

NGC 1624-2: anomaly or archetype?

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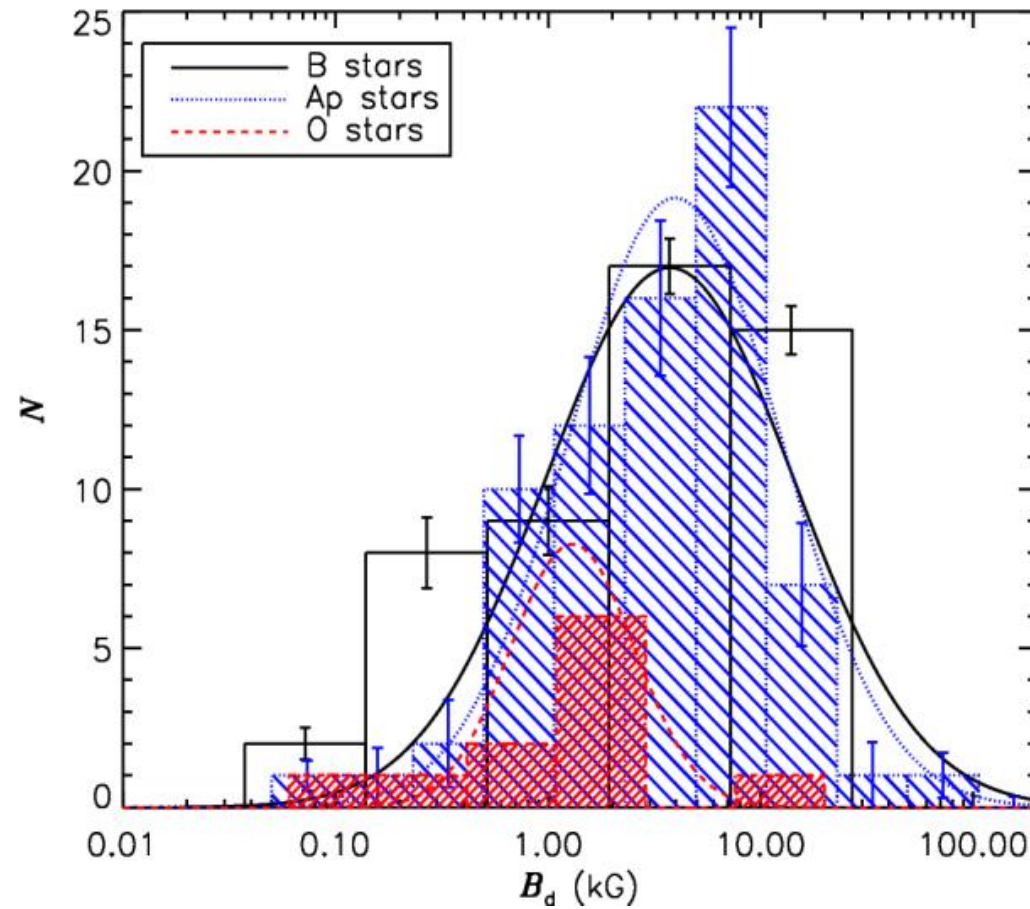
San Carlos de Bariloche, November 5th 2018

Magnetic fields in massive stars

What we know:

- They exist
- They affect stellar structure, evolution, rotation and mass loss
- We have some vague idea about their distribution and certain interesting features

Magnetic fields in massive stars



Adapted from Shultz 2016 (PhD Thesis)

Magnetic fields in massive stars

What we don't know:

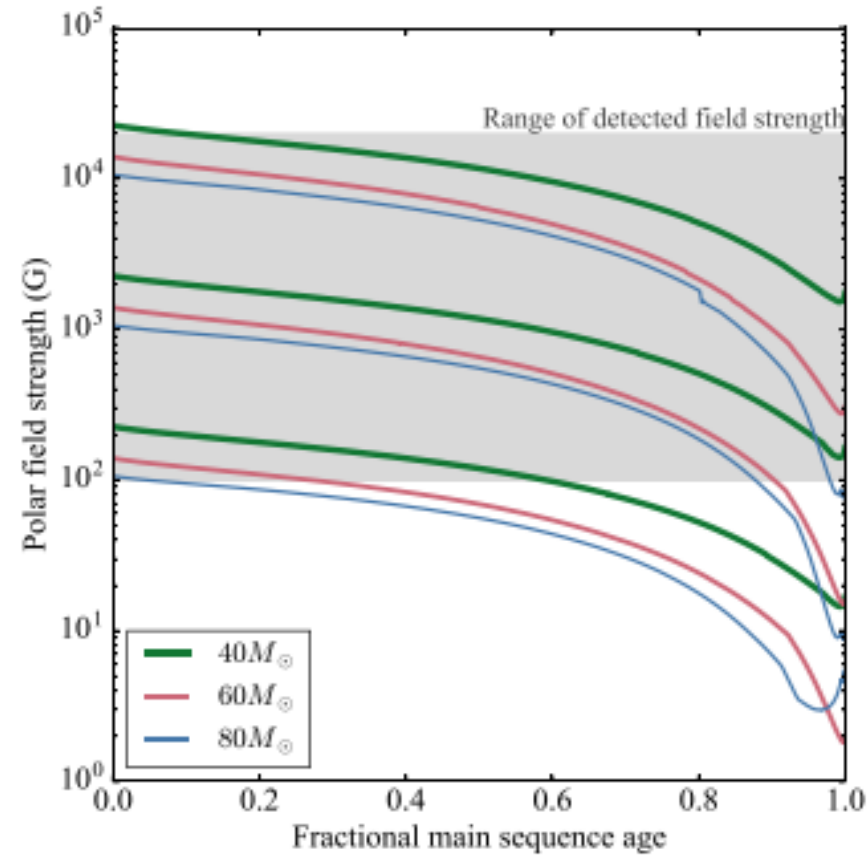
- Mostly everything!

Magnetic fields in massive stars

What we don't know:

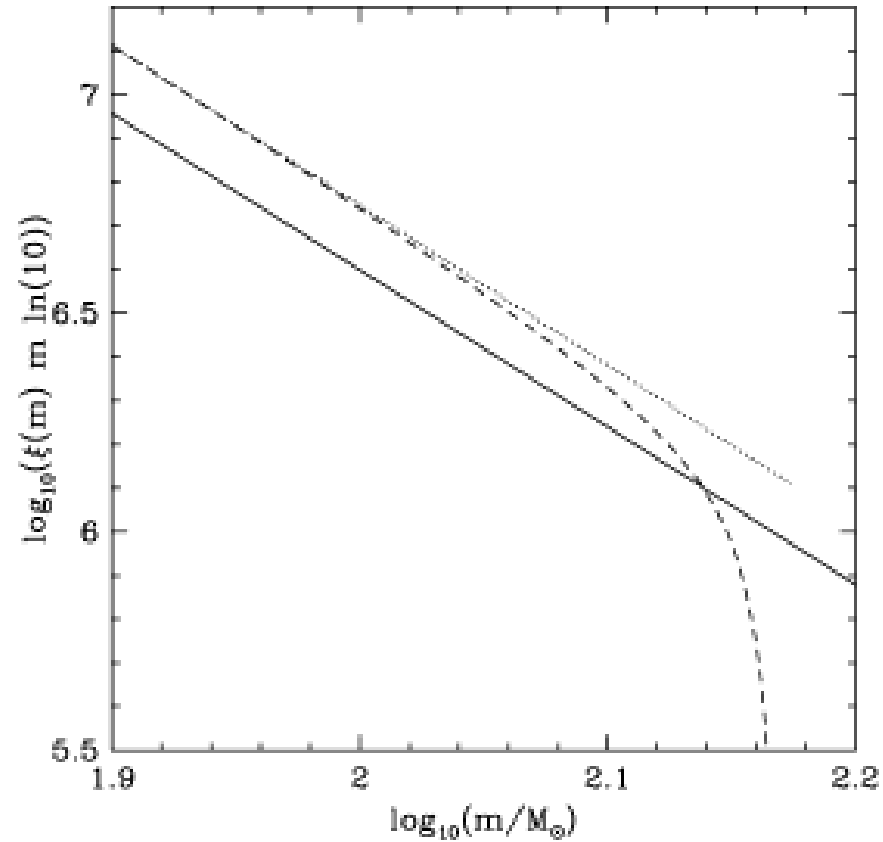
- Formation mechanism
- Subsequent evolution (is the flux conserved?)
- Is there an upper limit to the initial magnetic field?

Magnetic field evolution



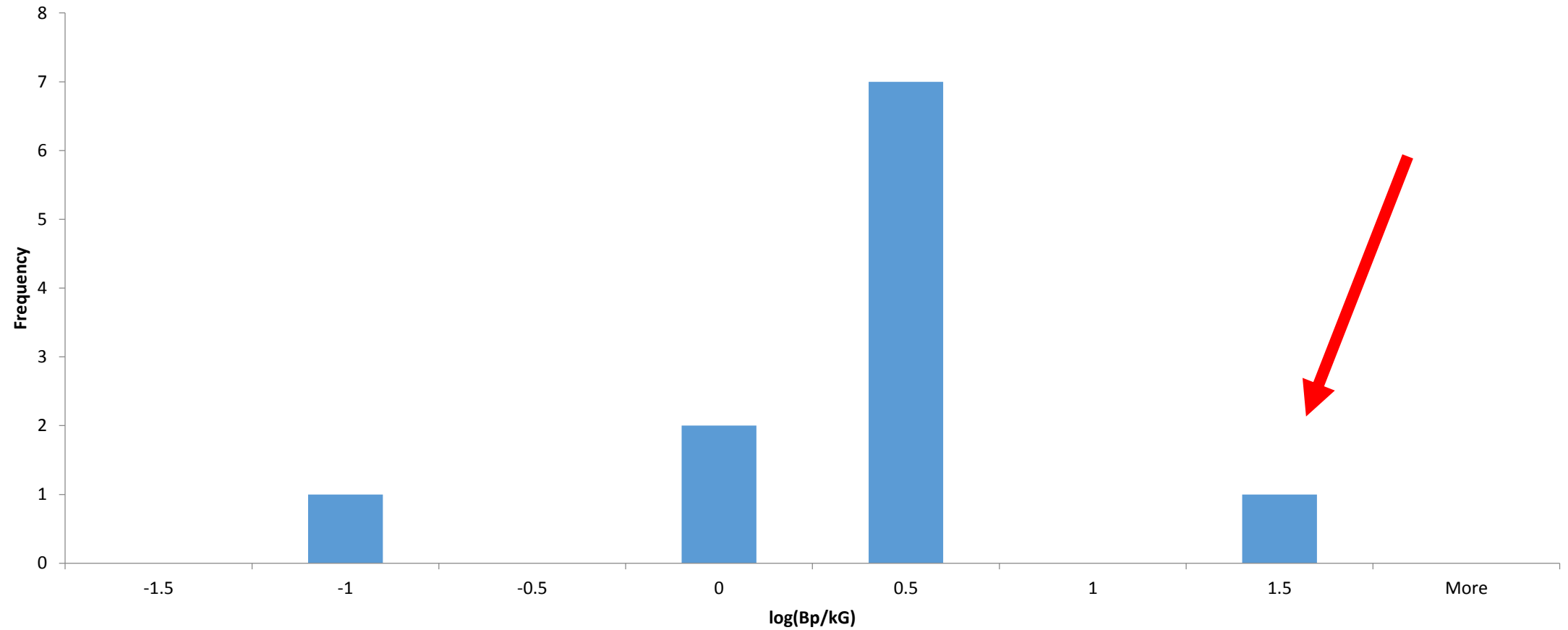
Petit et al., 2017

Upper limit to initial magnetic field function?



Weidner & Kroupka, 2004

Magnetic field strengths in O stars



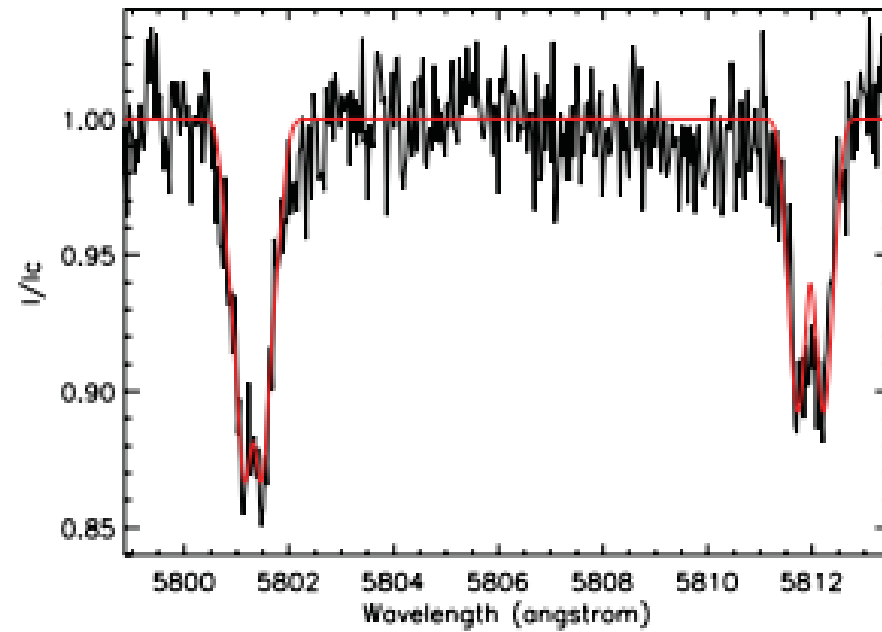
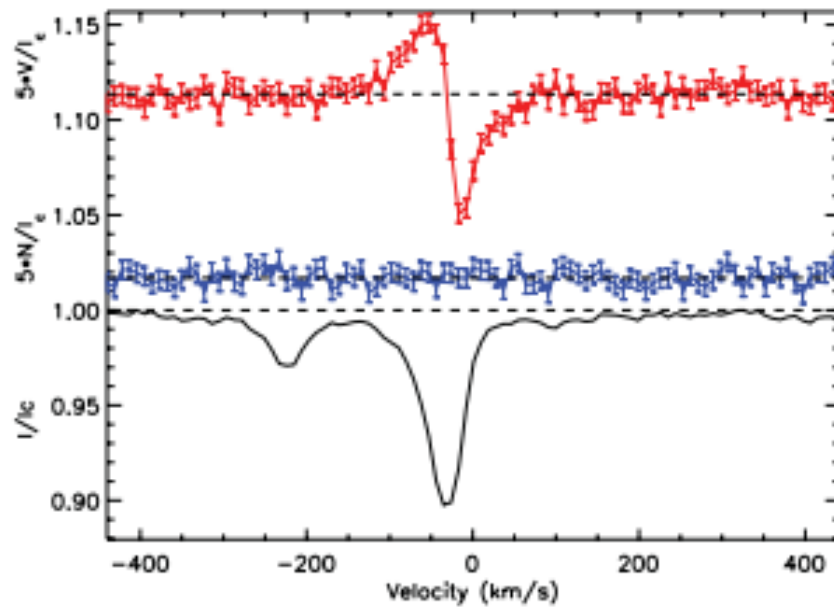
NGC 1624-2



Walborn et al., 2010

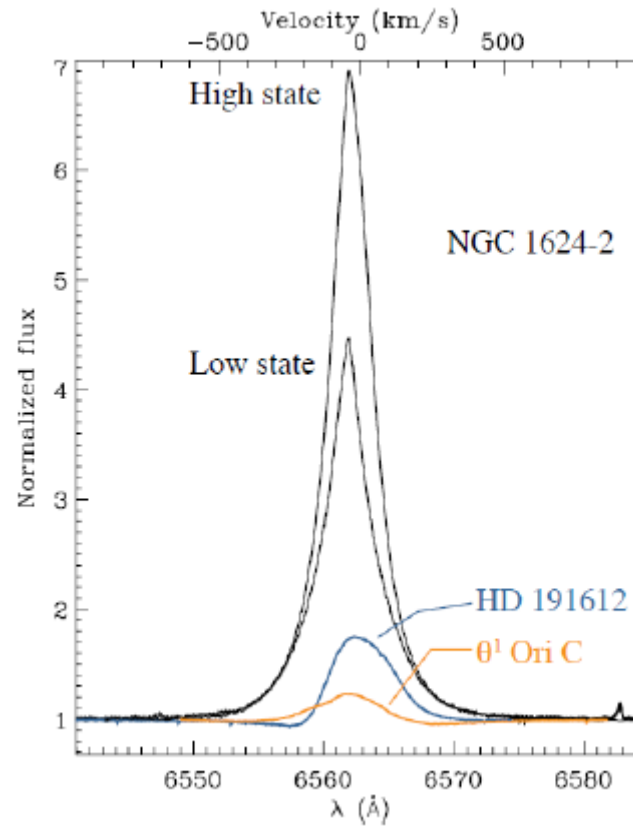
- Spectral type: O7f?p
- Most strongly magnetized O-type star ($B_p \sim 20$ kG, Wade et al. 2012)
- $P_{\text{rot}} = 157.99$ d
- Magnetic field can be diagnosed through a variety of observational diagnostics

NGC 1624-2 – Spectropolarimetry



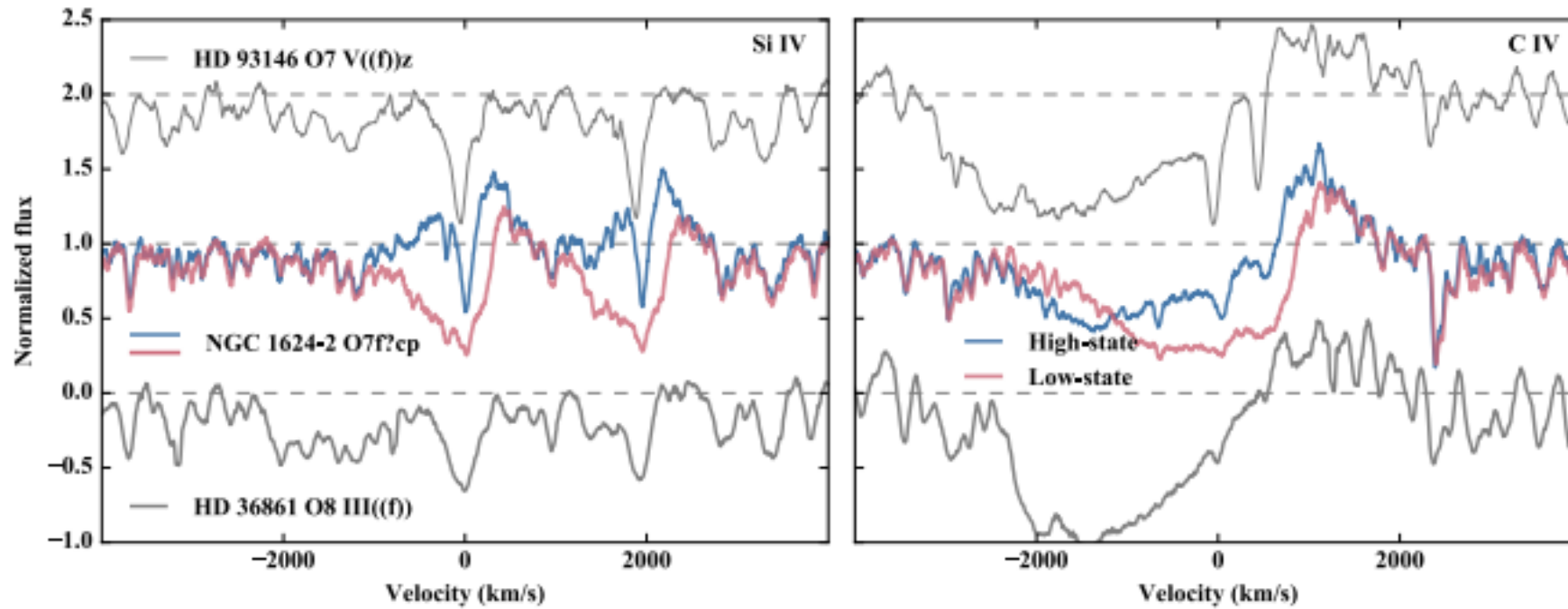
Wade et al., 2012

NGC 1624-2 – H α emission



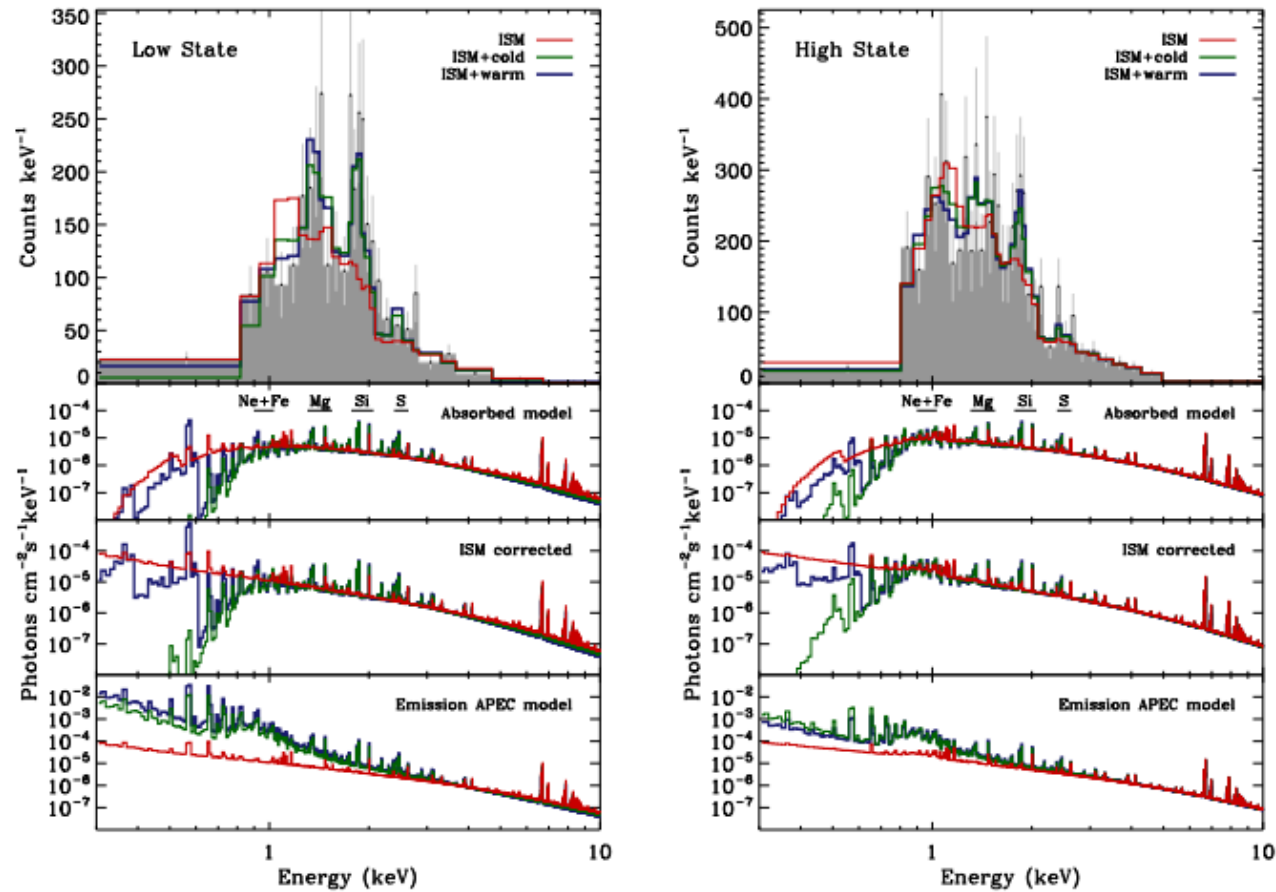
Adapted from Wade et al., 2012

NGC 1624-2 – UV resonance lines



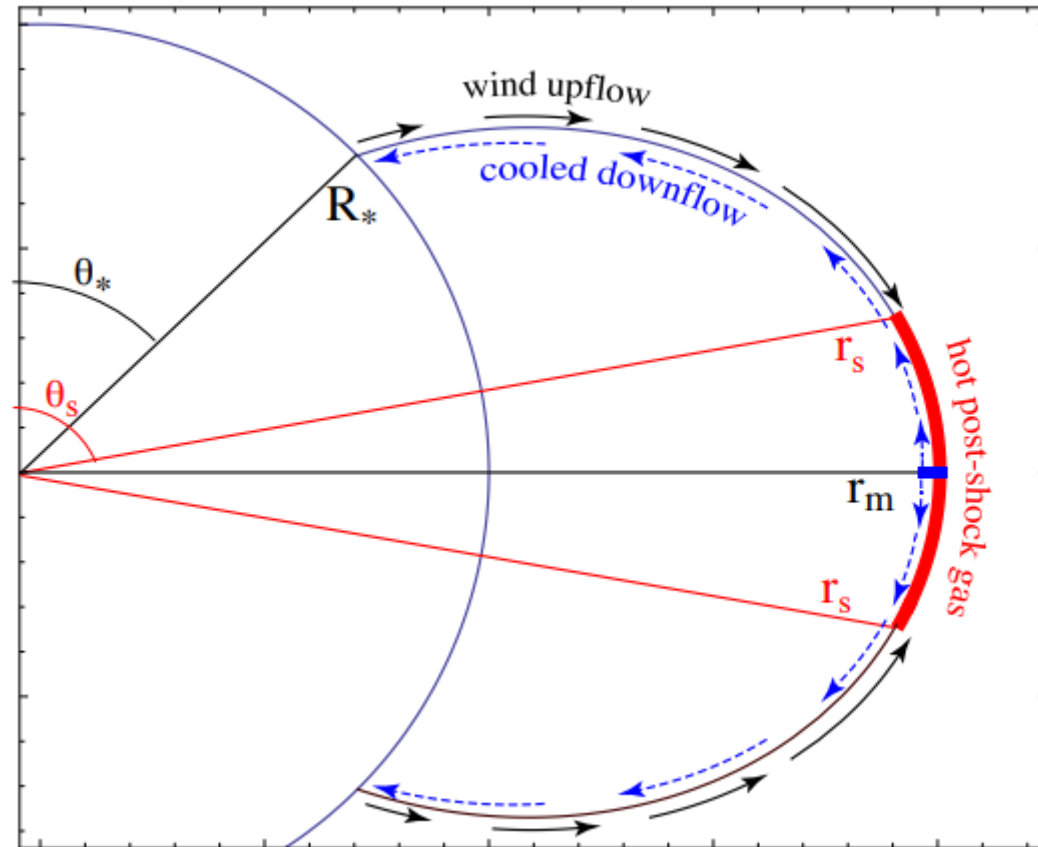
David-Uraz et al., subm.

NGC 1624-2 – X-ray



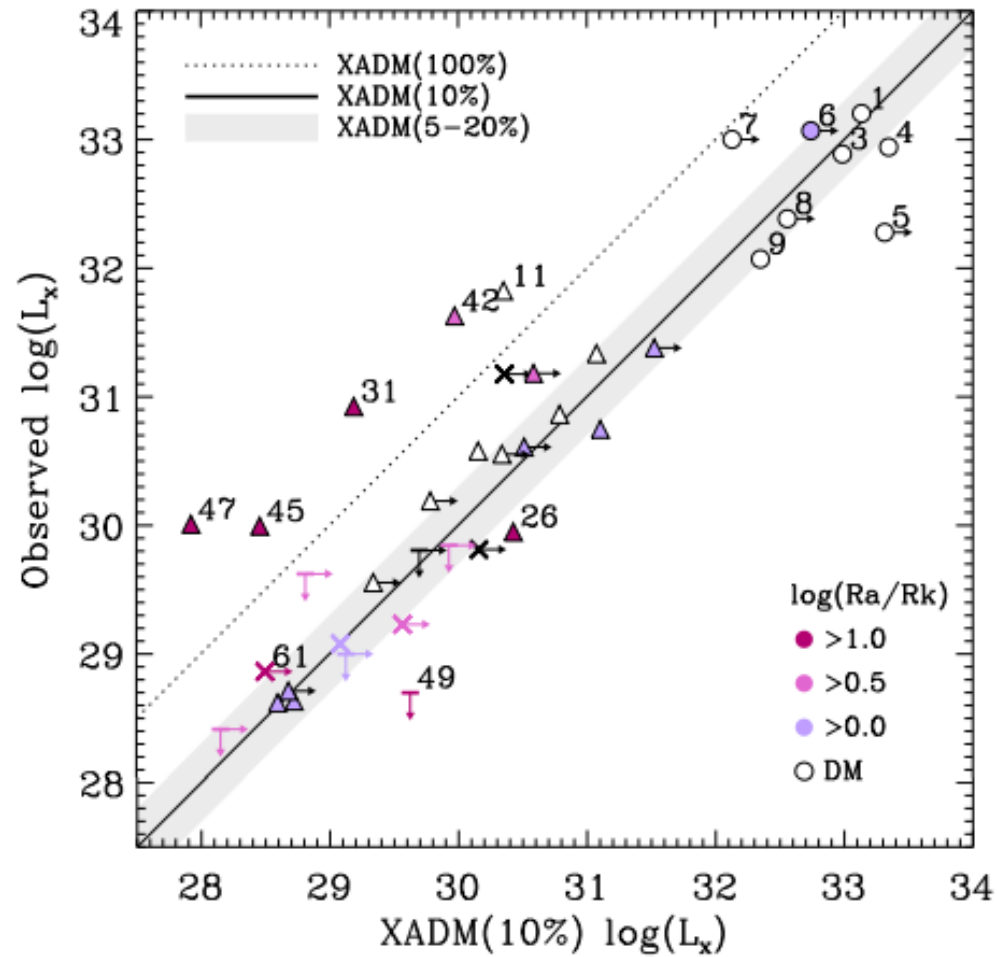
Petit et al., 2015

Analytic Dynamical Magnetosphere model



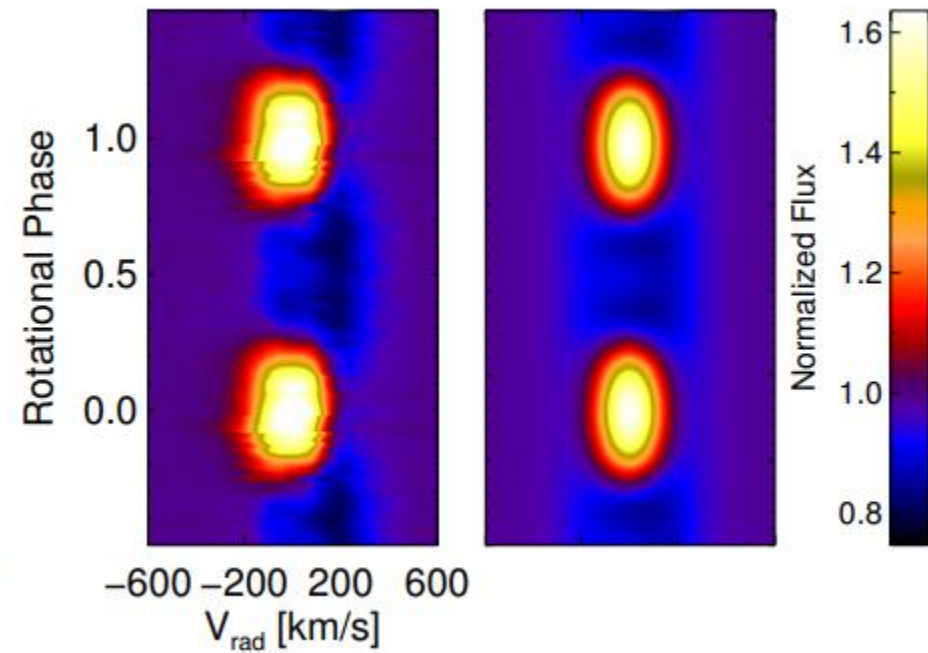
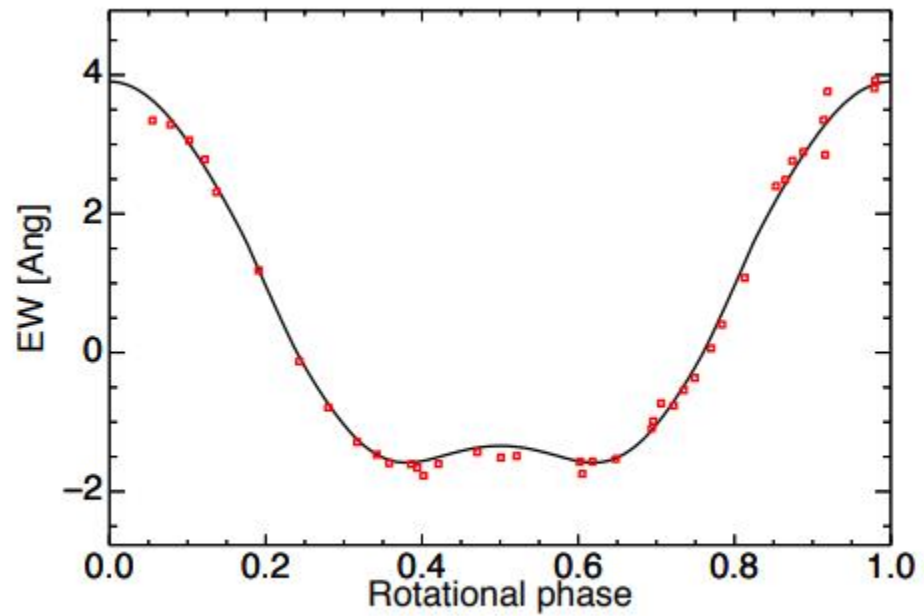
Owocki et al., 2016

ADM predictions



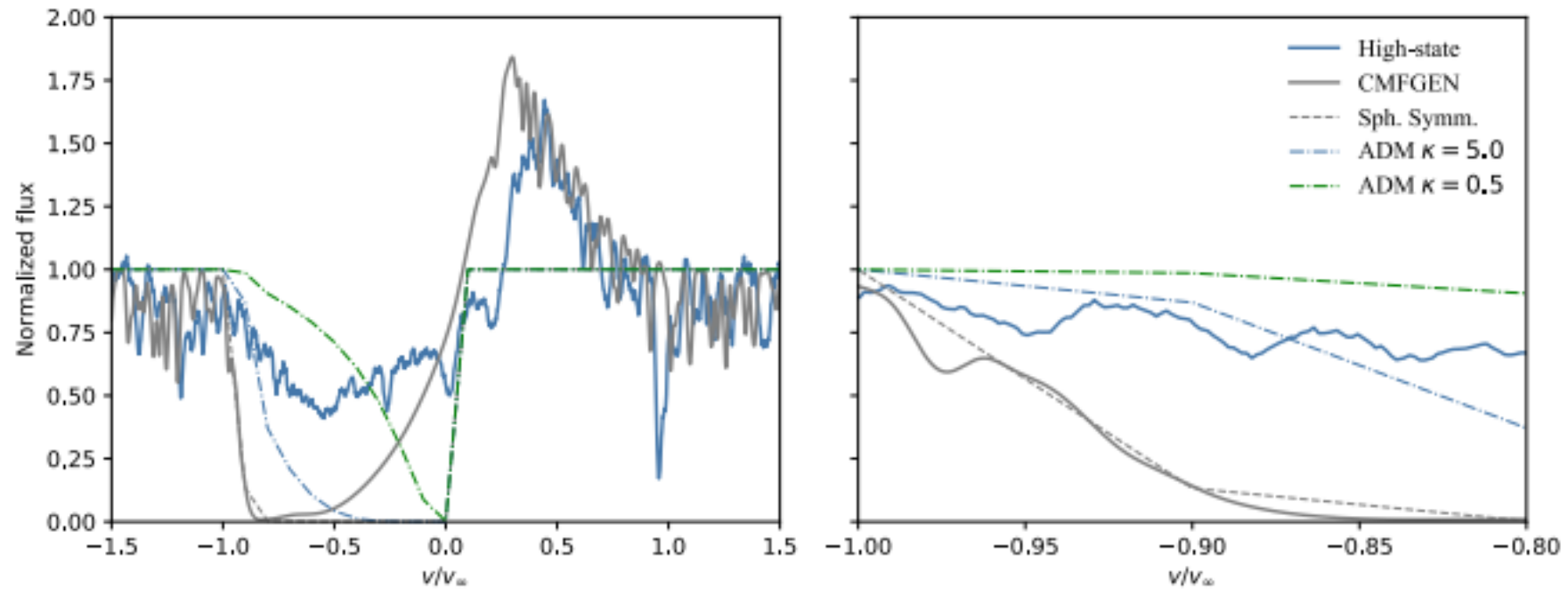
Nazé et al., 2014

ADM predictions



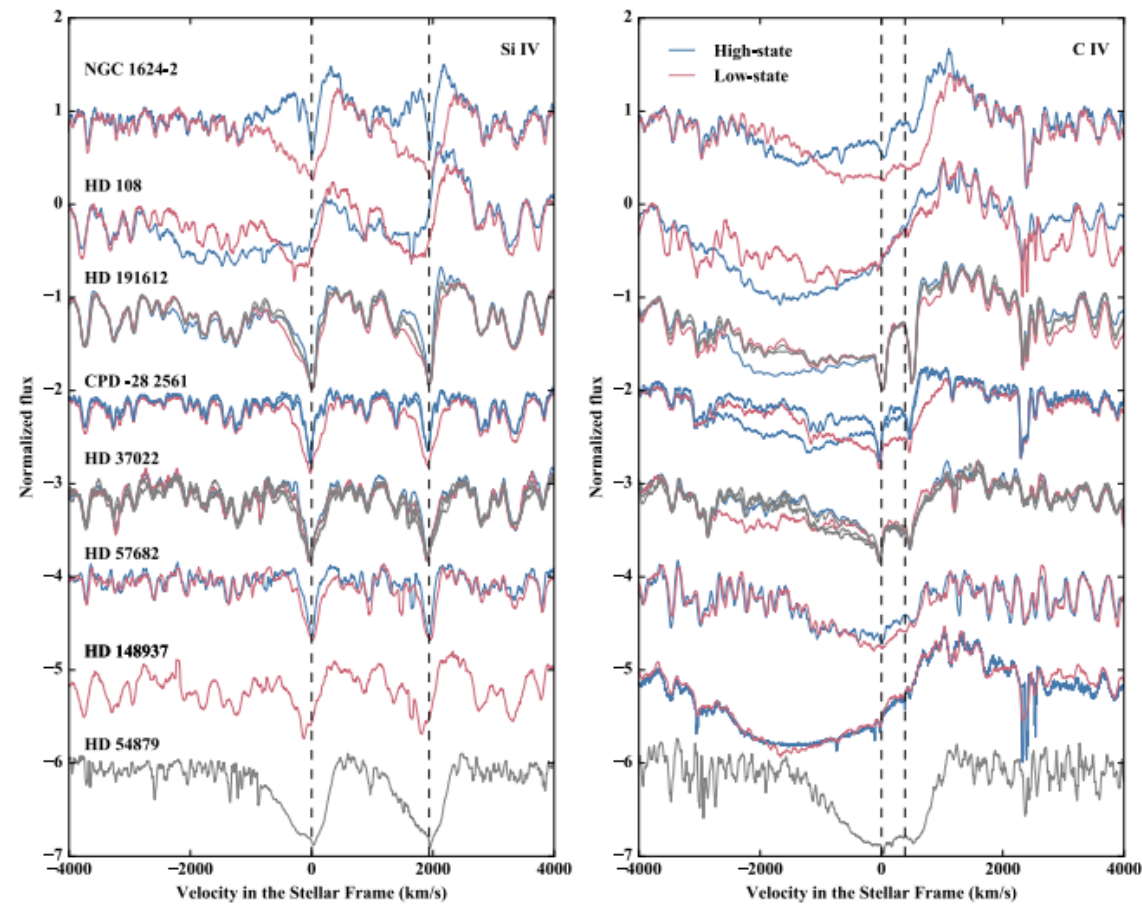
Owocki et al., 2016

ADM predictions



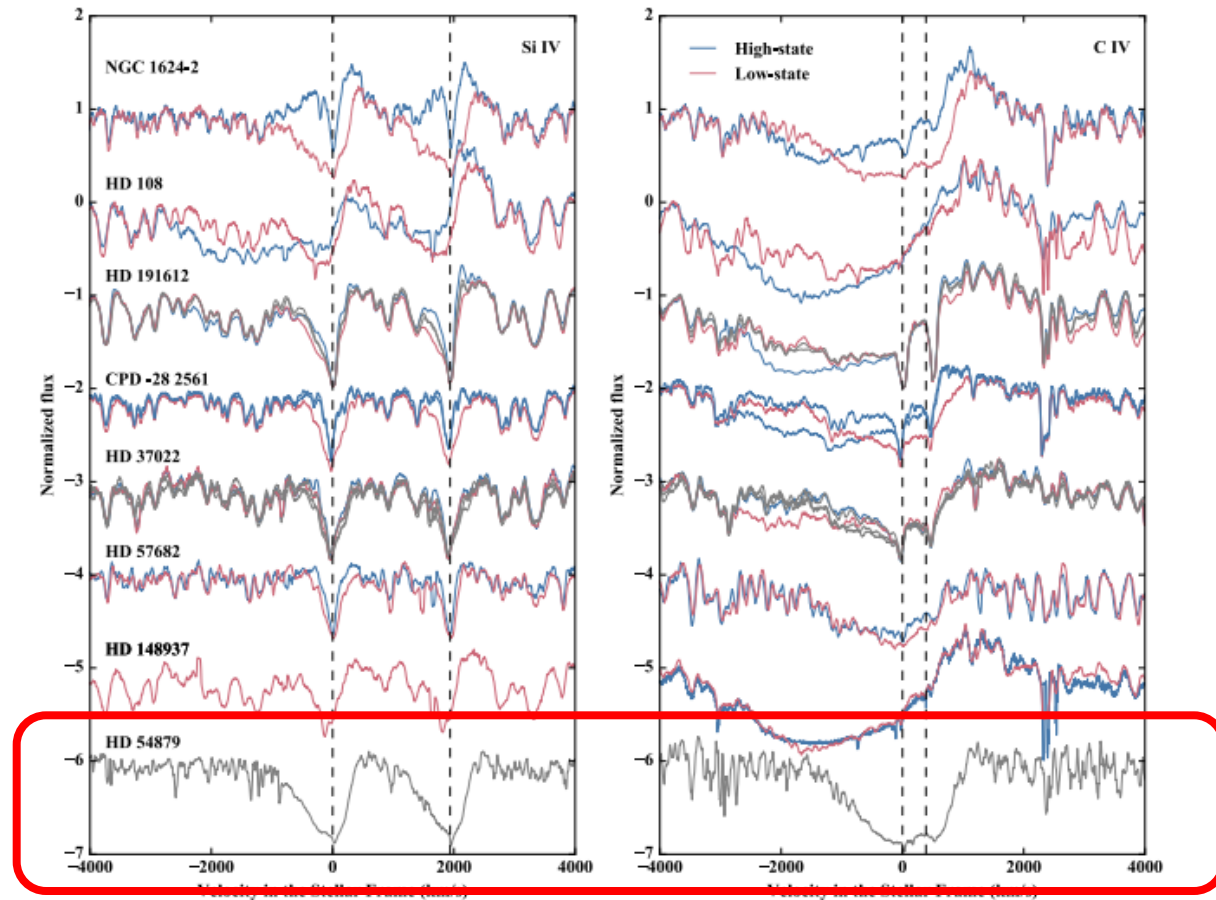
David-Uraz et al., subm.

NGC 1624-2 analogue candidates?



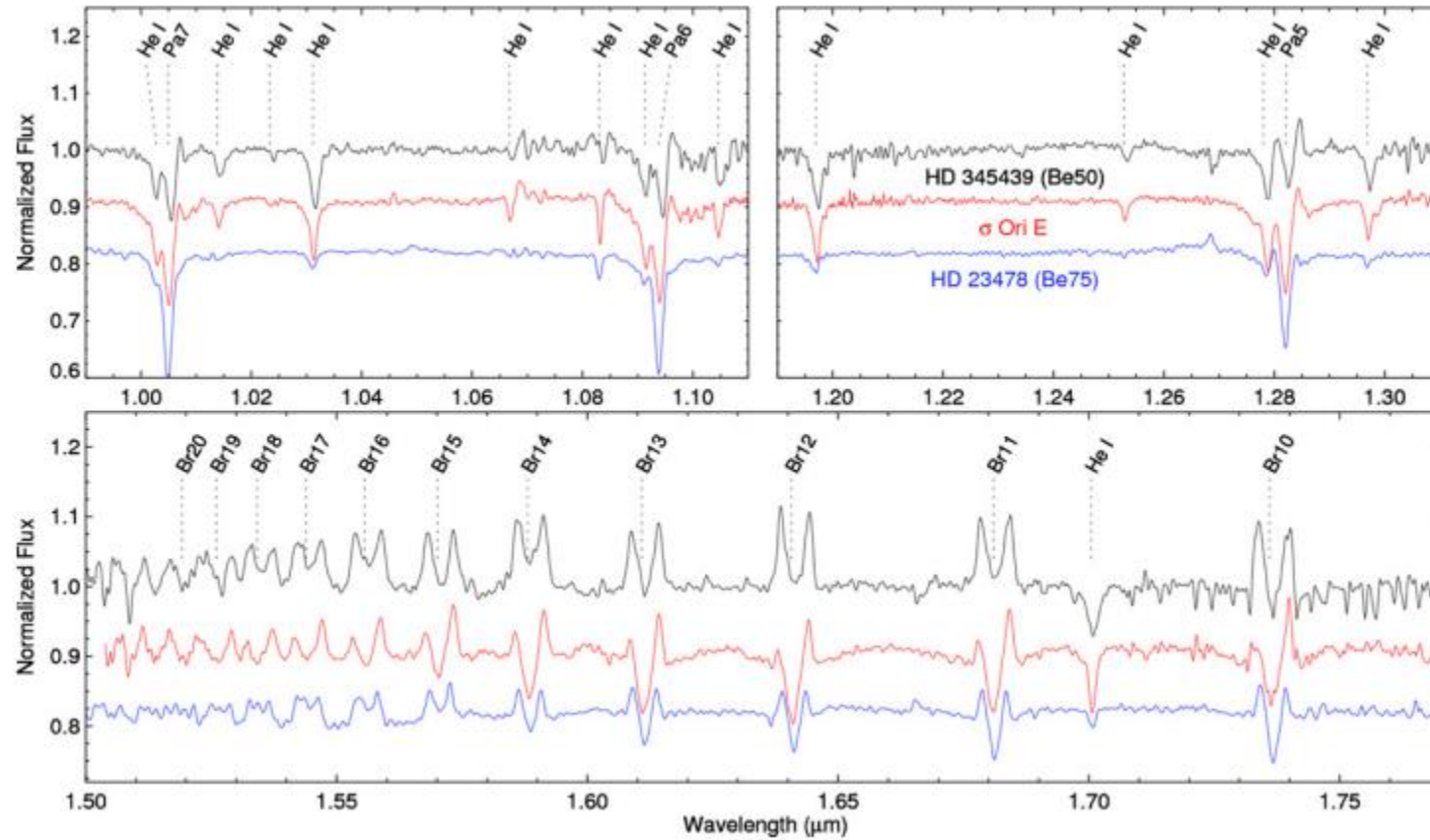
David-Uraz et al., subm.

NGC 1624-2 analogue candidates?



David-Uraz et al., subm.

Infrared diagnostics?



Eikenberry et al., 2014

Conclusions

- Constraining the upper limit of the initial magnetic field distribution will allow us to better understand the formation and evolution of these fields
- Using a vast array of indirect diagnostics (optical/IR/UV/X-rays), and testing them against theoretical predictions, might prove critical to discover an analogue to NGC 1624-2
- Some currently known magnetic O stars only have lower limits on their field strengths (e.g., HD 54879)

Thank you!



Thank you!

