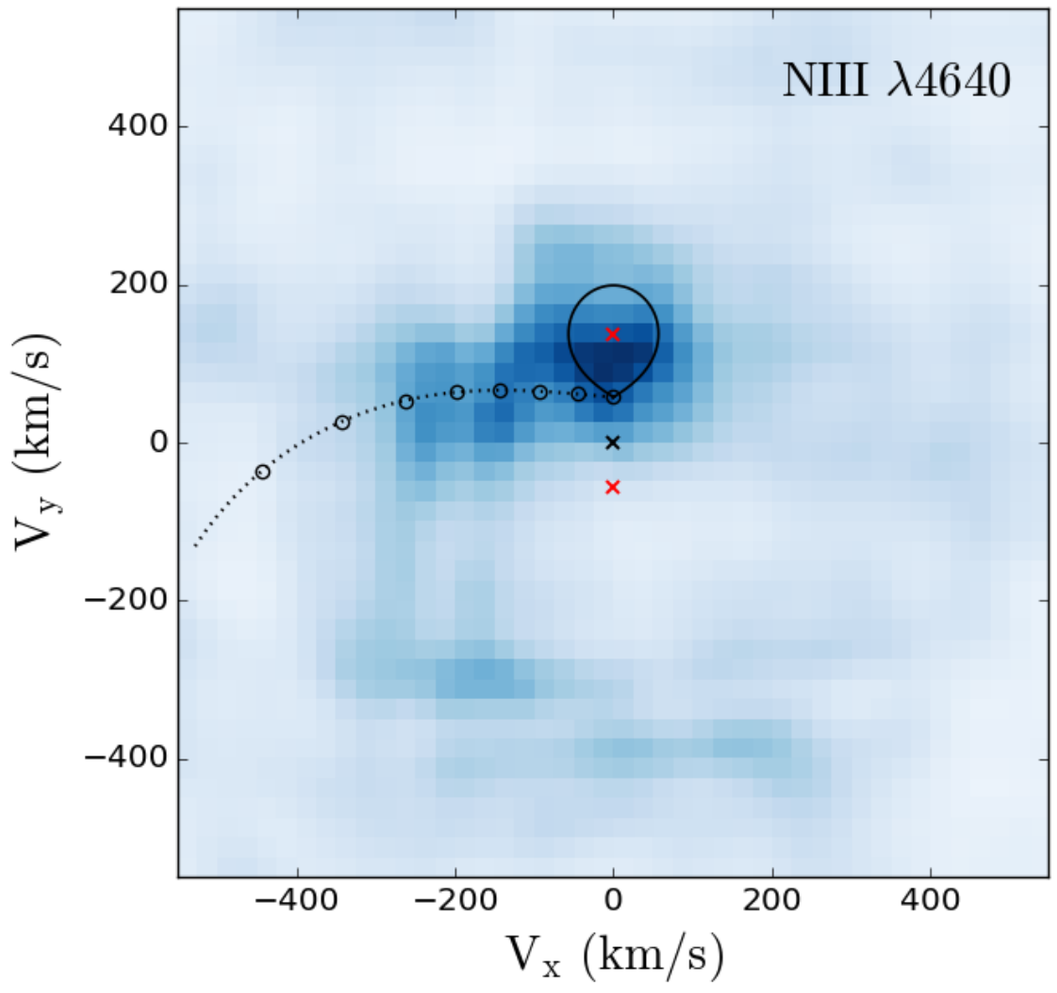
- Neutron star transient
- Outburst ~ 2 years
- GTC 10.4m (2011, 2013 and 2016)

Aquila X-1

Jiménez-Ibarra et al. 2018 (MNRAS)

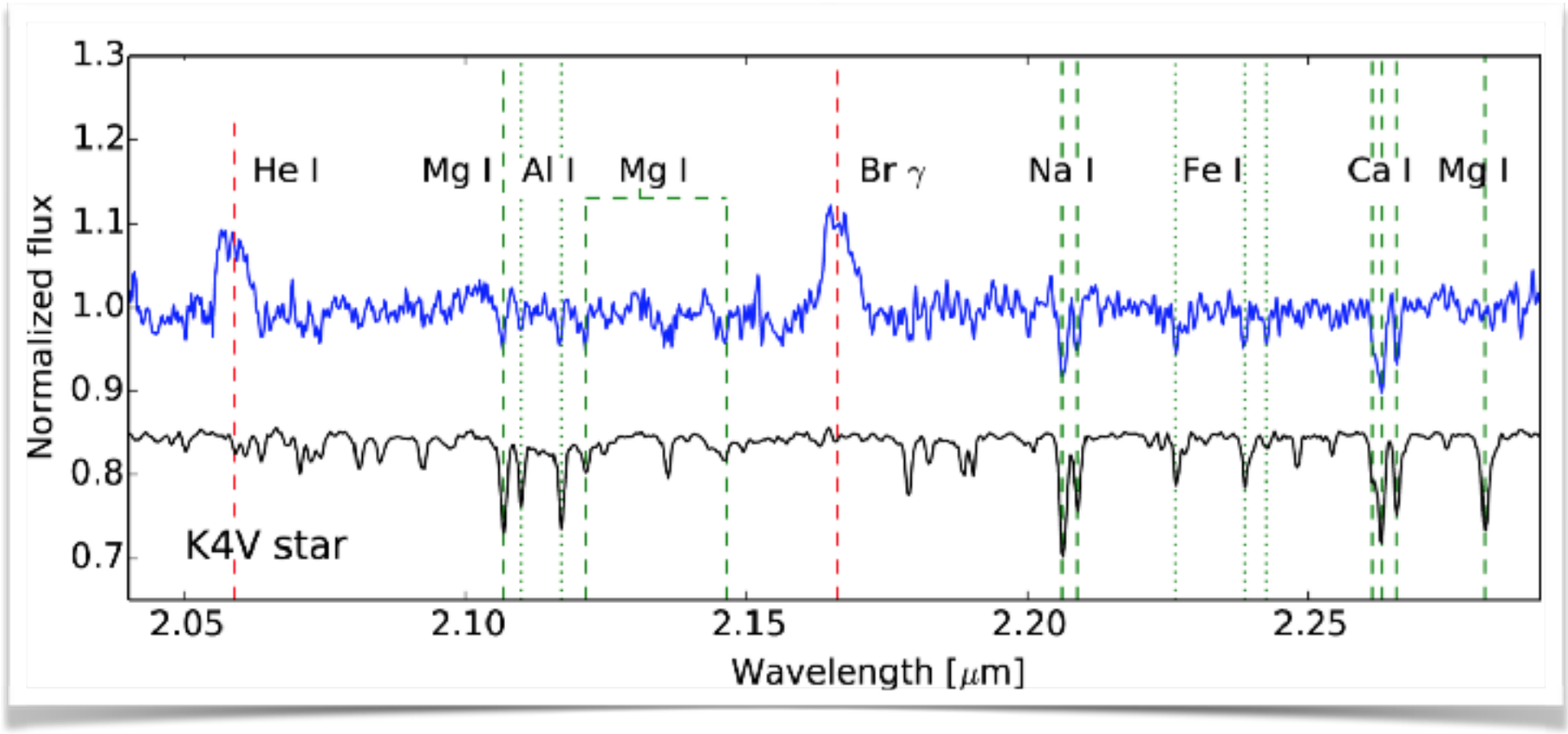




$K_{em} = 102 \pm 6$ km s^{-1}

Aquila X-1

Mata Sánchez et al. 2017 (VLT-nIR)



$$K_2 = 136 \pm 4 \text{ km s}^{-1}$$

$$M_2 / M_1 = 0.41 \pm 0.08$$

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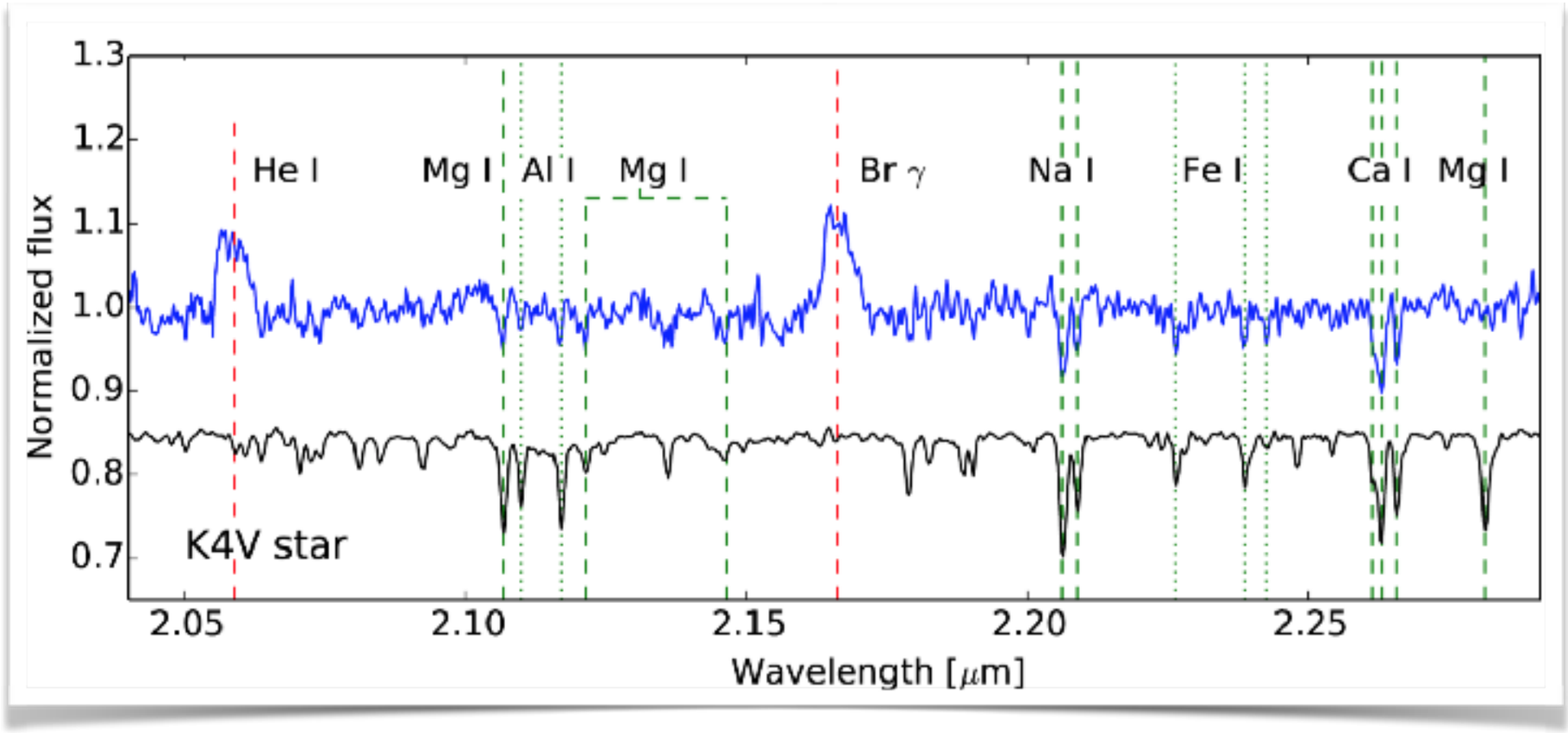

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Opening angle

$$K_c\ (\boldsymbol{\alpha}, M_2/M_1) = K_{em} / K_2$$

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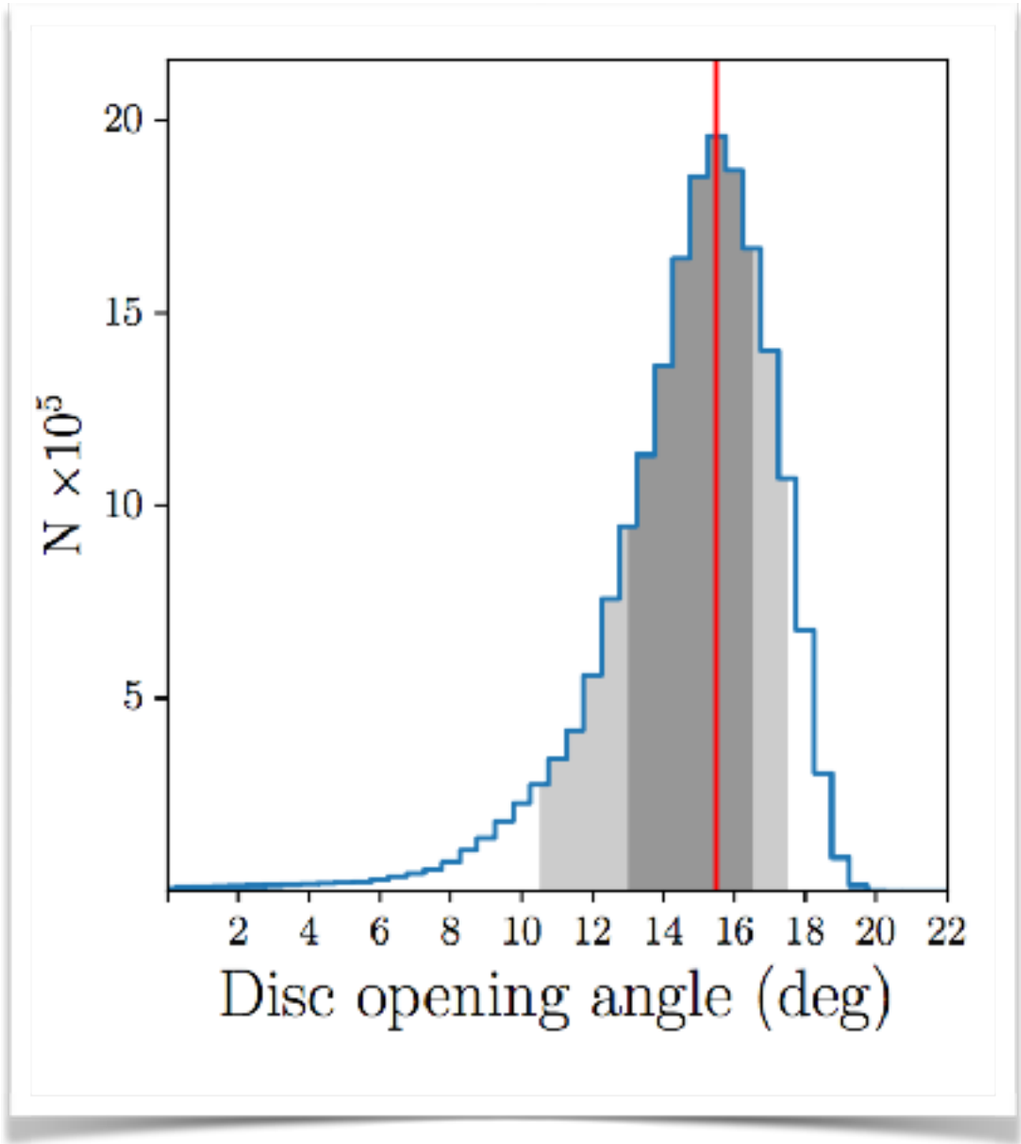
K_{em}

K_2

M_2 / M_1



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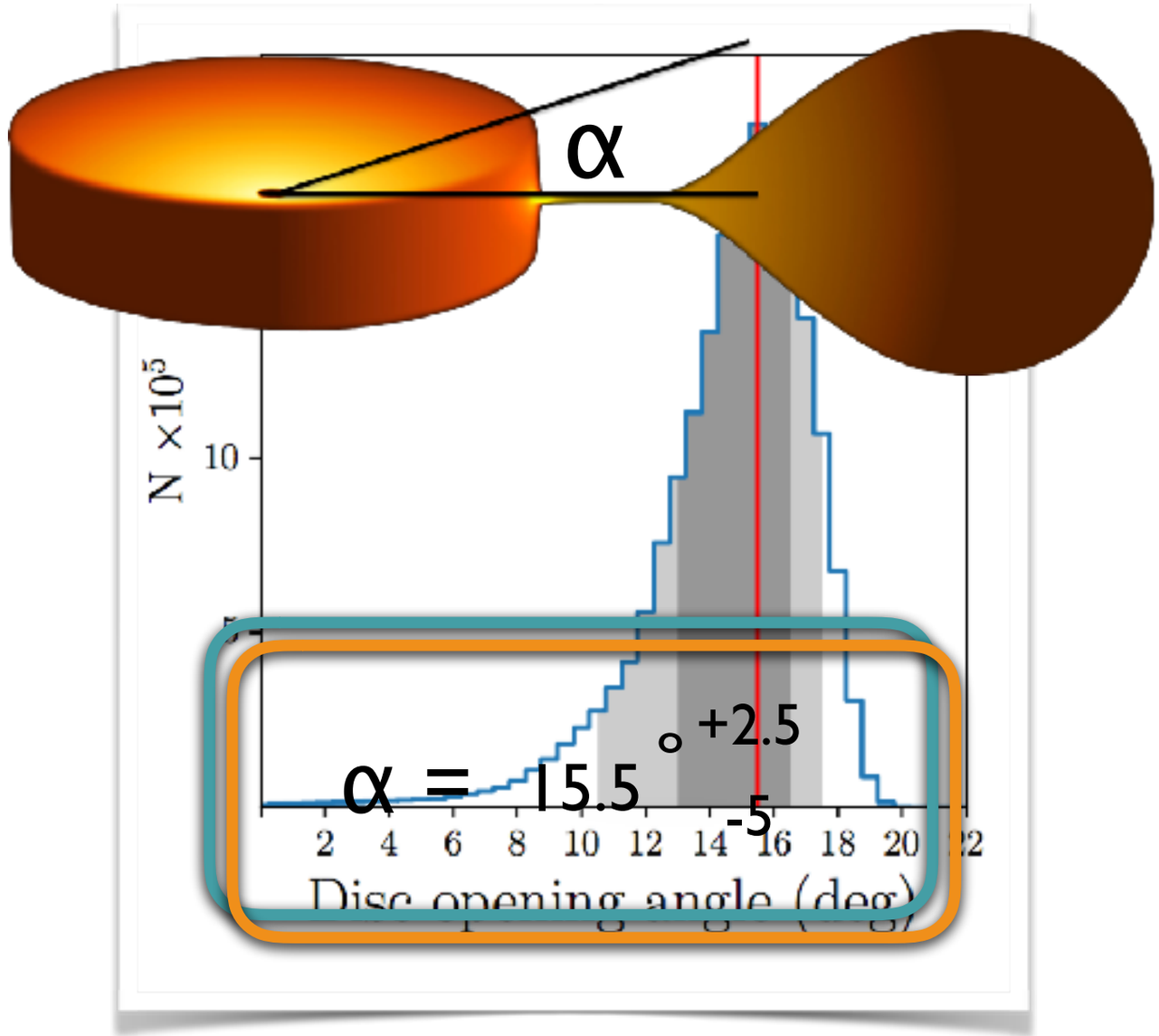
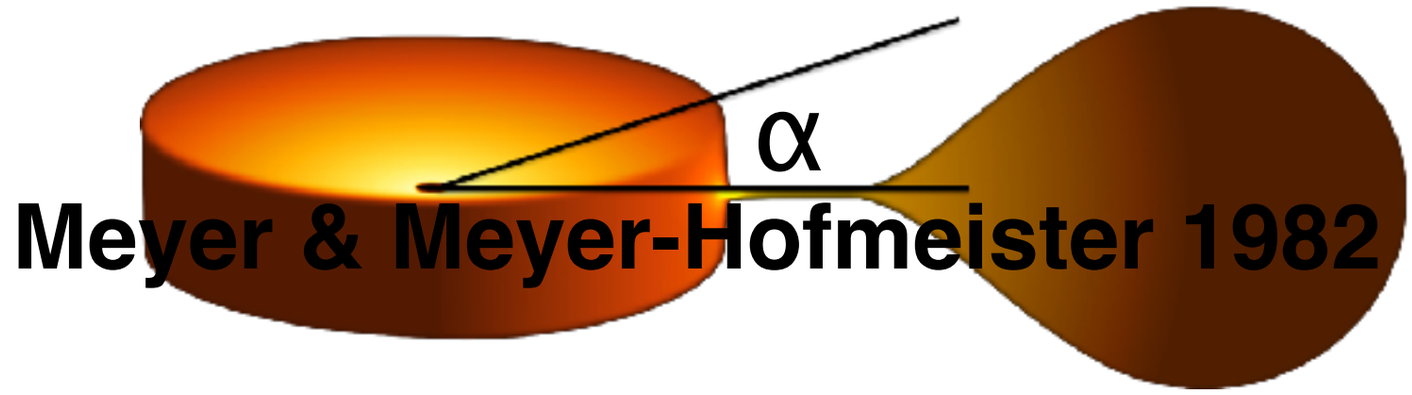


Opening angle



+ No X-ray heating $\alpha \sim 6$ deg

+ X-ray heating $\alpha \sim 18—22$ deg

$$\alpha = 15.5^{\circ}{}^{+2.5}_{-5}$$

Conclusions

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We measured opening angle of the accretion disc from empirical methods for the very first time

Monte Carlo technique allow us to give a robust estimate of the error.

Our result consistent with an irradiation-driven thick disc

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Thanks for the attention !