

UV Spectroscopy of Tidal Disruption Events

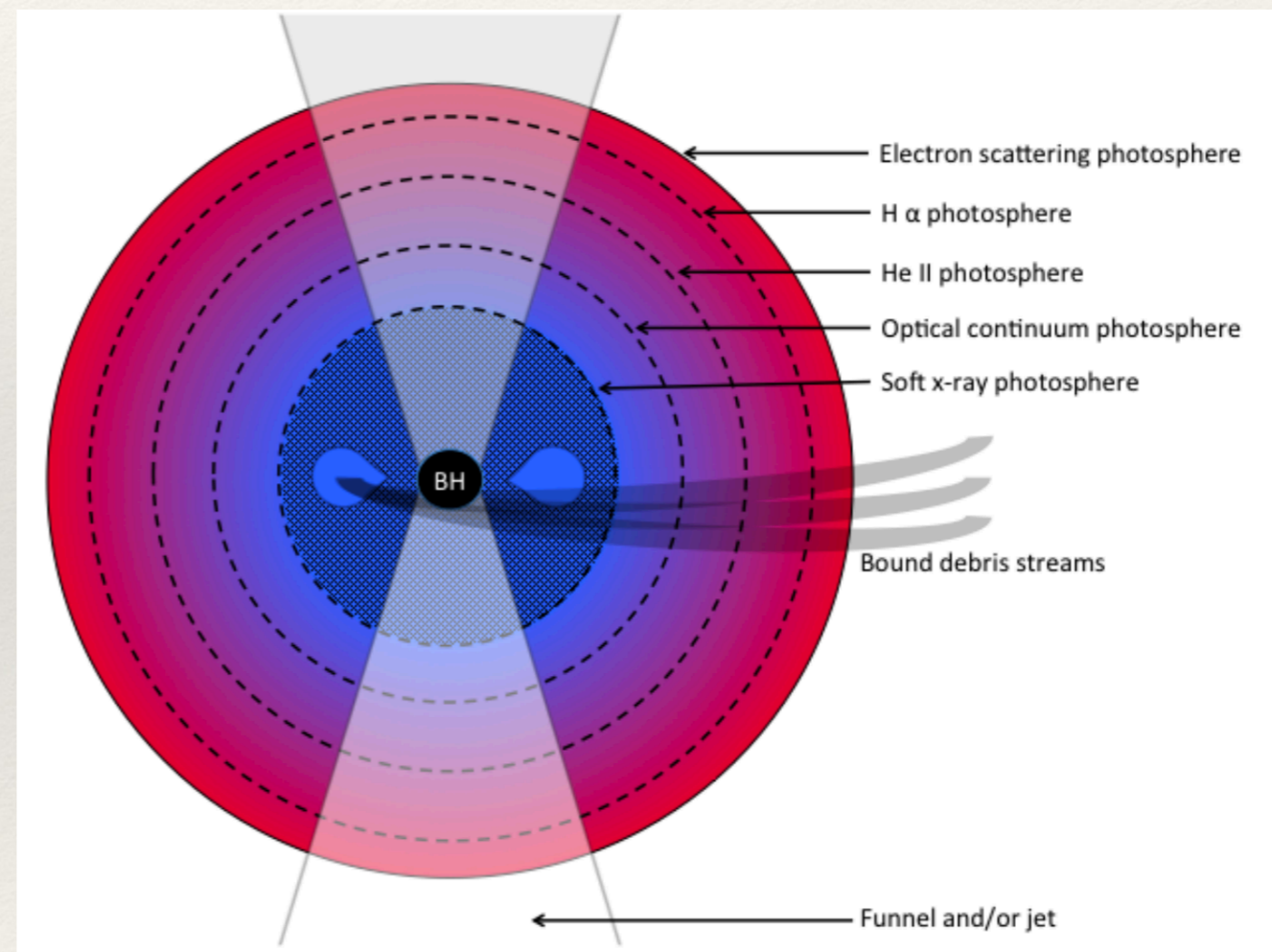
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UVEX Community Workshop
15 March 2023

Observational Puzzles

- ❖ Low (and slowly evolving) temperature in optical/UV discovered TDEs
- ❖ Ubiquity of outflows (variety of velocities)
- ❖ Peculiar abundance patterns in optical (and particularly UV) spectroscopy

Possible Explanations: Circularization and Reprocessing

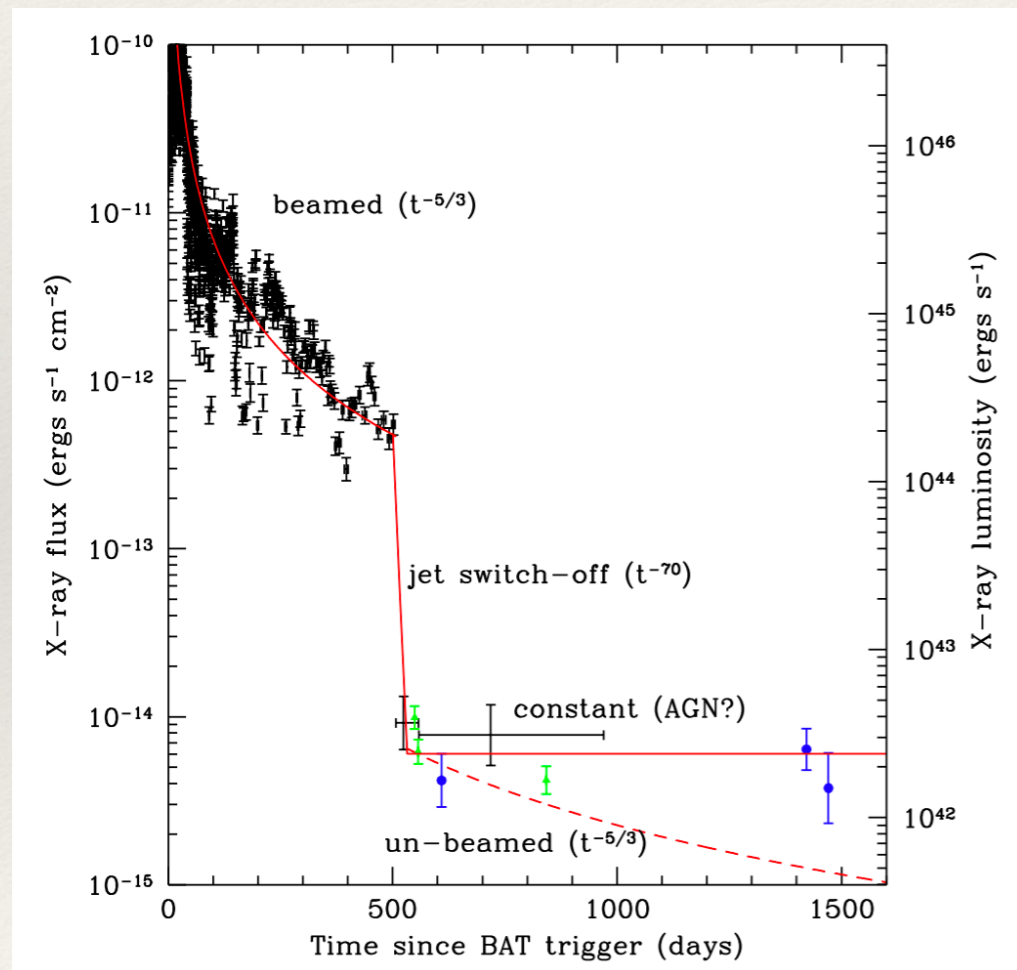
- ❖ 1. Efficient circularization at large radii (due to relativistic precession) leads directly to emission at these distances
- ❖ 2. Reprocessing of inner accretion disk by outer layer of material yields large photosphere



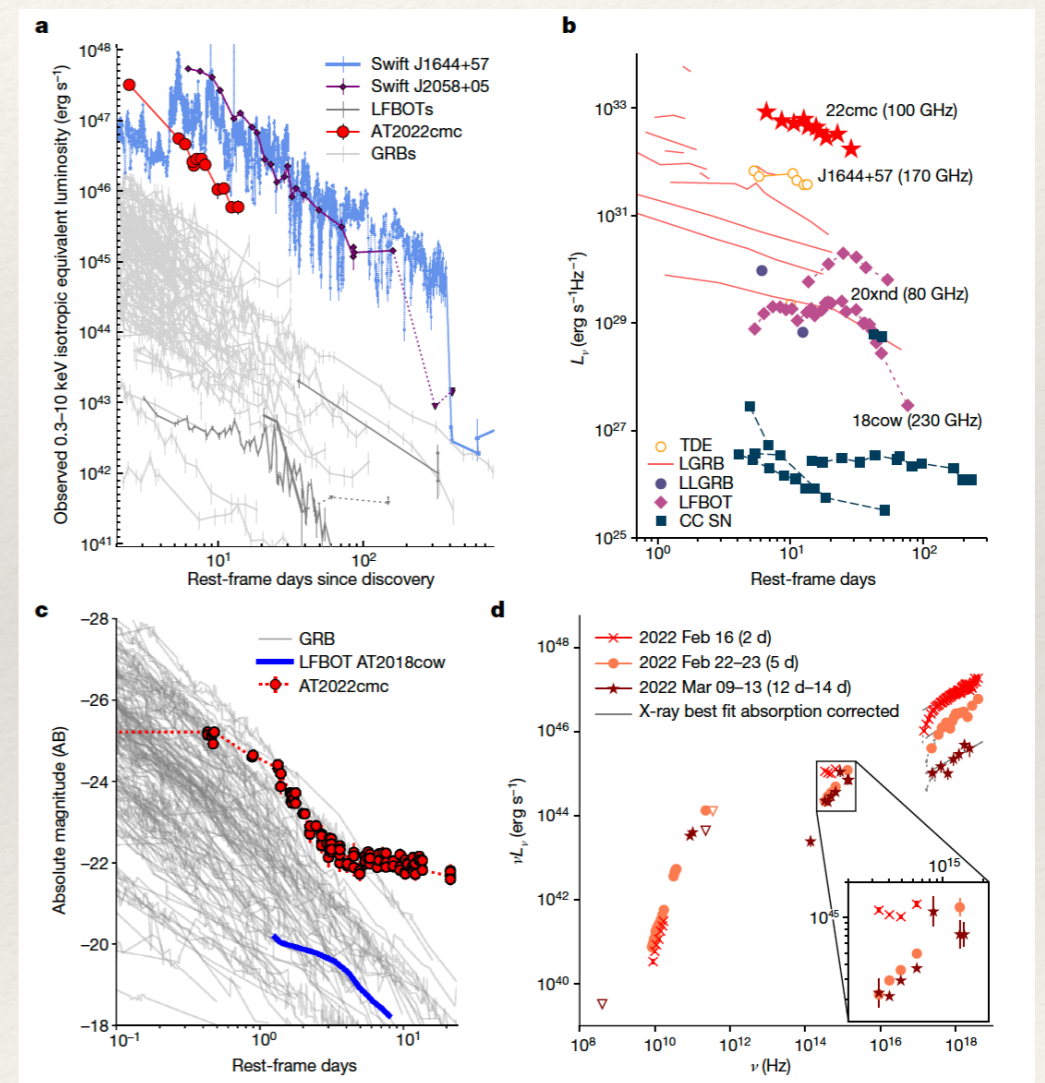
Roth et al., 2016

Outflows I: Relativistic TDFs

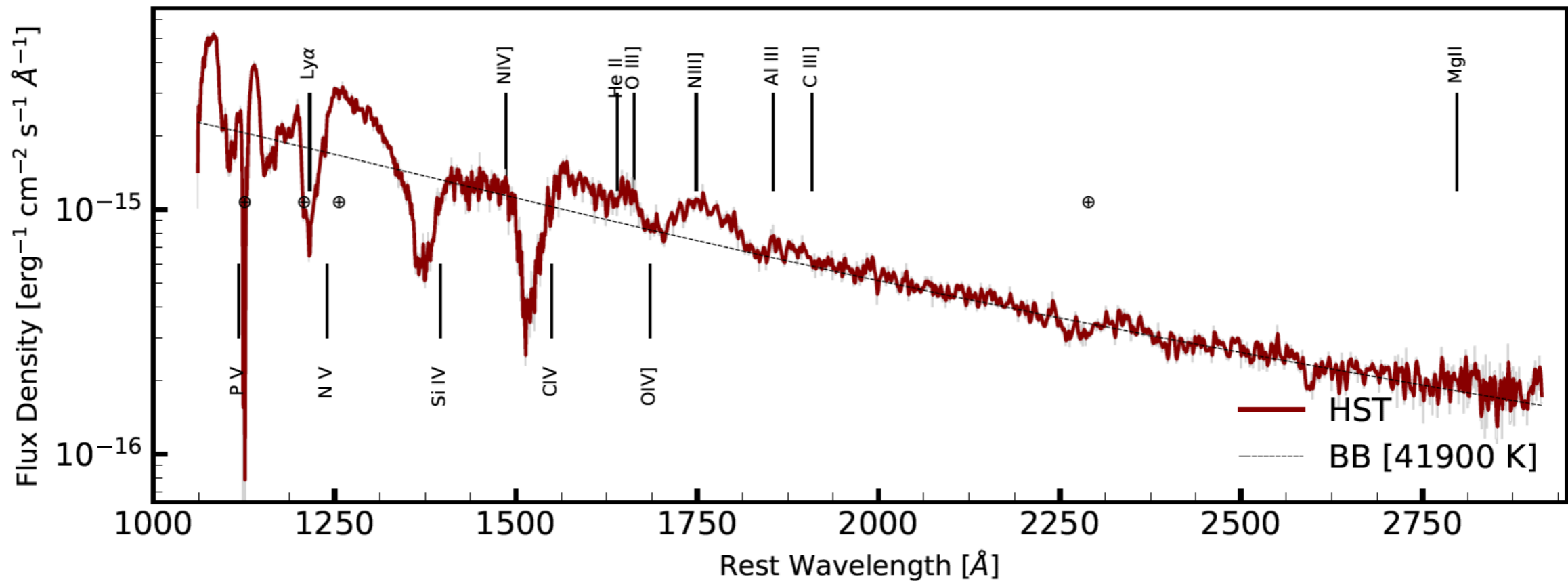
Sw J1644+57



AT 2022cmc



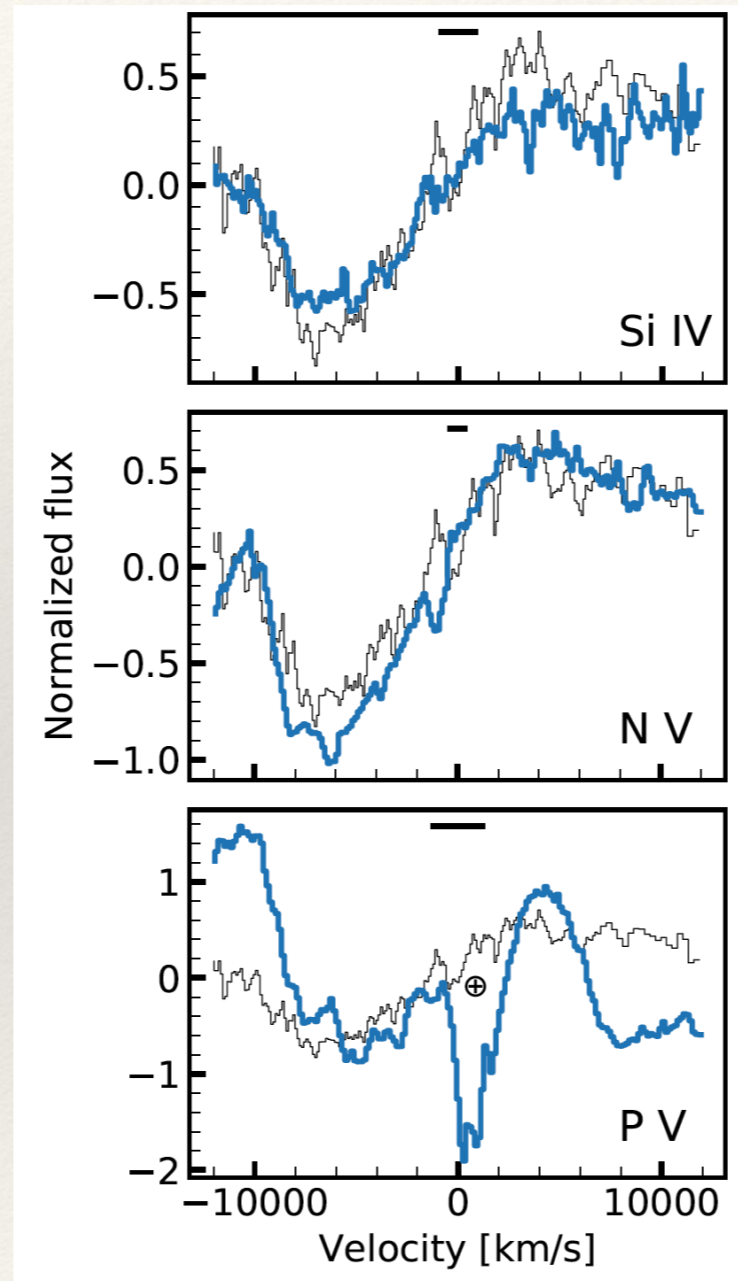
Outflows II: Fast (but not relativistic)



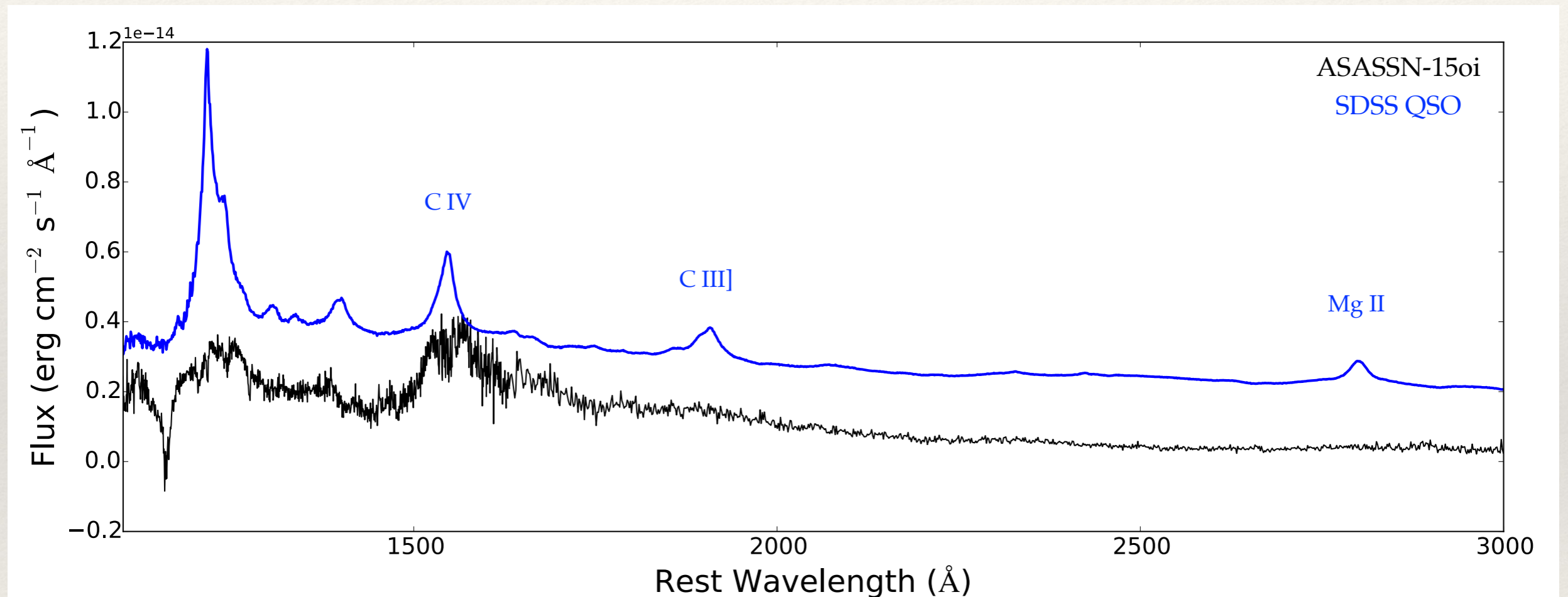
Blagorodnova+ 2018

Broad ($\sim 10000 \text{ km s}$), blue-shifted absorption
of C IV, Si IV, Ly α (?); BAL-QSO like?

Outflows II: Fast (but not relativistic)

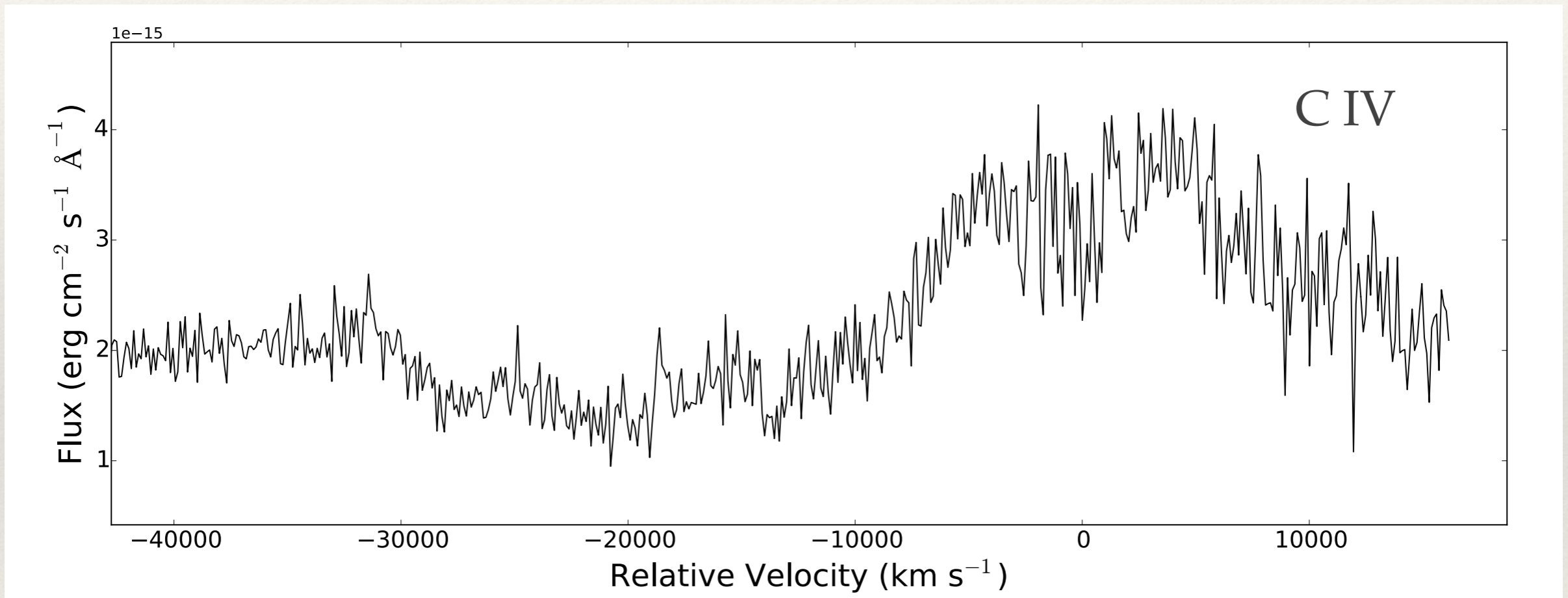


Outflows II: Fast (but not relativistic)



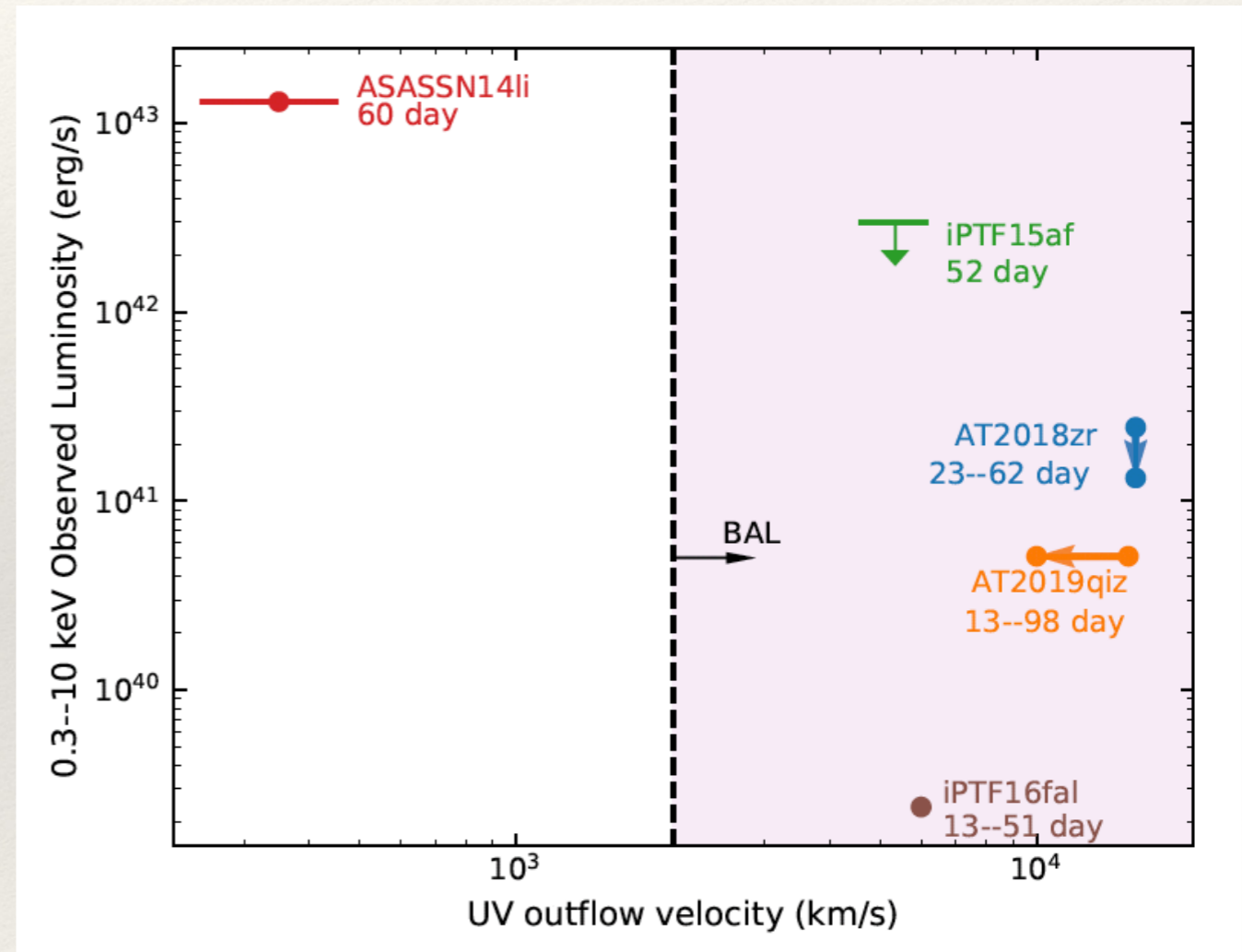
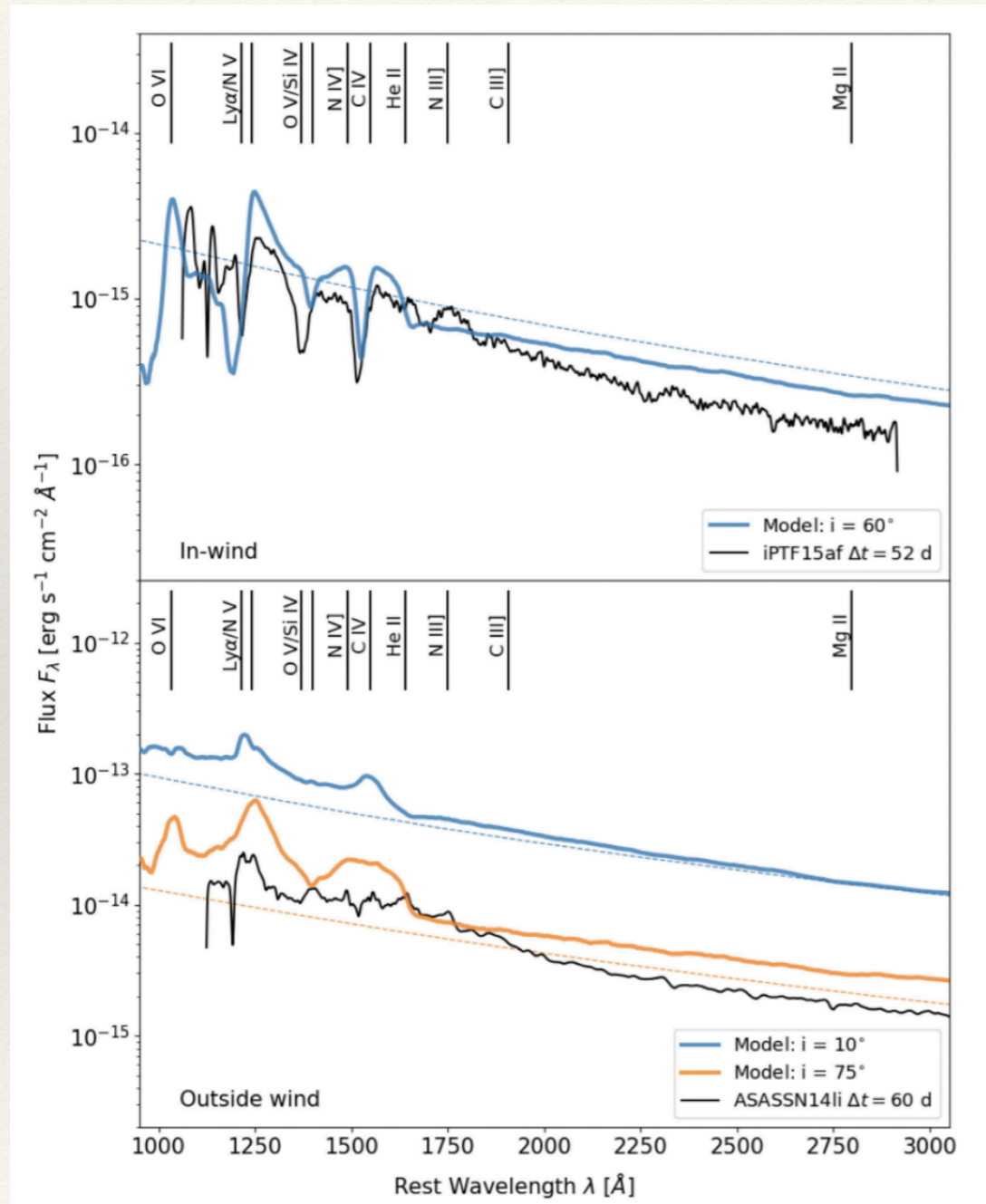
Strong C IV emission, weak Ly-alpha, not many other features

Outflows II: Fast (but not relativistic)



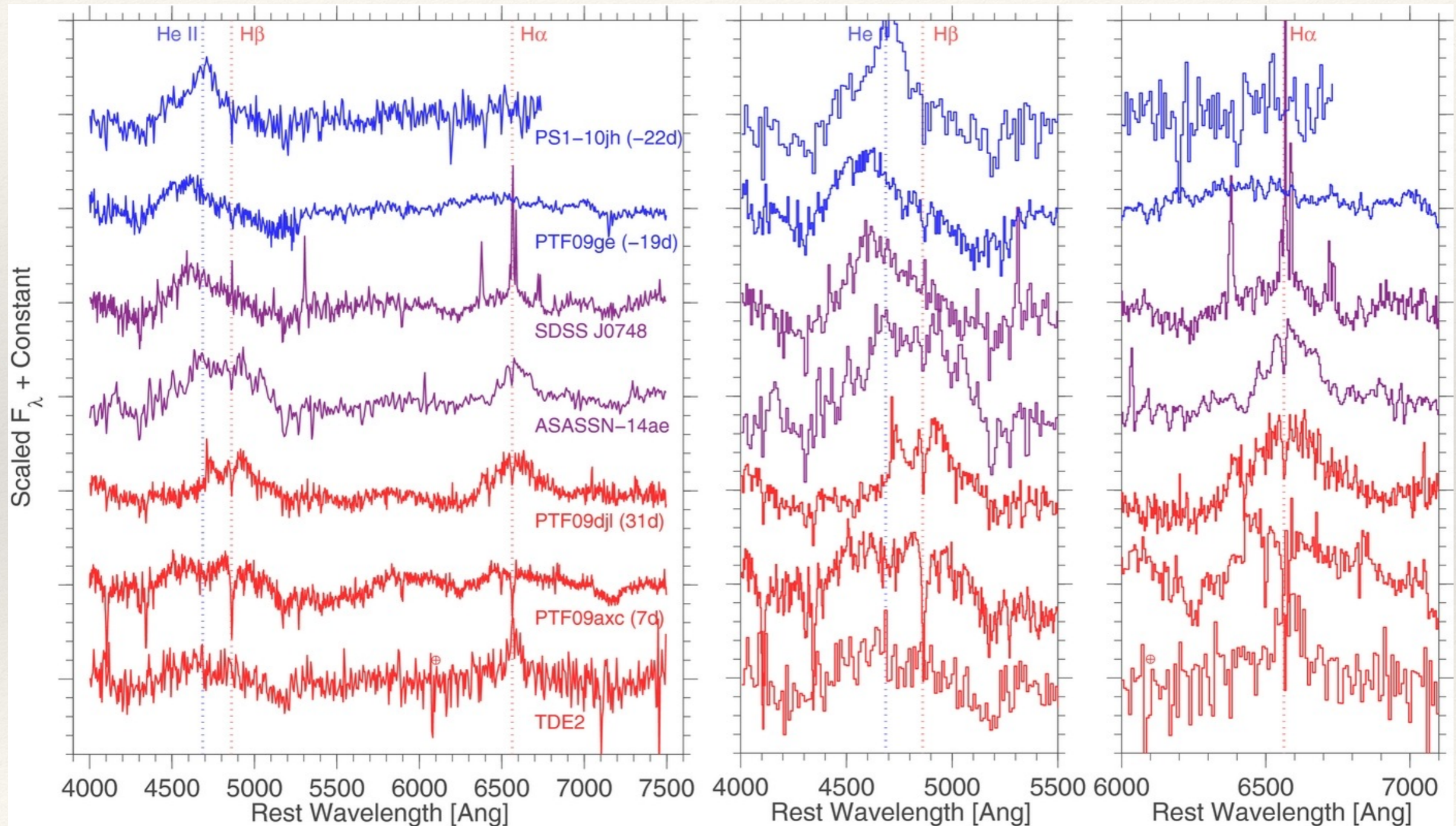
High-velocity ($v \sim 0.3c$), P Cygni / BAL C IV?

Anti-correlation between BAL and L_X

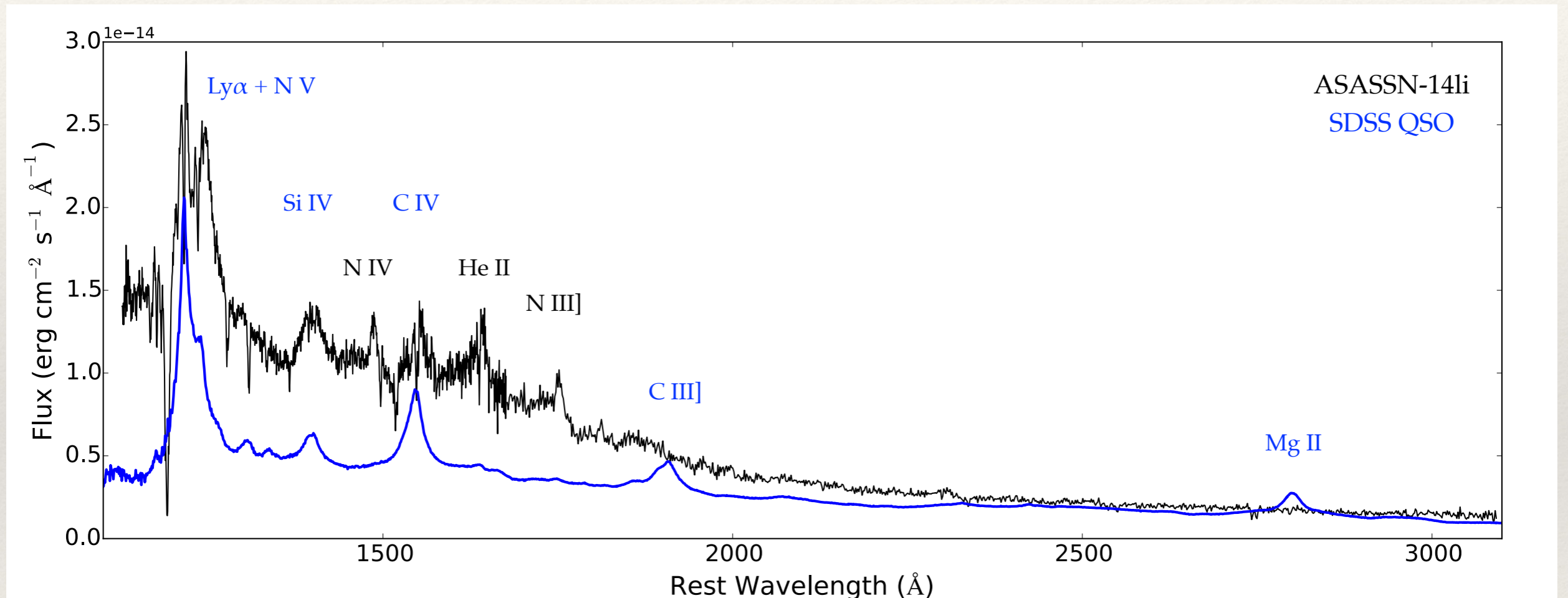


Kulkarni+2021

Variable H-He Ratio in Optical Spectra

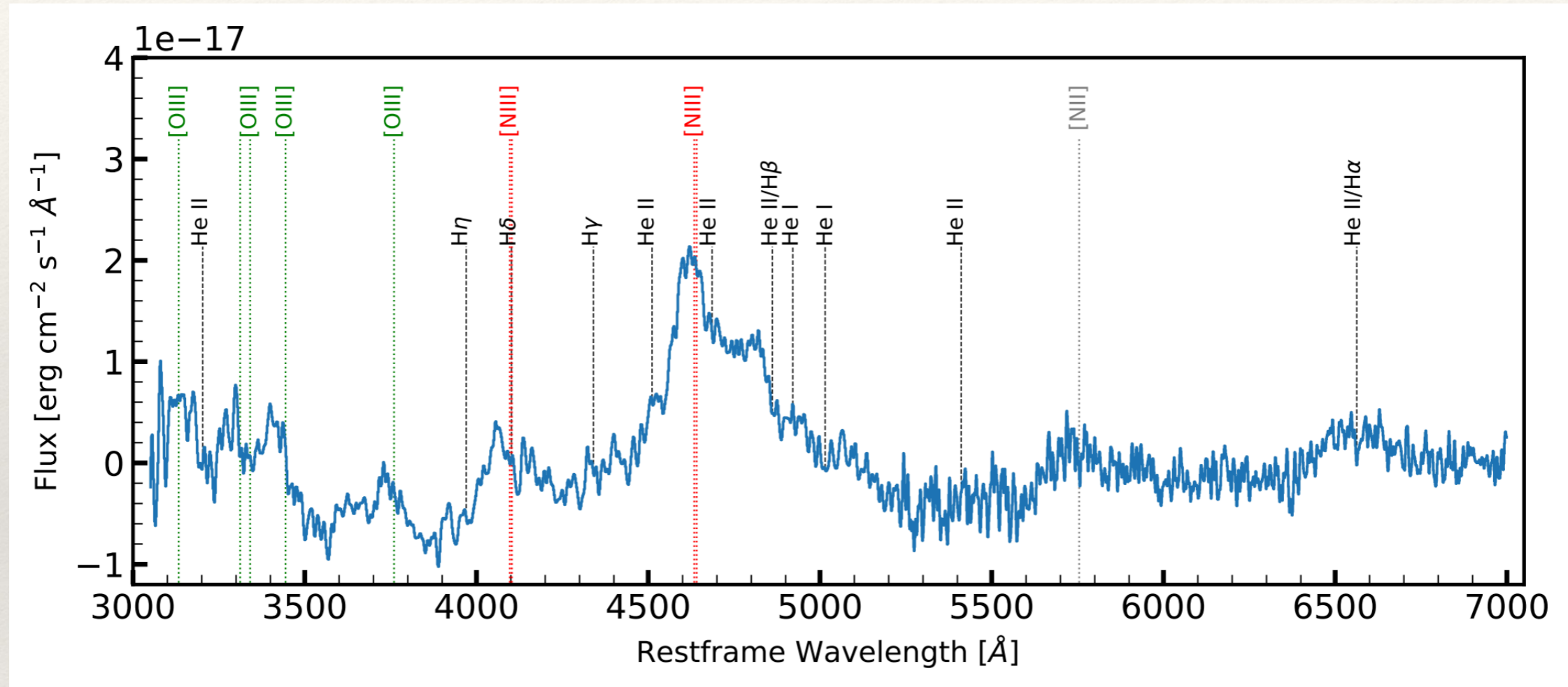


Abundance Patterns: ASASSN-14li



N-rich Quasars: possible TDEs?? N over-abundance due to CNO processing in Sun-like star (Kochanek et al. 2016)

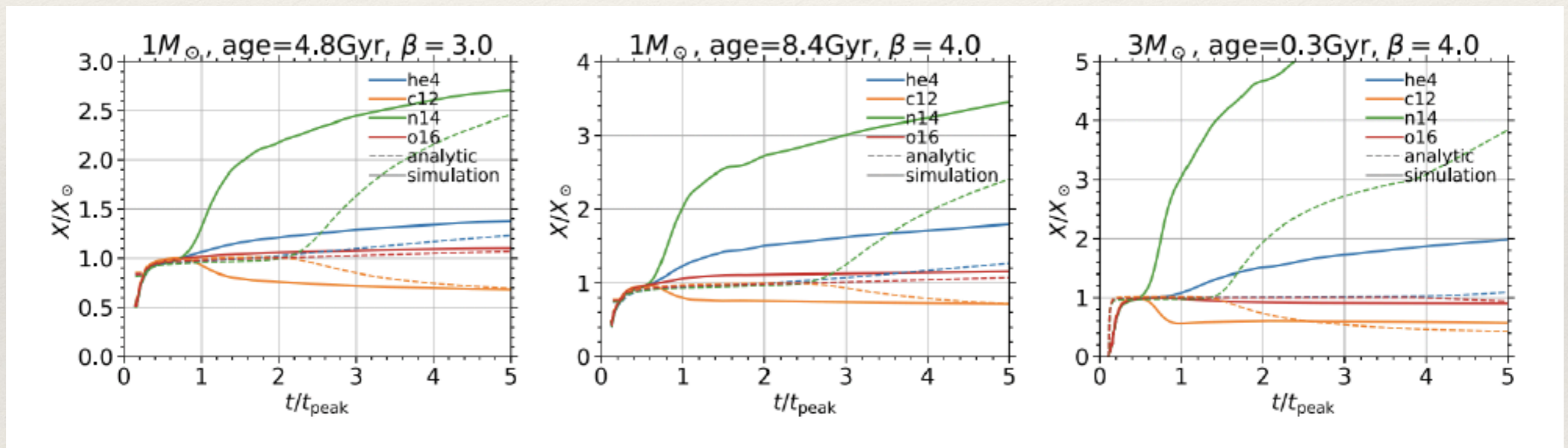
Abundance Patterns: iPTF15af



Blagorodnova+ 2018

Bowen fluorescence lines (like Wolf-Rayet stars) could be contributing to large He II ratio as well!

Spectral Evolution



Law-Smith+2019

C/N ratio should evolve strongly with time, but **need observations before peak!**

Conclusions

- ❖ TDEs are highly complicated systems! We still do not understand
 - ❖ Why is the UV / optical emission seen from TDEs coming from such a large radius?
 - ❖ What dictates the presence / speed of outflowing material in TDEs?
 - ❖ How does the observed abundance pattern relate to physical conditions in the emitting gas?
- ❖ Prompt, regular spectra with UVEX will answer these longstanding questions