Broad Line Variability on Long Timescales

A Complex BLR Response

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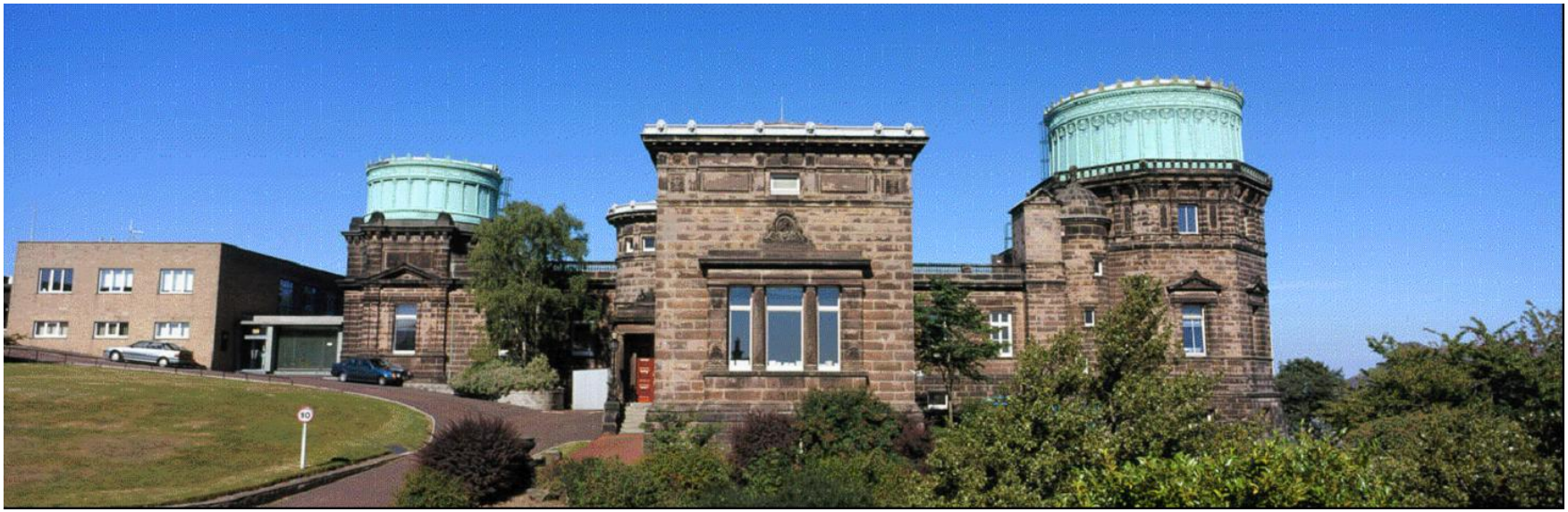
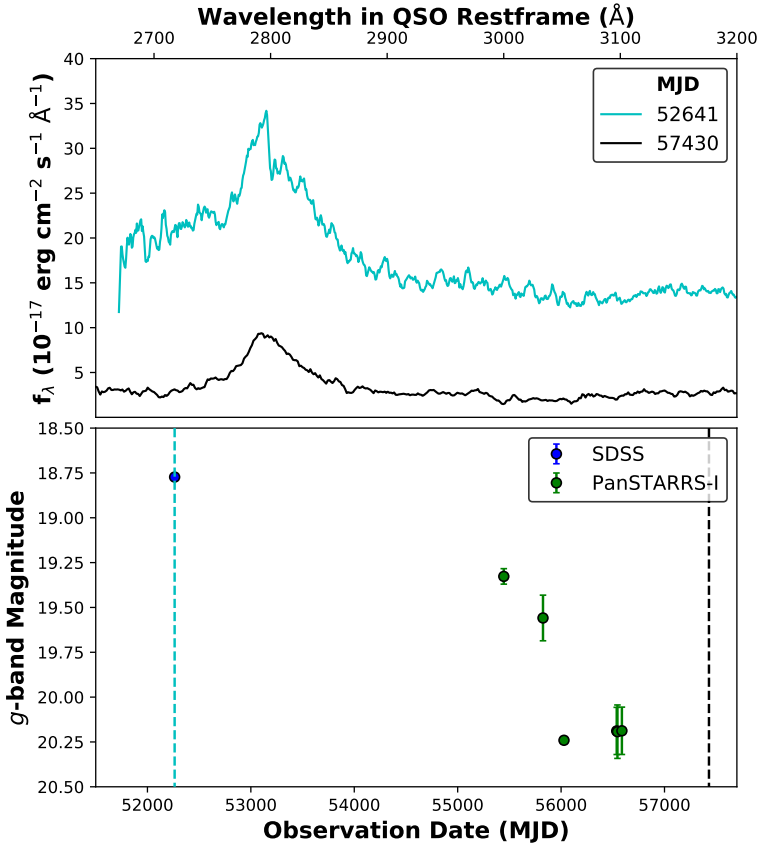


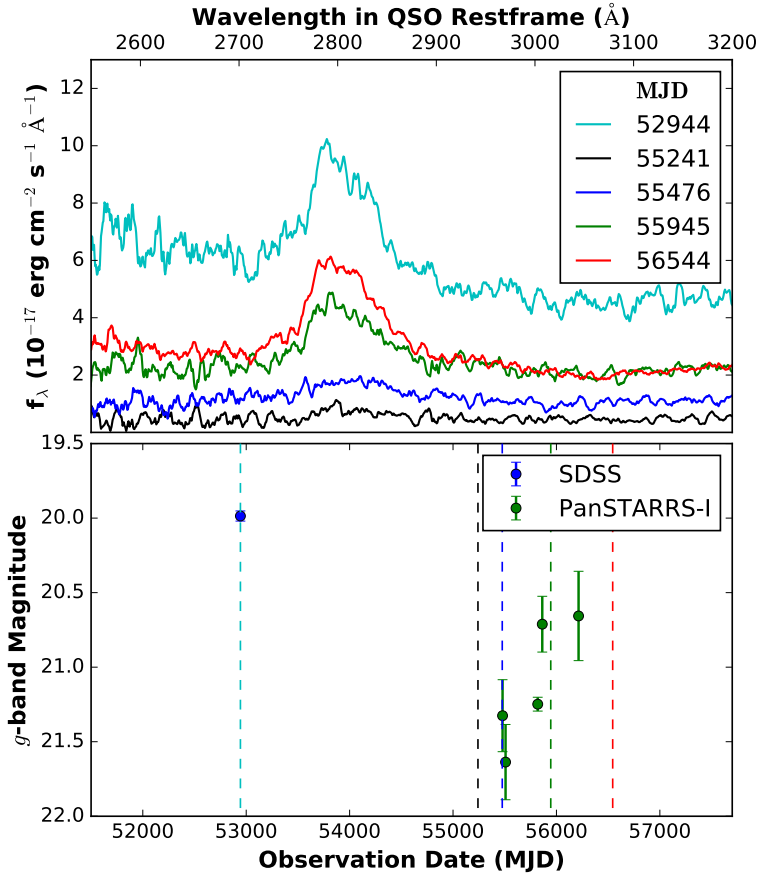
- Collaborators:
  Andy Lawrence, Chelsea MacLeod, Nic Ross, Alastair Bruce, Martin Ward, Hermine Landt
- BLR response to continuum changes
  - MgII 2798Å: variability range
  - Mrk 110: a tracker for the EUV continuum

Different types of MgII behaviour

J224829:

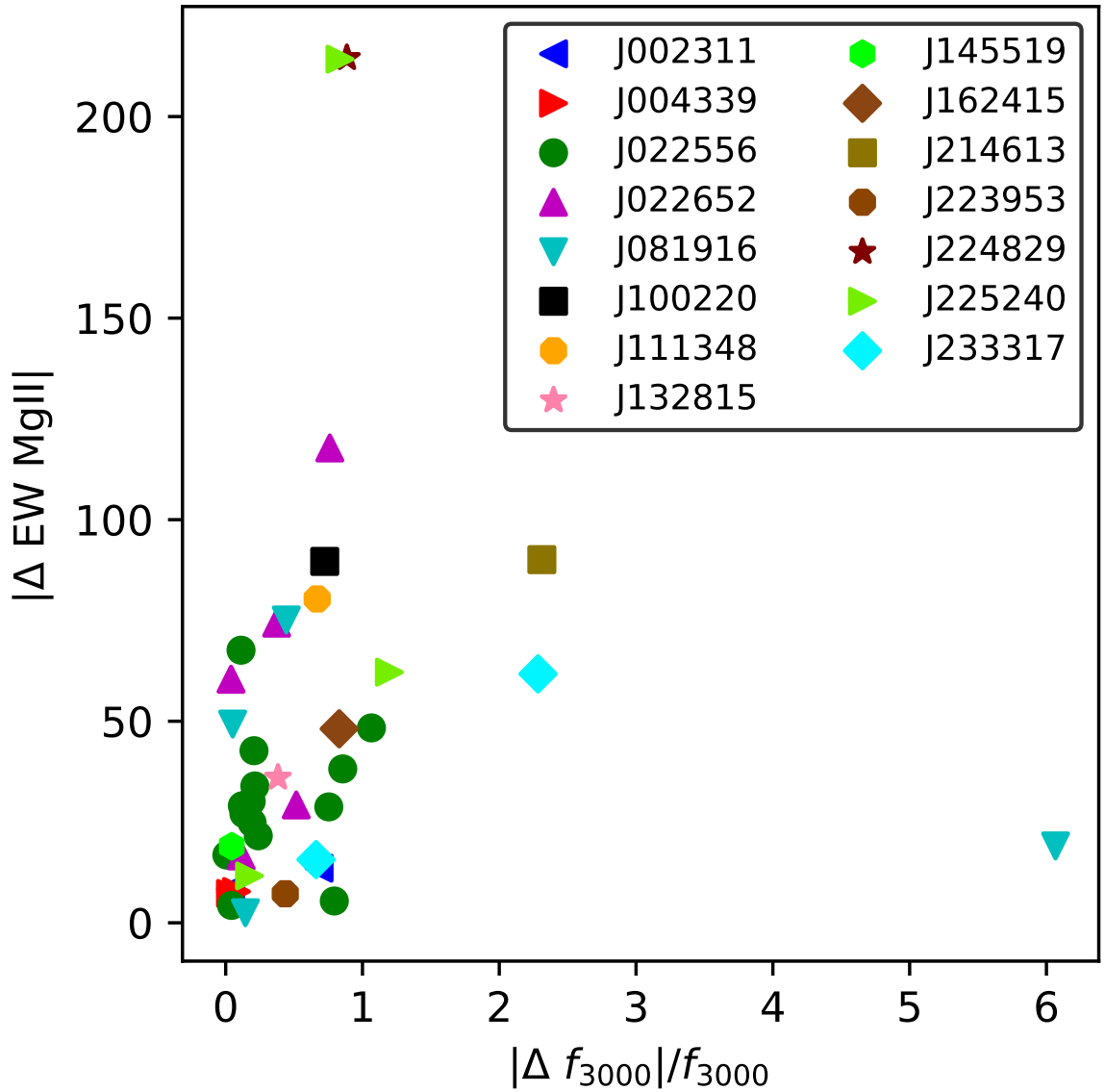


J022556:

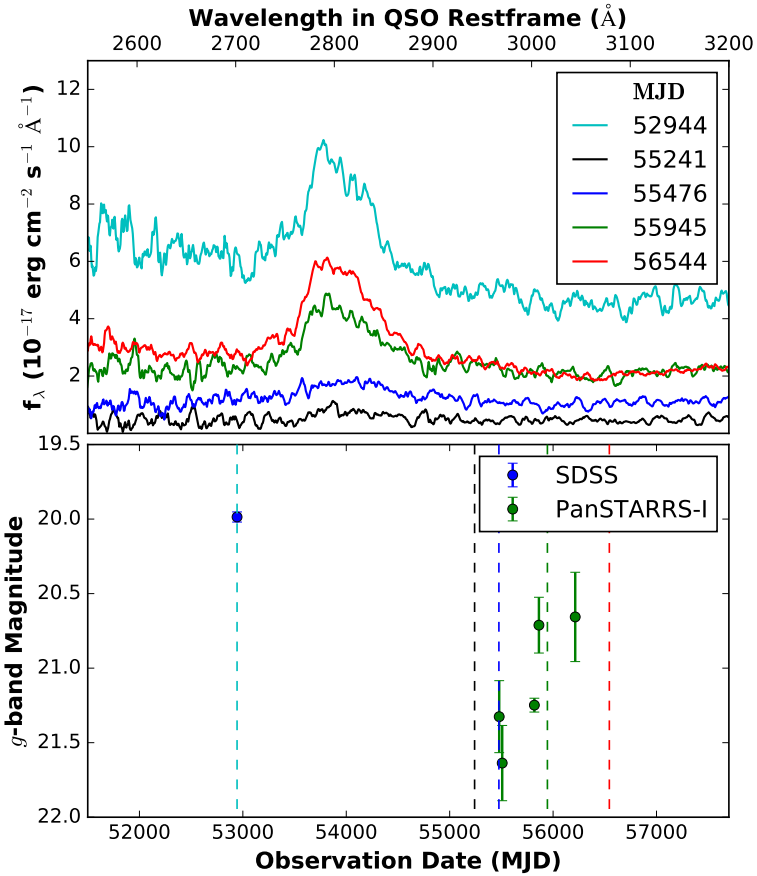


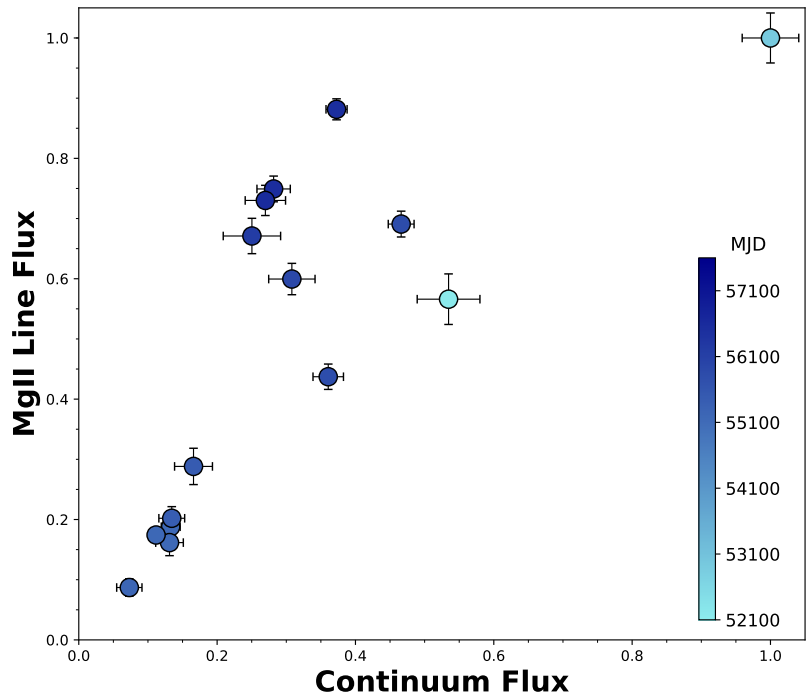
MacLeod et al. MNRAS 547 (2016)

- New observations for a sample of highly variable AGN: $|\Delta g| > 1$, searching for new CLQs
- Subsample of 15 objects for which f_{MgII} could be measured

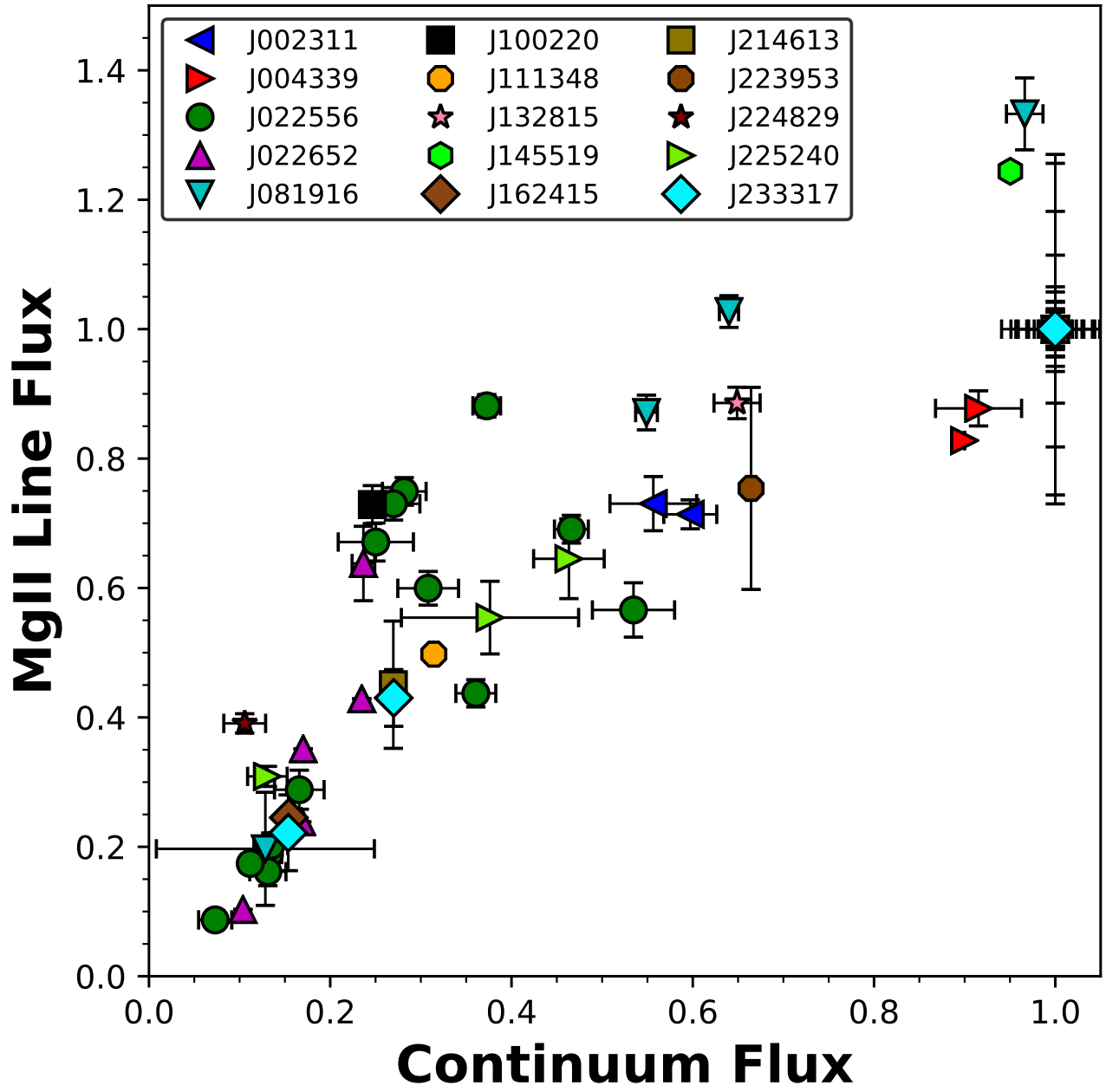


- Object J022556 was covered by Stripe 82; total of 15 spectra
- Maximum MgII flux change by a factor ∼11



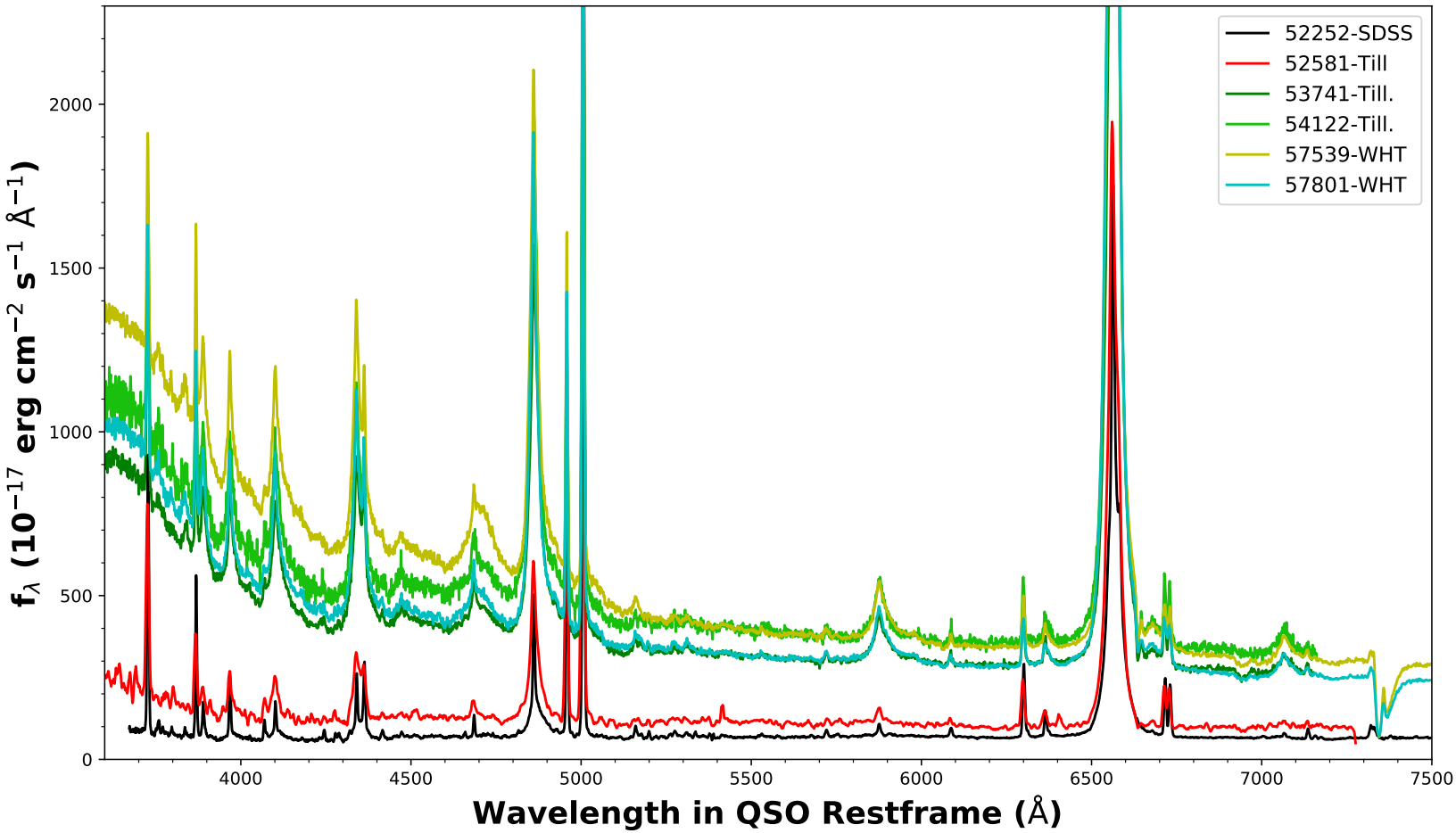


- Line Flux vs. Continuum flux for the entire sample



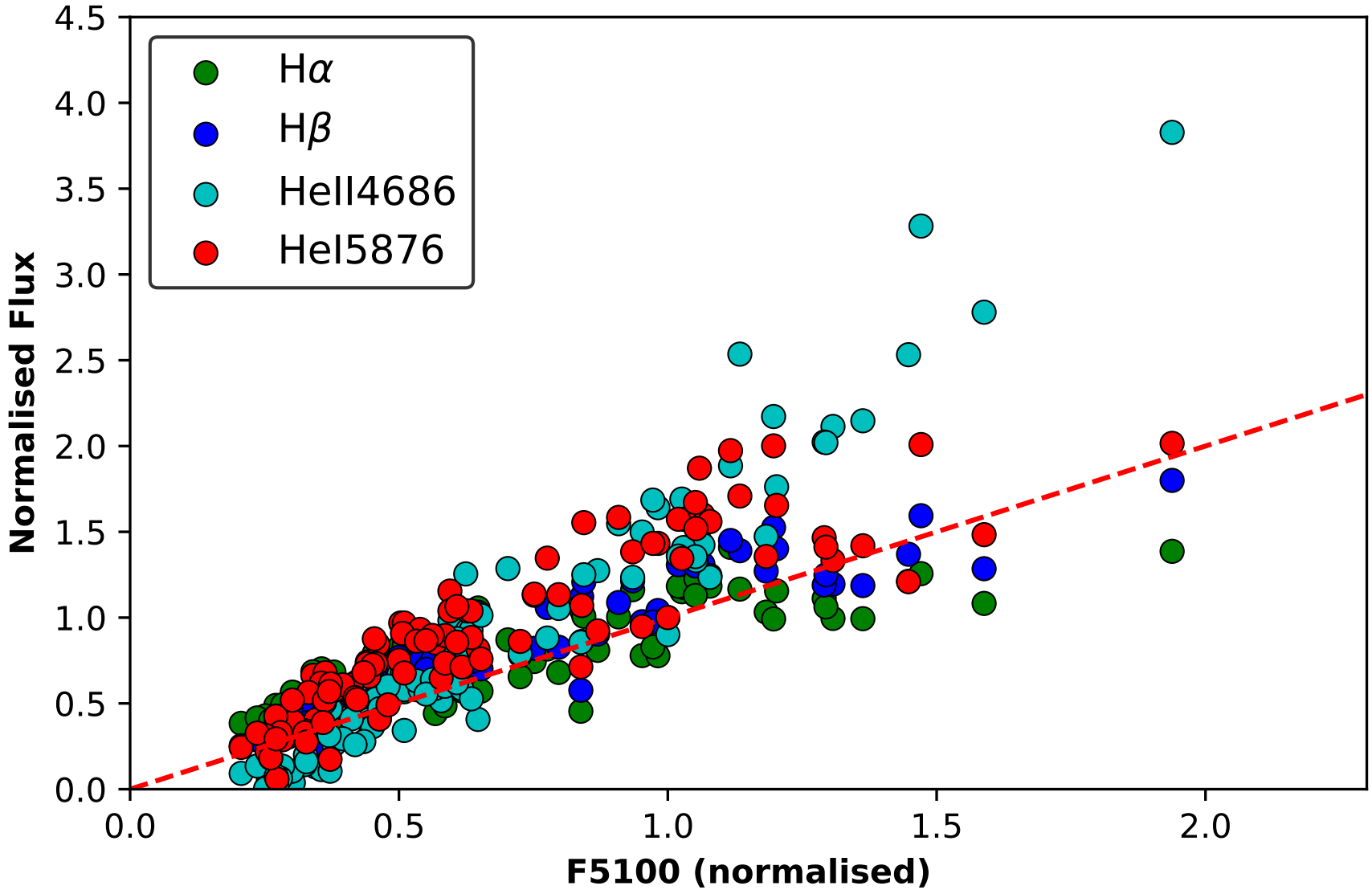
Line responsivity in Mrk 110

- Mrk 110: Seyfert I at z=0.0355
- Observations over several decades, ∼100 spectra



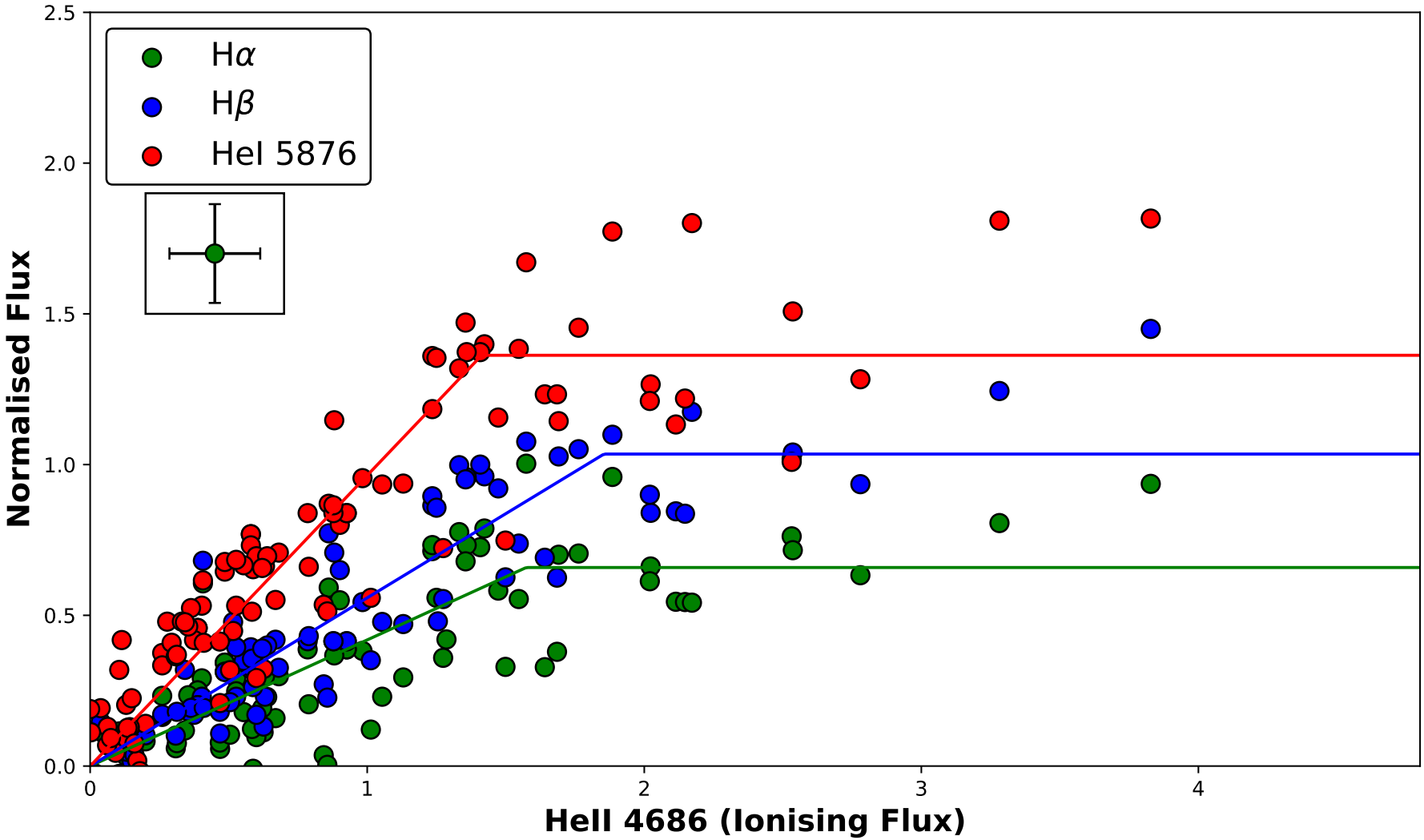
Landt et al. ApJS 174 (2008)

- Line fluxes against the continuum at 5100Å
- Fluxes normalised to a single date



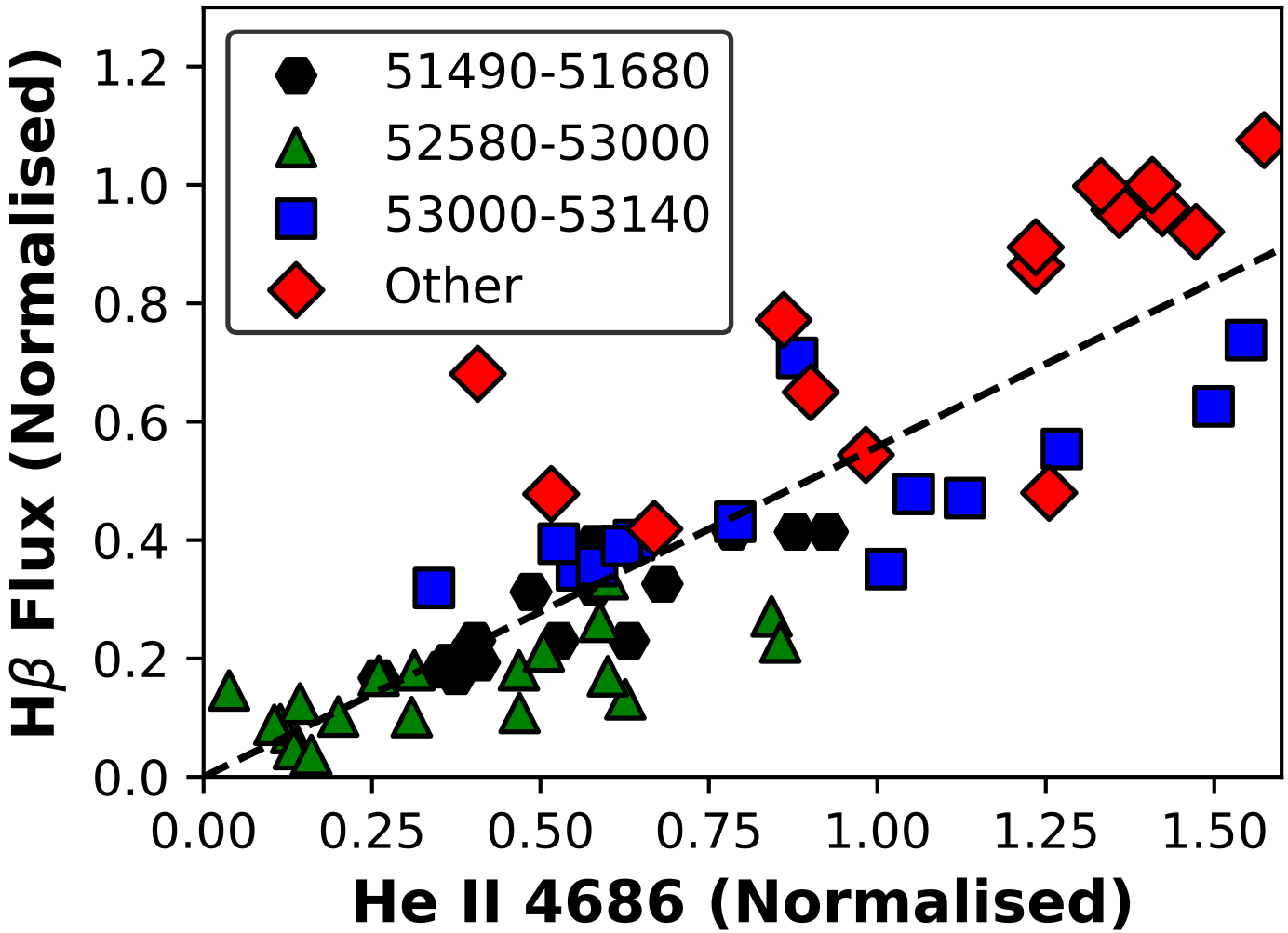
Bisschoff & Kollatschny A&A 345 (1999), Kollatschny et al. A&A 379 (2001)

- Compare normalised line fluxes to HeII 4686 flux
- Approximate behaviour with a simple fitting function

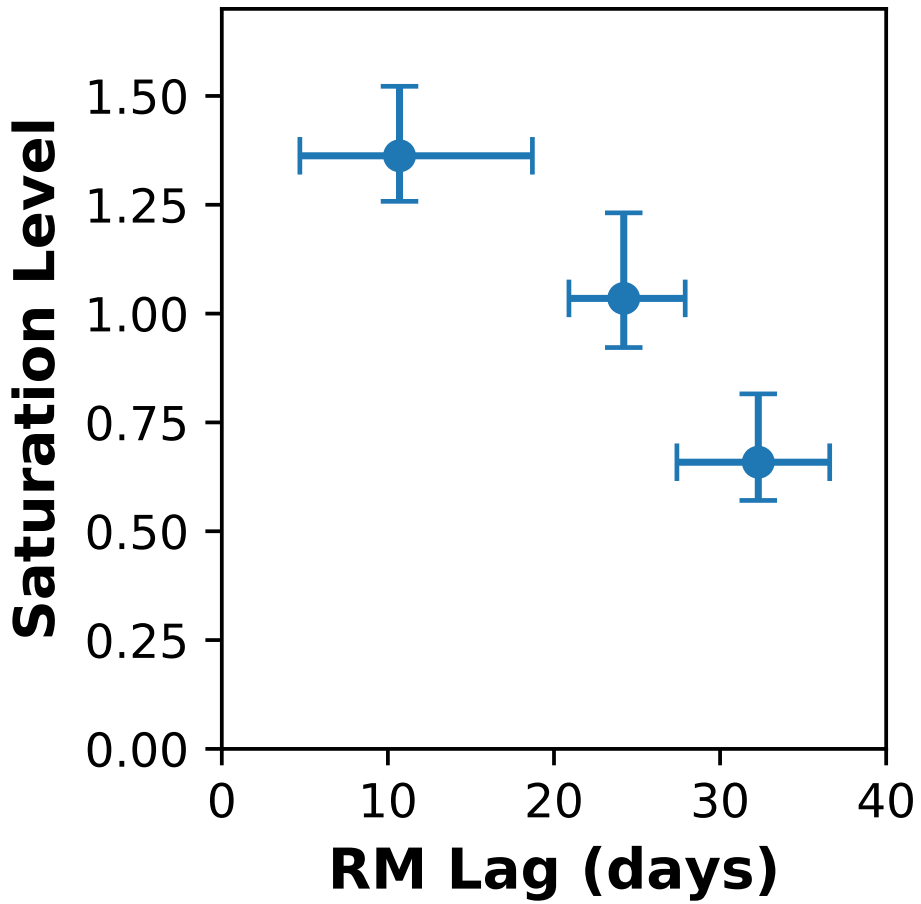


Lawrence et al. (2017, in prep.)

- On shorter timescales, the resonsiveness can deviate
- Results from separate RM studies:



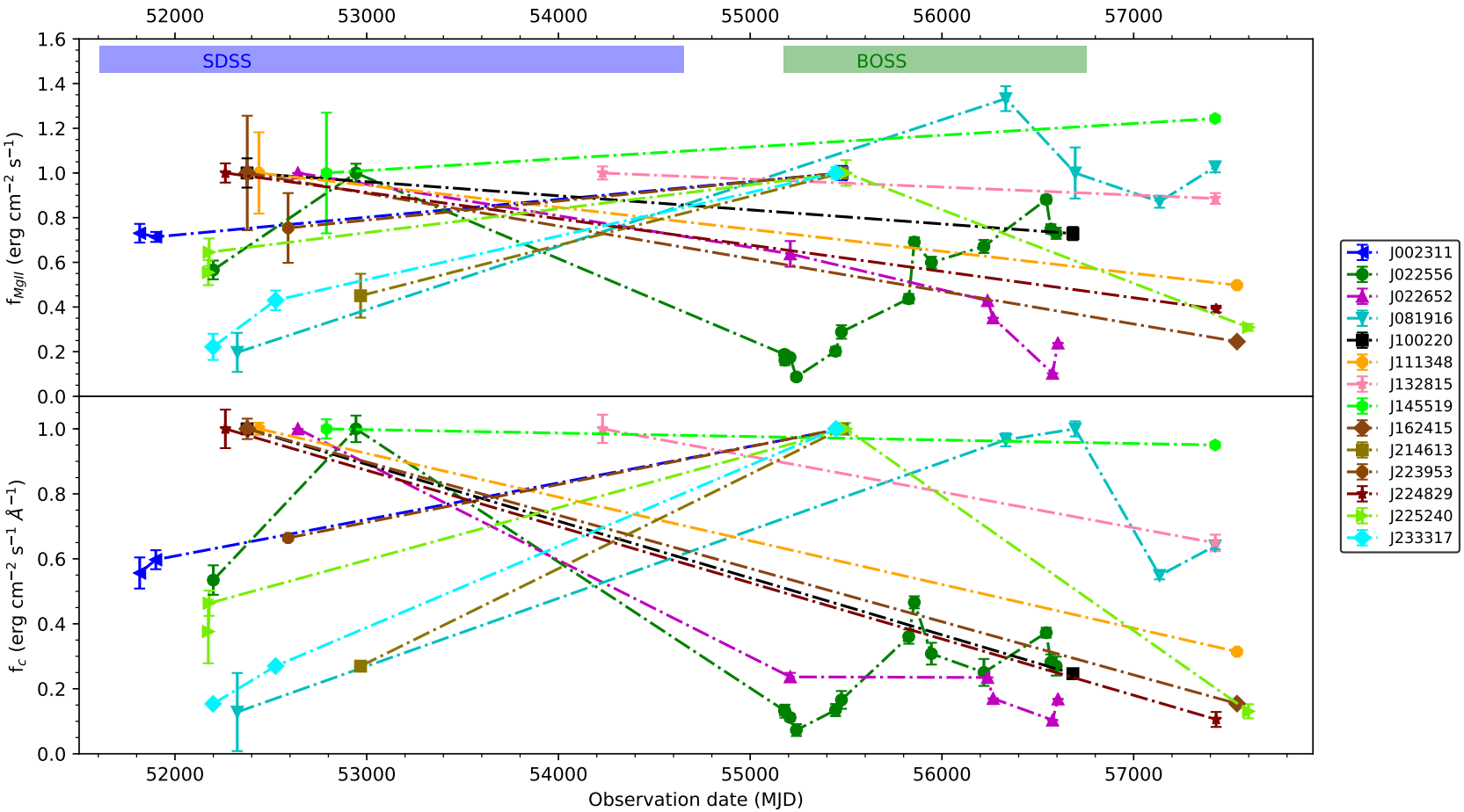
- Empirical fitting function
- Apparent cut-off in line responsivity
- Correlation with known lags from RM

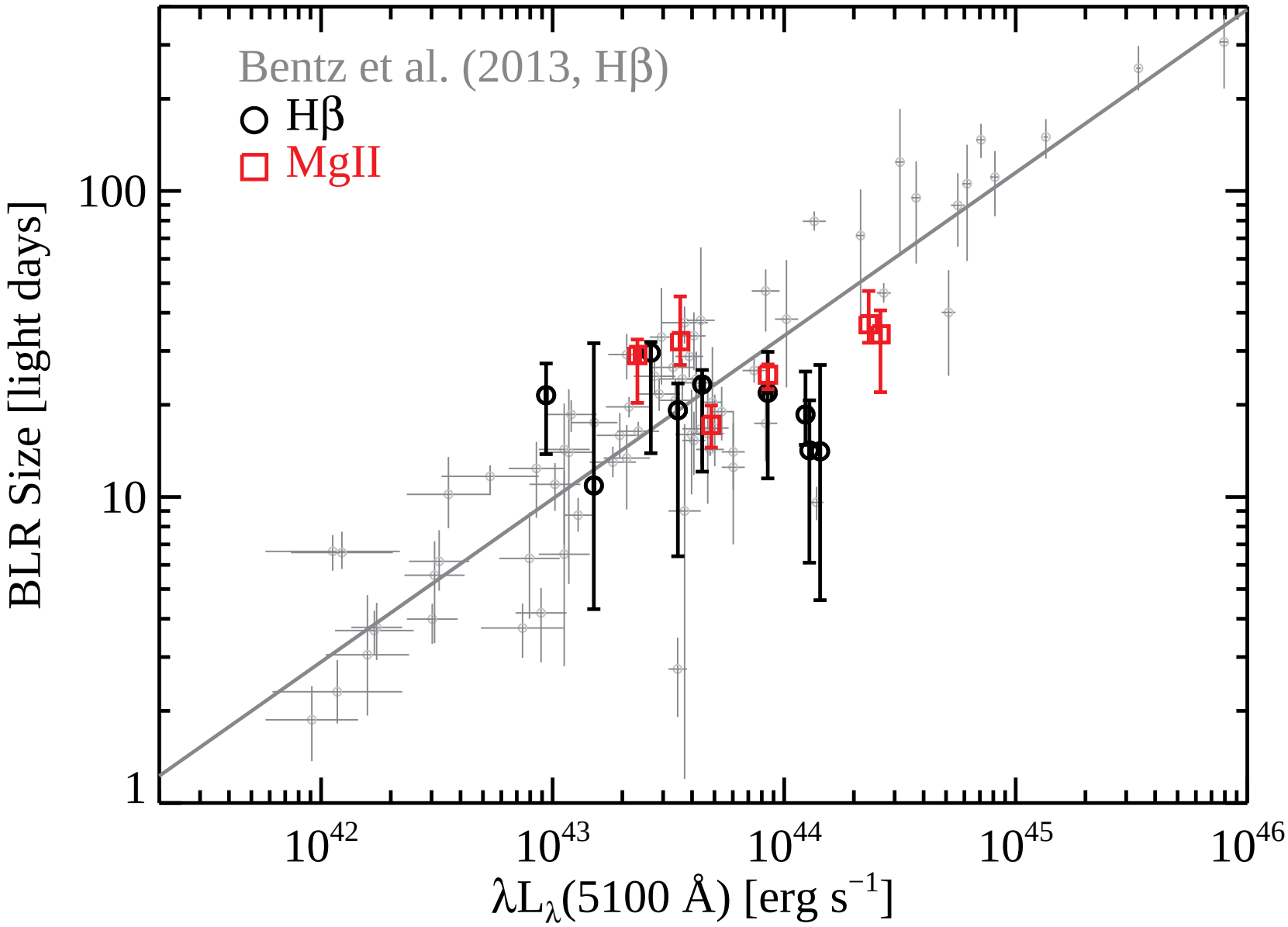


Summary

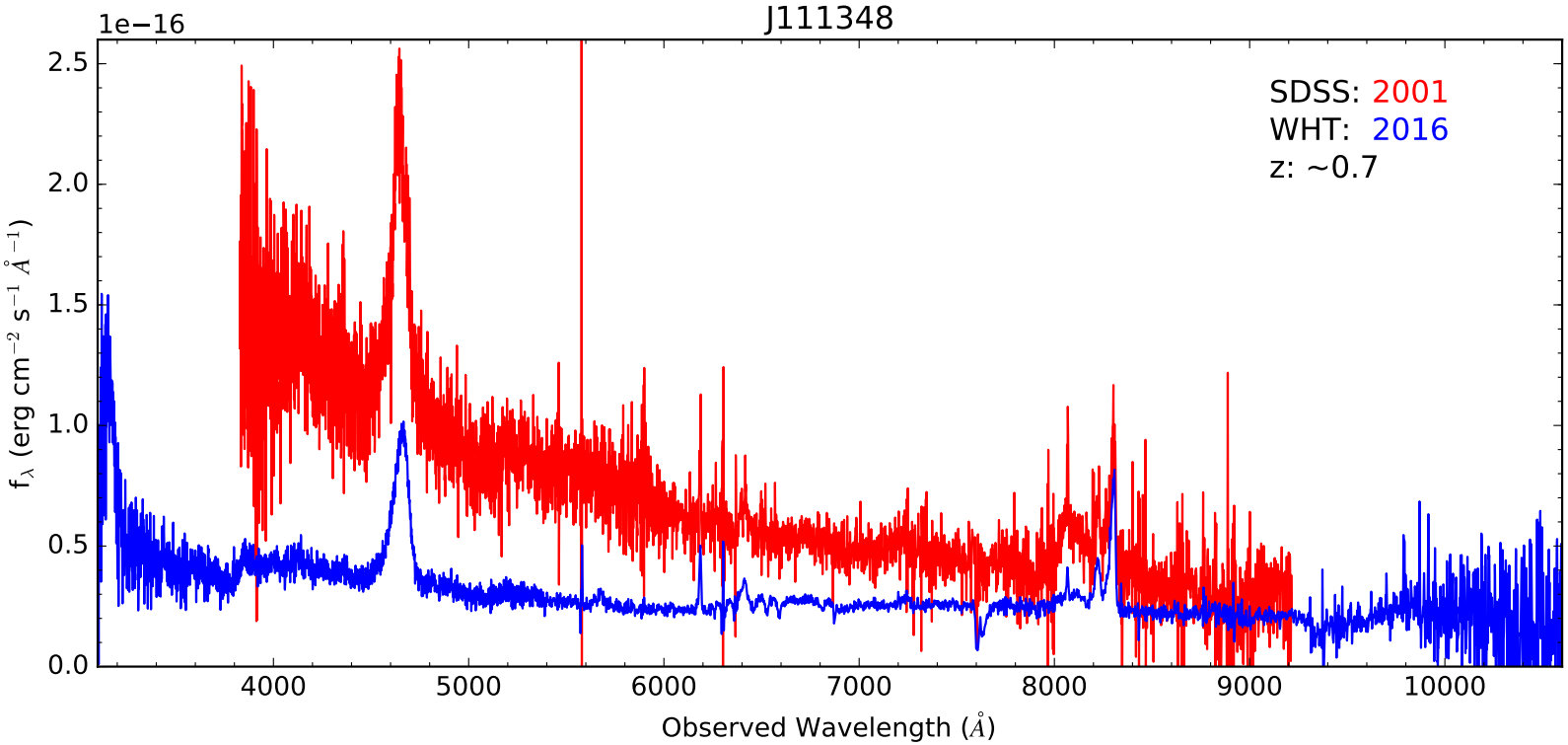
- Range in broad MgII response
  - Clear difference with short timescales (RM)
- Large number of spectra allows better analysis for Mrk 110
- The responsiveness of broad lines appears to diminish for higher EUV continuum values
- Possible connection:
  - high state versus low state responsiveness

MgII Line and Continuum flux light curves

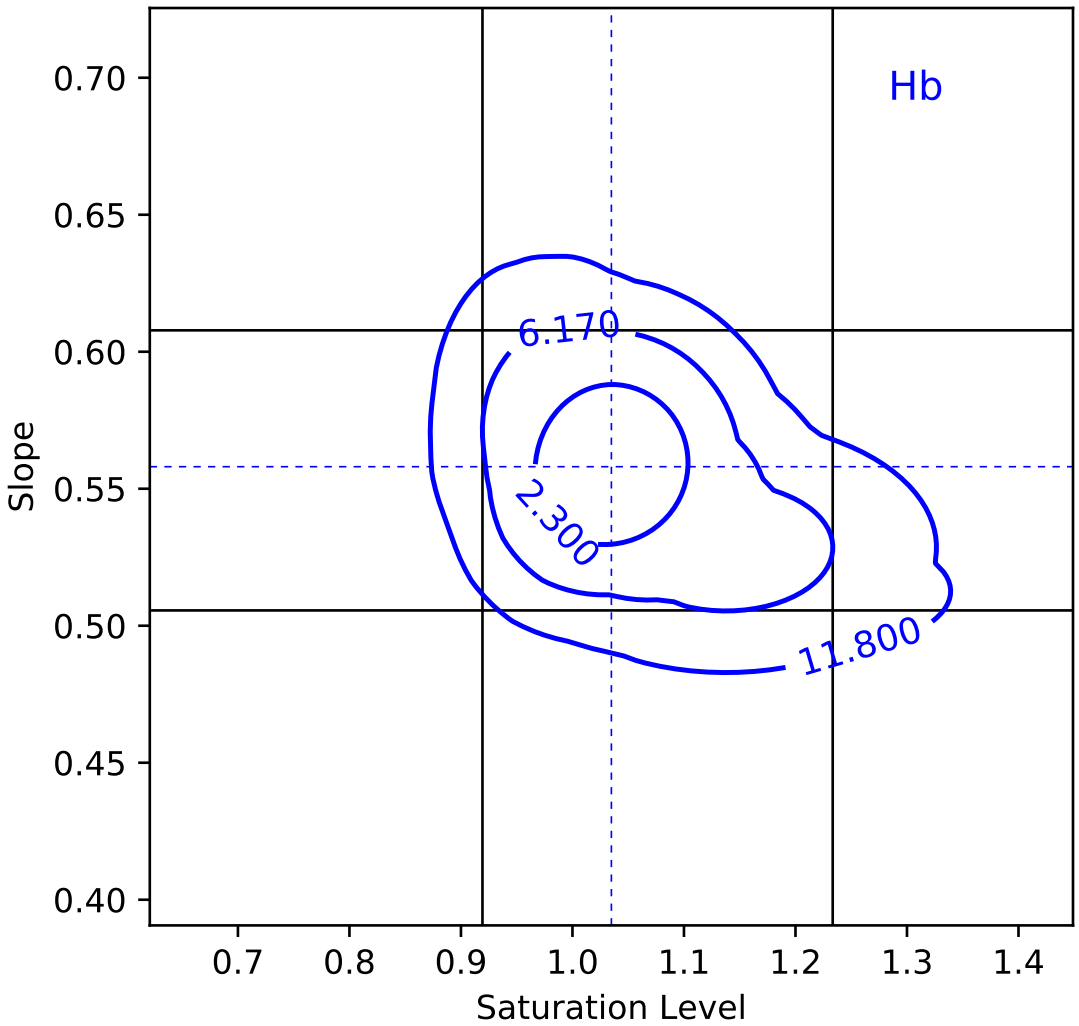




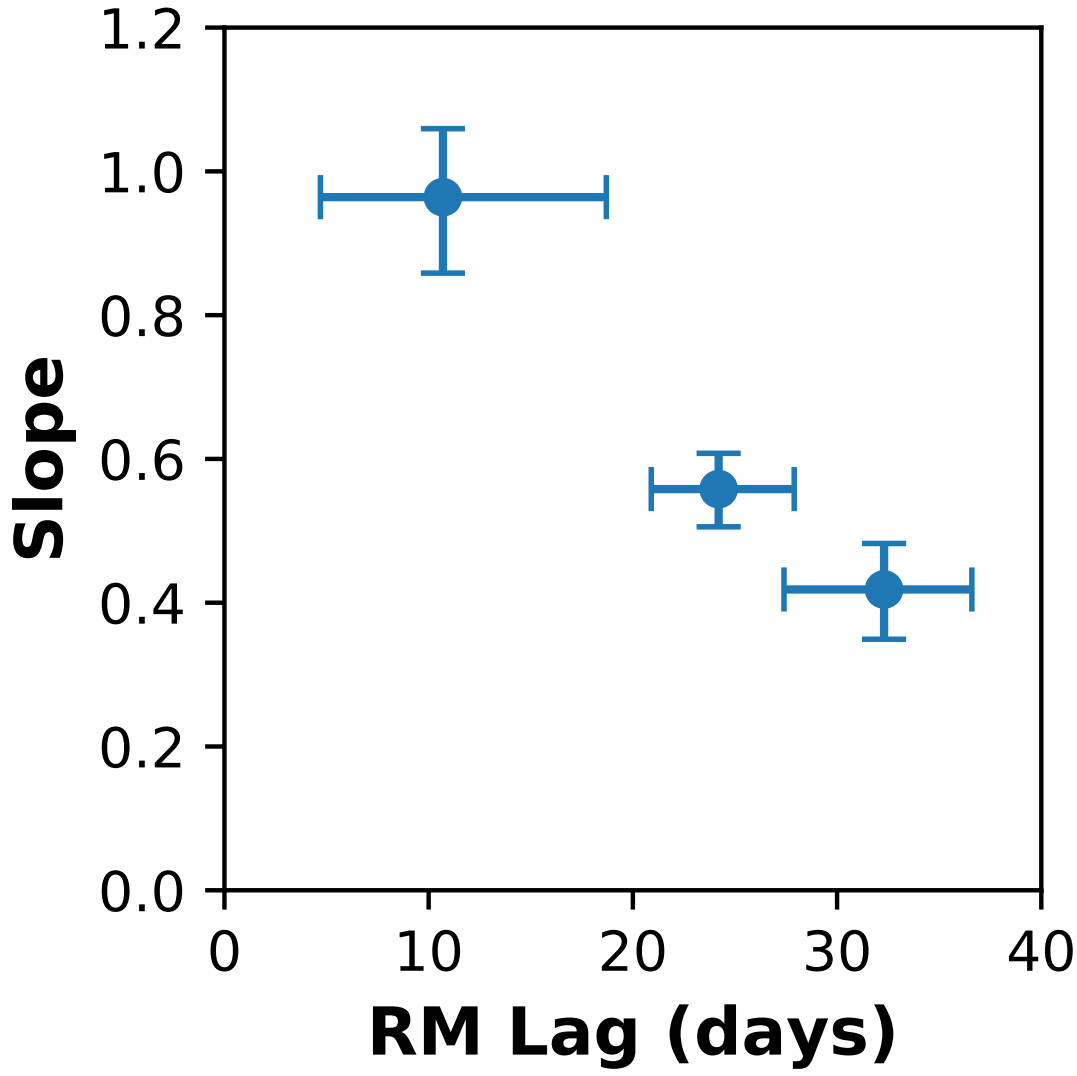
Shen et al. APJ 818 (2016)

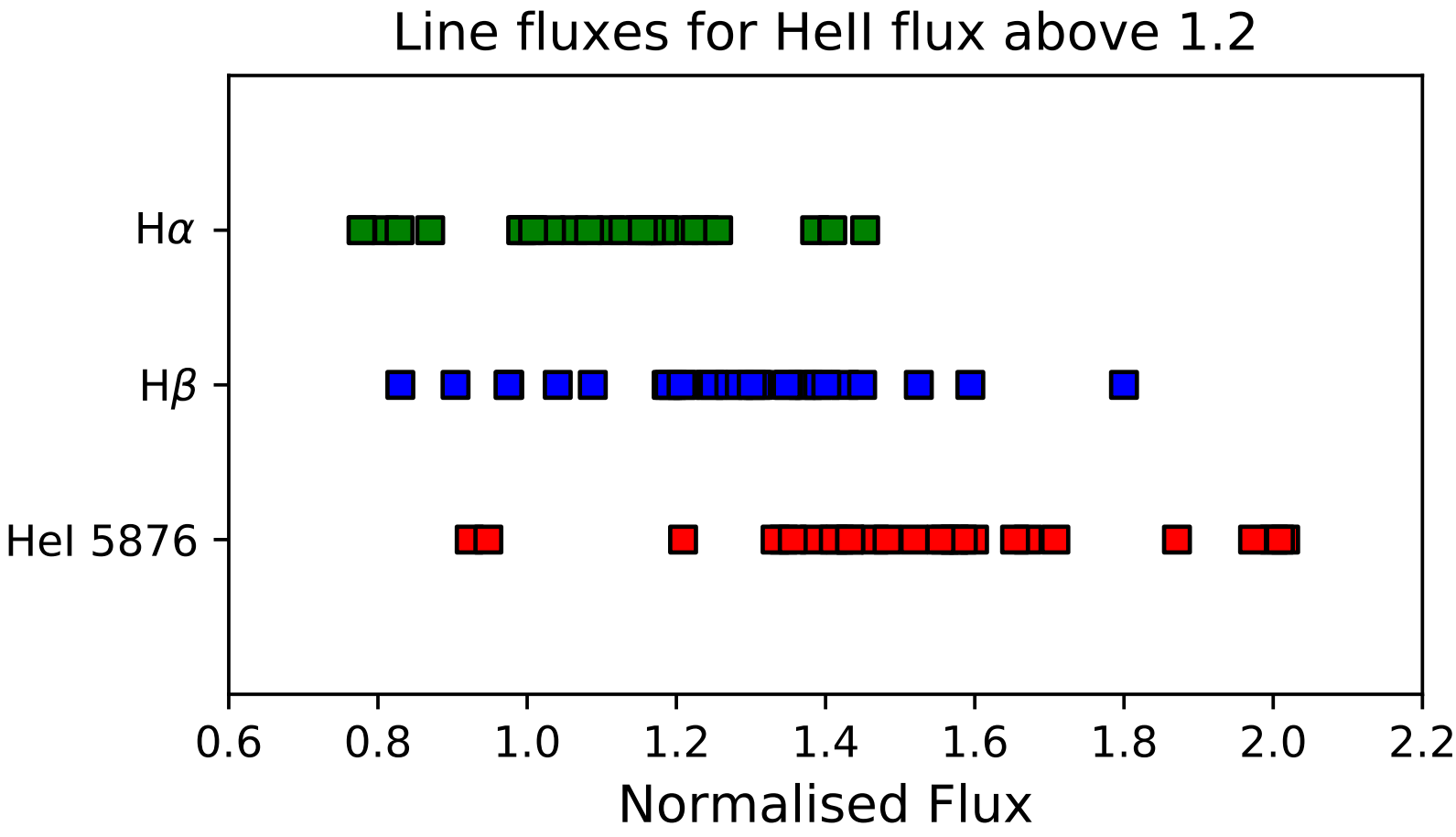

J111348
1e−16
SDSS: 2001
WHT: 2016
z: ~0.7
f_λ (erg cm^{-2} s^{-1} Å^{-1})
Observed Wavelength (Å)
0.0
0.5
1.0
1.5
2.0
2.5
4000
5000
6000
7000
8000
9000
10000

χ^2-Contours for fit to Hβ



Fit results: slope versus lag




Line fluxes for HeII flux above 1.2
Hα
Hβ
HeI 5876
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
Normalised Flux