

# Nocturnal SHS Observations of the 327.2nm $O^+$ Doublet

Stan Briczinski

Susan Nossal

Edwin Mierkiewicz

Fred Roesler

- The University of Wisconsin-Madison

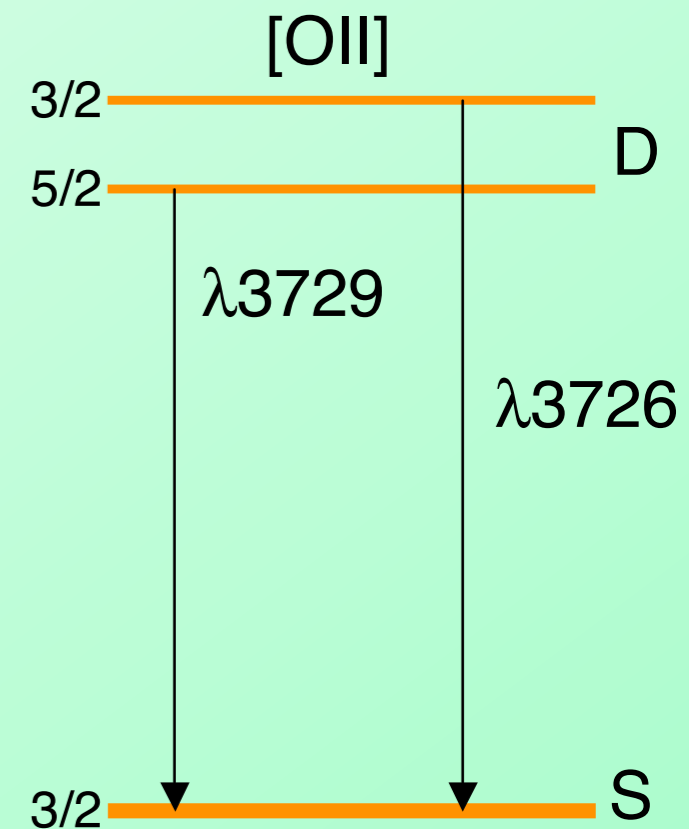
Phil Richards

- George Mason University

# Chemistry of the Nighttime

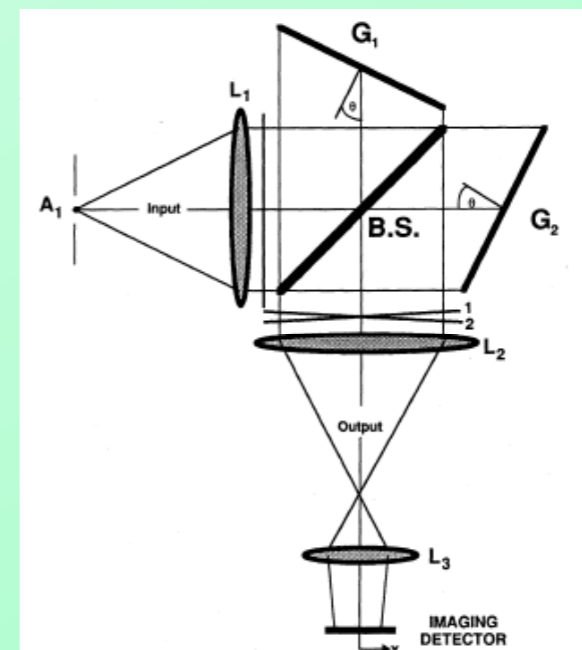
## 3727 Doublet

- $O^+(^2D)$  state excited from ground O state by nighttime photo electron impact
- $O^+(^2D) \rightarrow O^+(^4S) + 3727$  Doublet
- Intensity strength  $\sim 1$  Rayleigh
- Metastable state (Avg lifetime  $\sim 3$ hrs)
- $O^+(^2D) + N_2 \rightarrow O + N_2^+$
- Use as diagnostic for  $N_2$  concentration?



# The Spatial Heterodyne Spectrometer (SHS)

- The SHS is a modified Michelson interferometer
- Replace the mirrors with diffraction gratings
- Allows for higher sensitivity than traditional interferometers in the near UV region

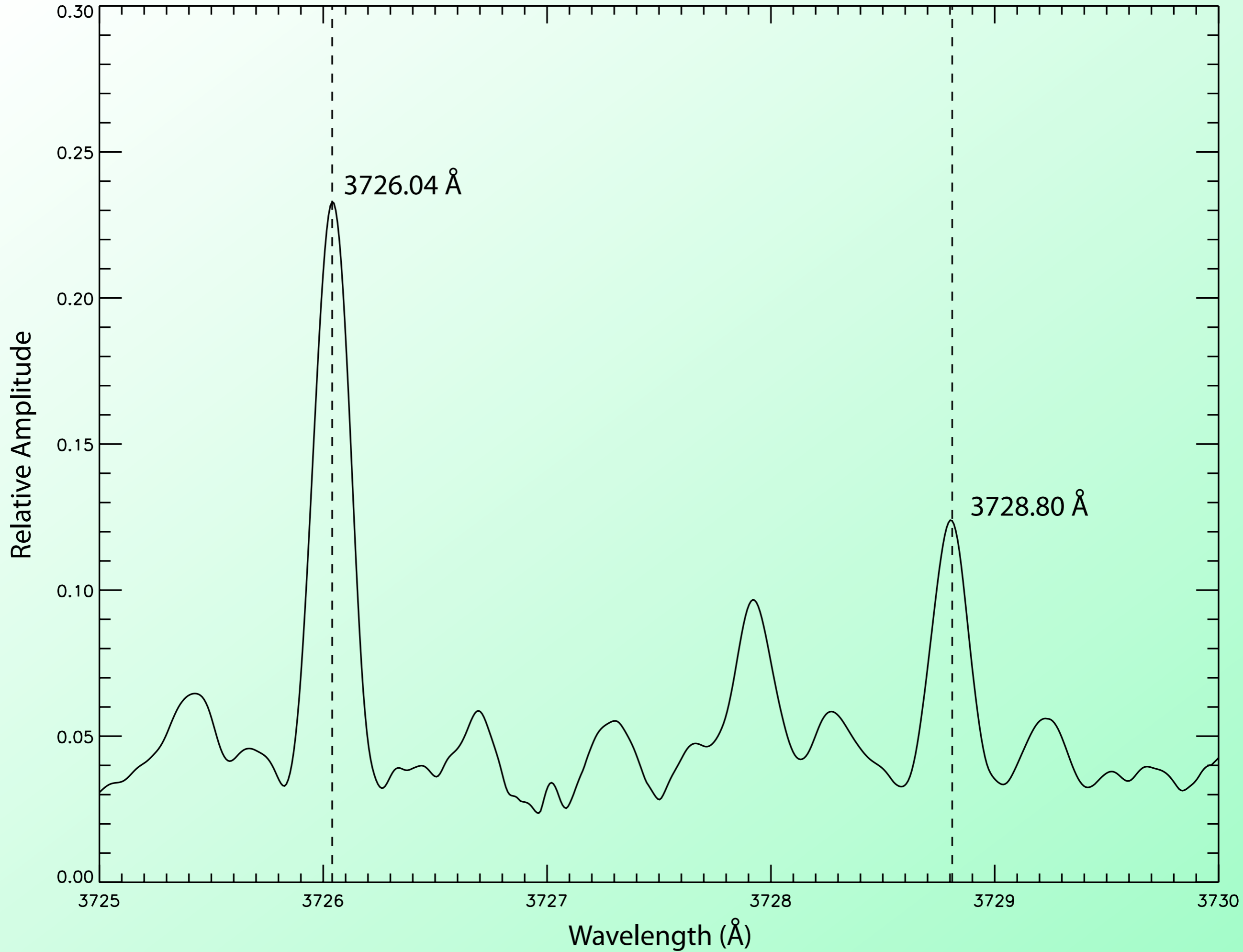


# Previous Observations

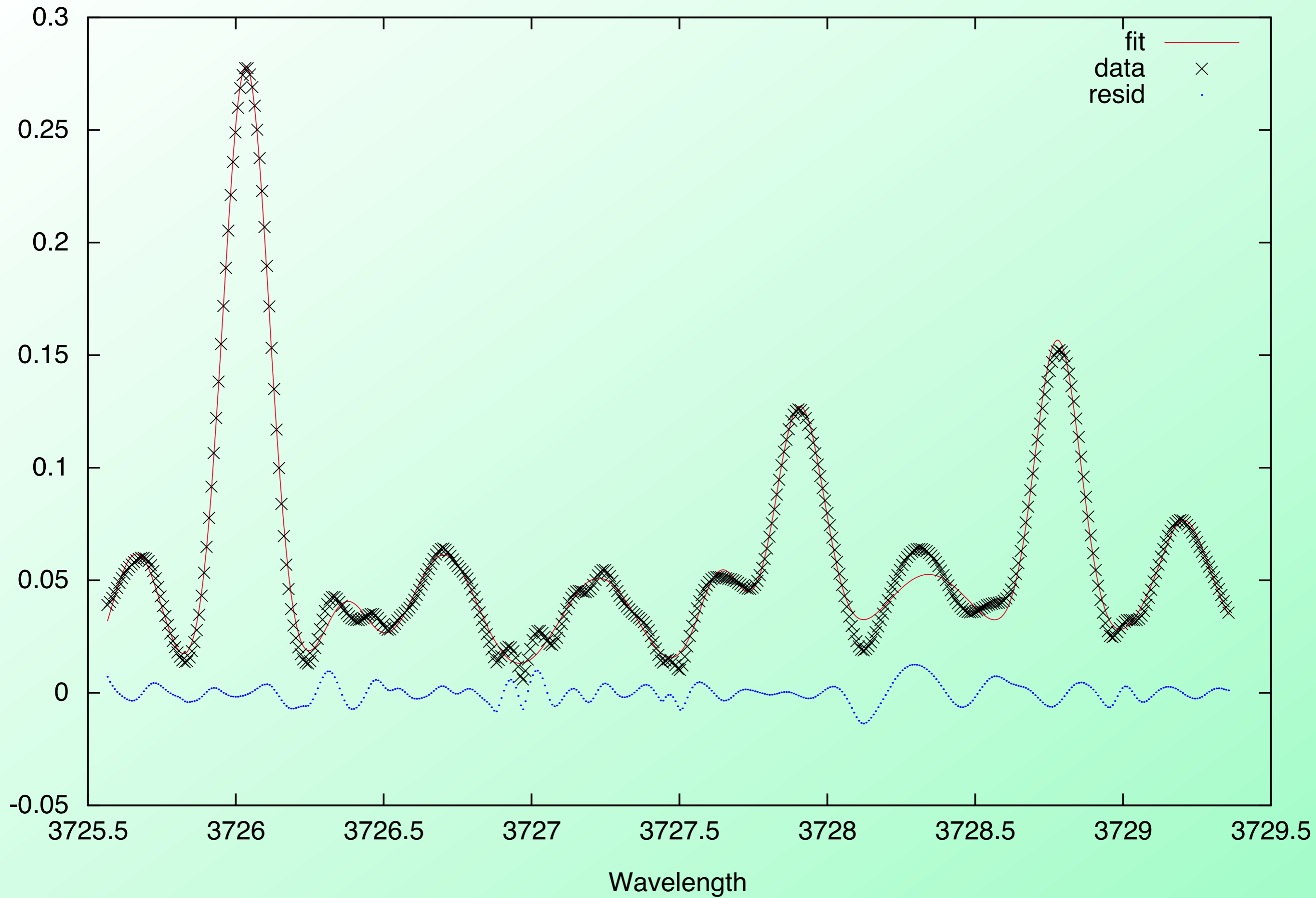
- Wallace (1959)
- Sivjee (1991)
- Mierkiewicz et al. (2006)
- Sharpee et al. (2008)

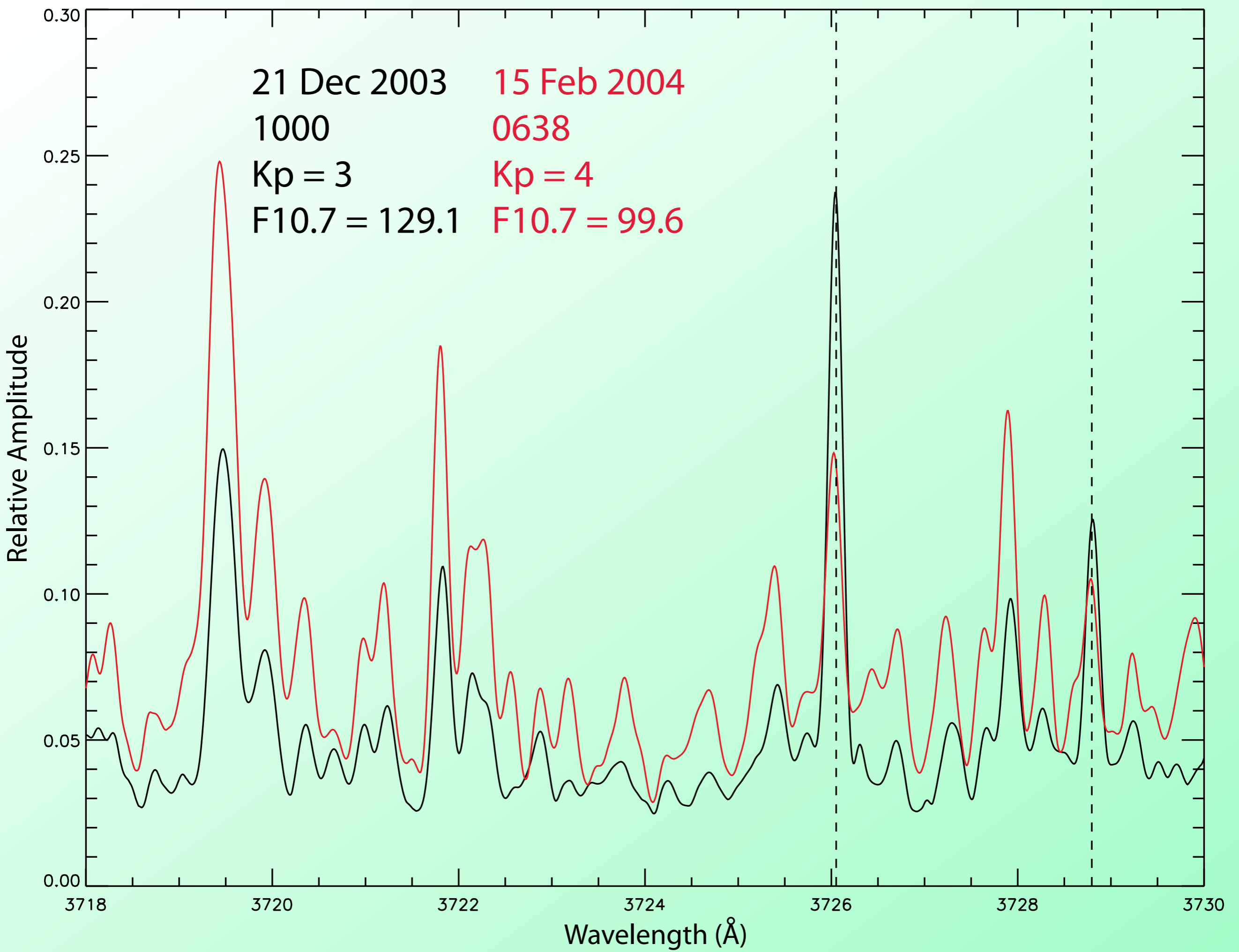
# WI Doublet Observations

- Observed during galactic  $O^+$  campaign at the Pine Bluff Observatory
- Multiple observations during several periods between December 2003 and October 2005
- Not attributed to any galactic source, but present (“contaminant”) in galactic observations
- Recent atmospheric observations in February and March 2010

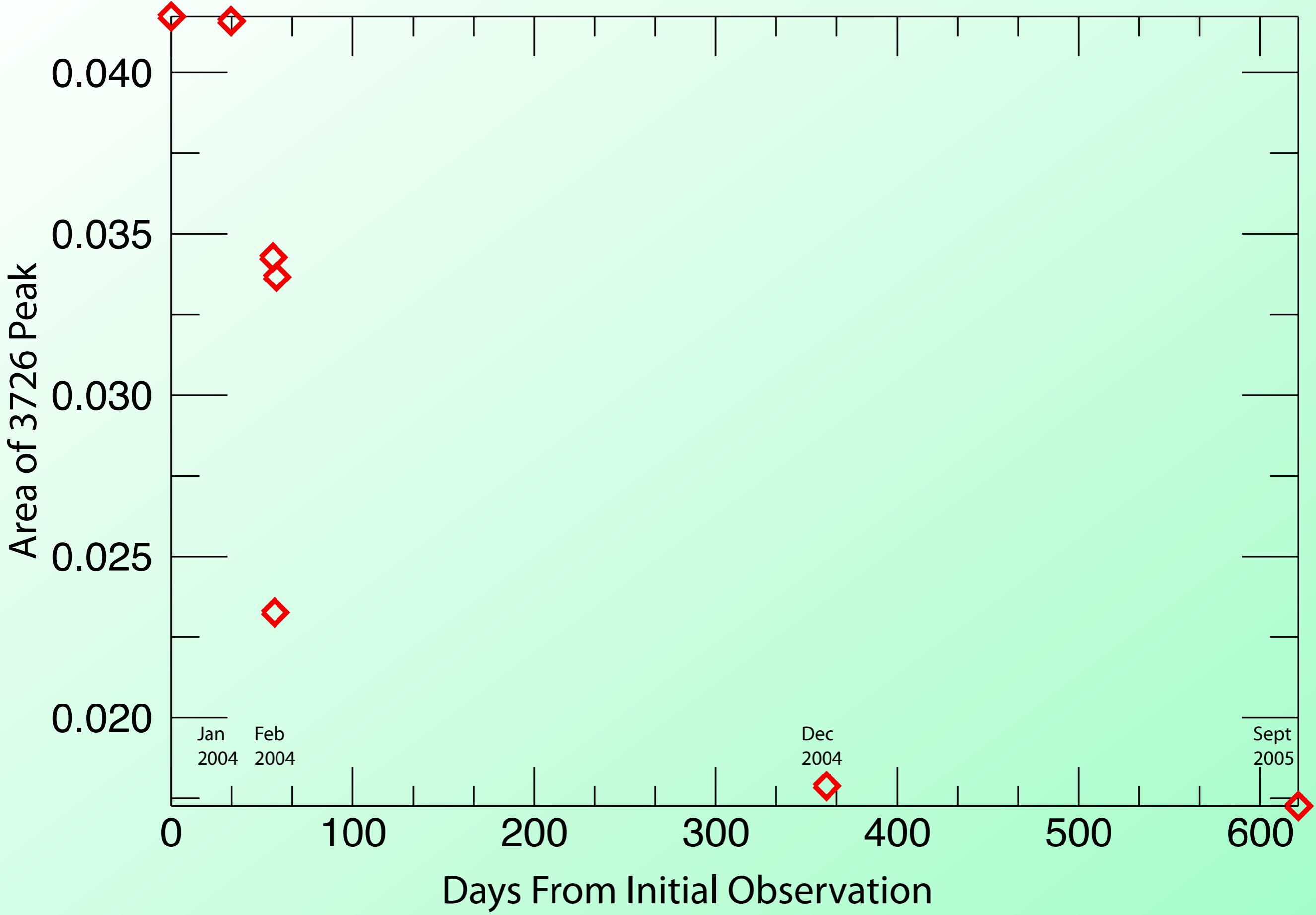


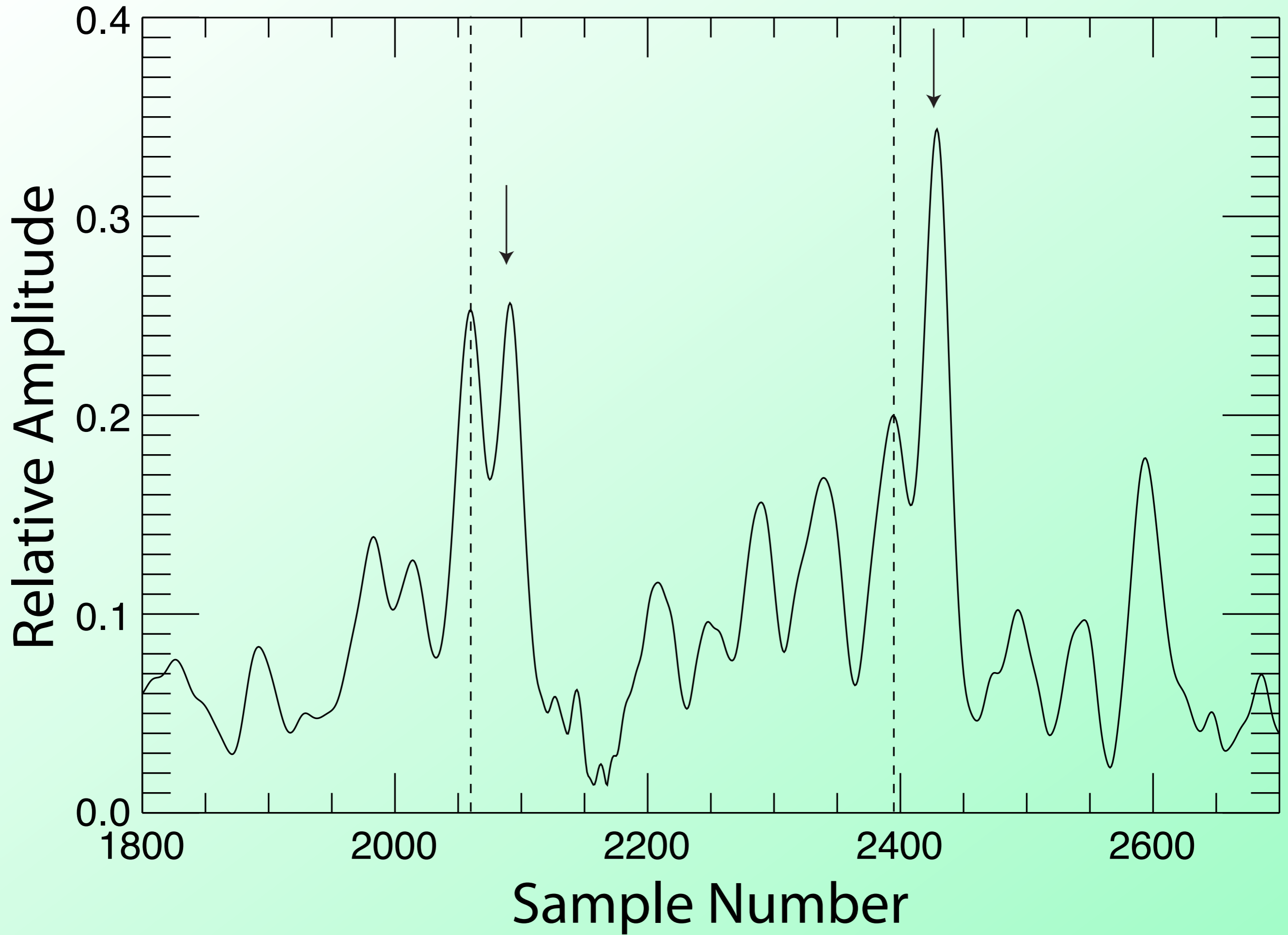
Voigt fit to OII\_25\_s.txt;  $\chi^2 = 3.81$

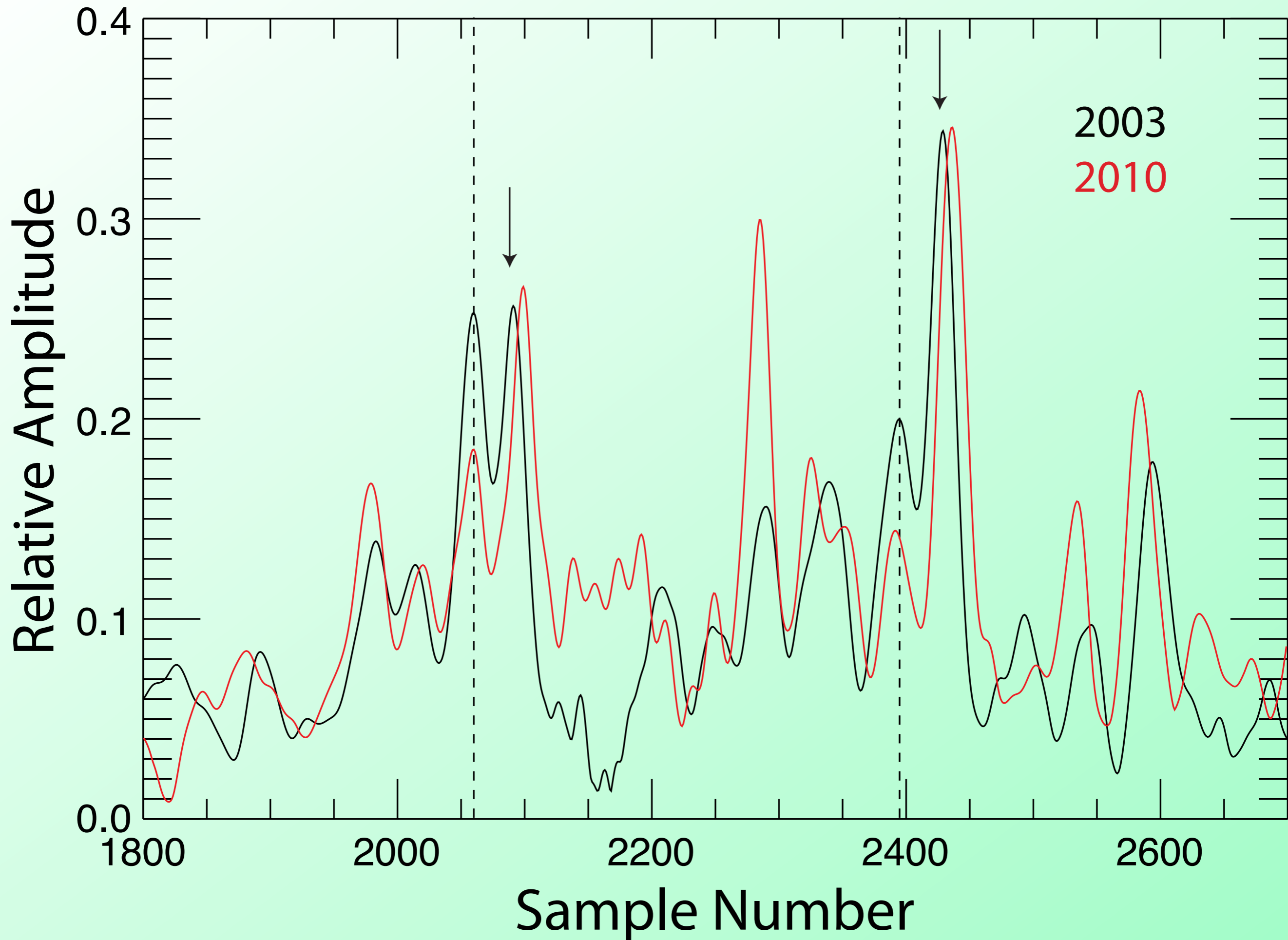




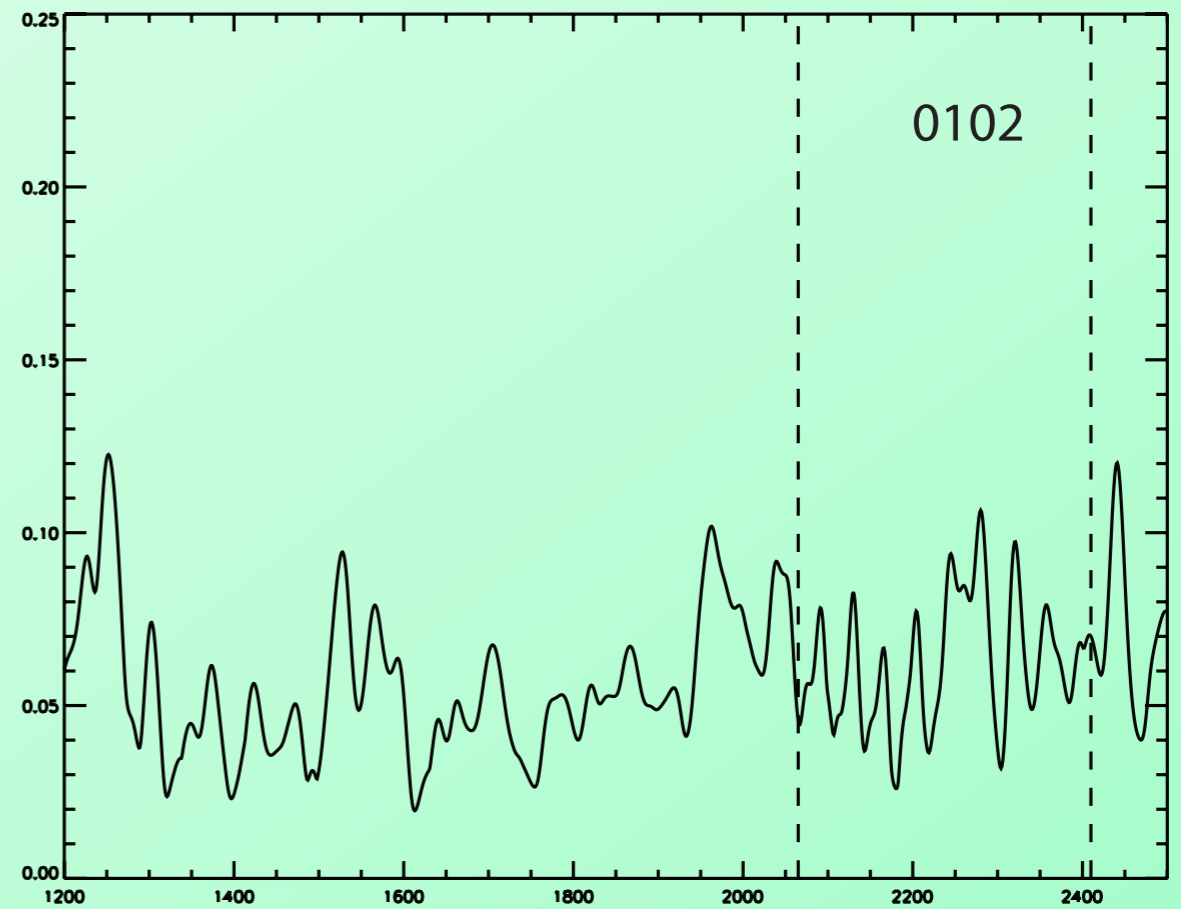
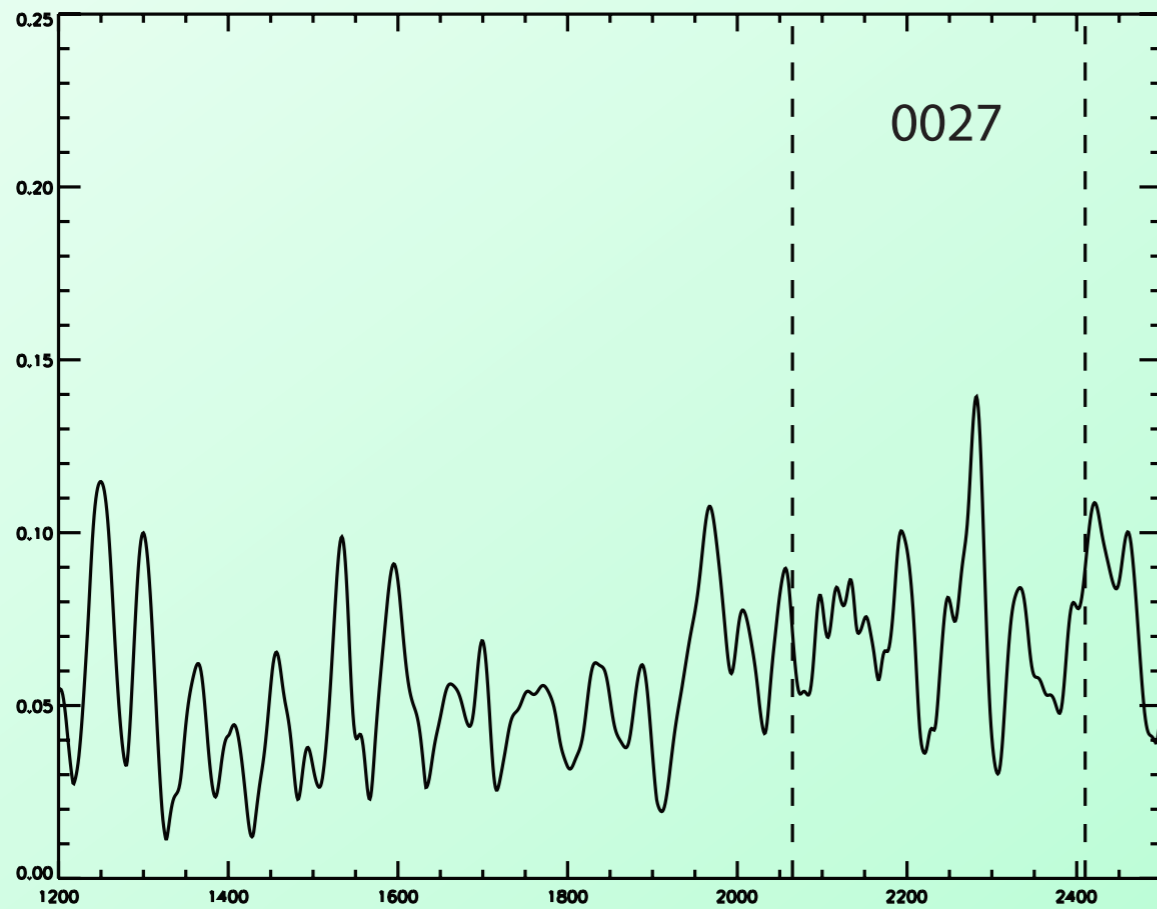
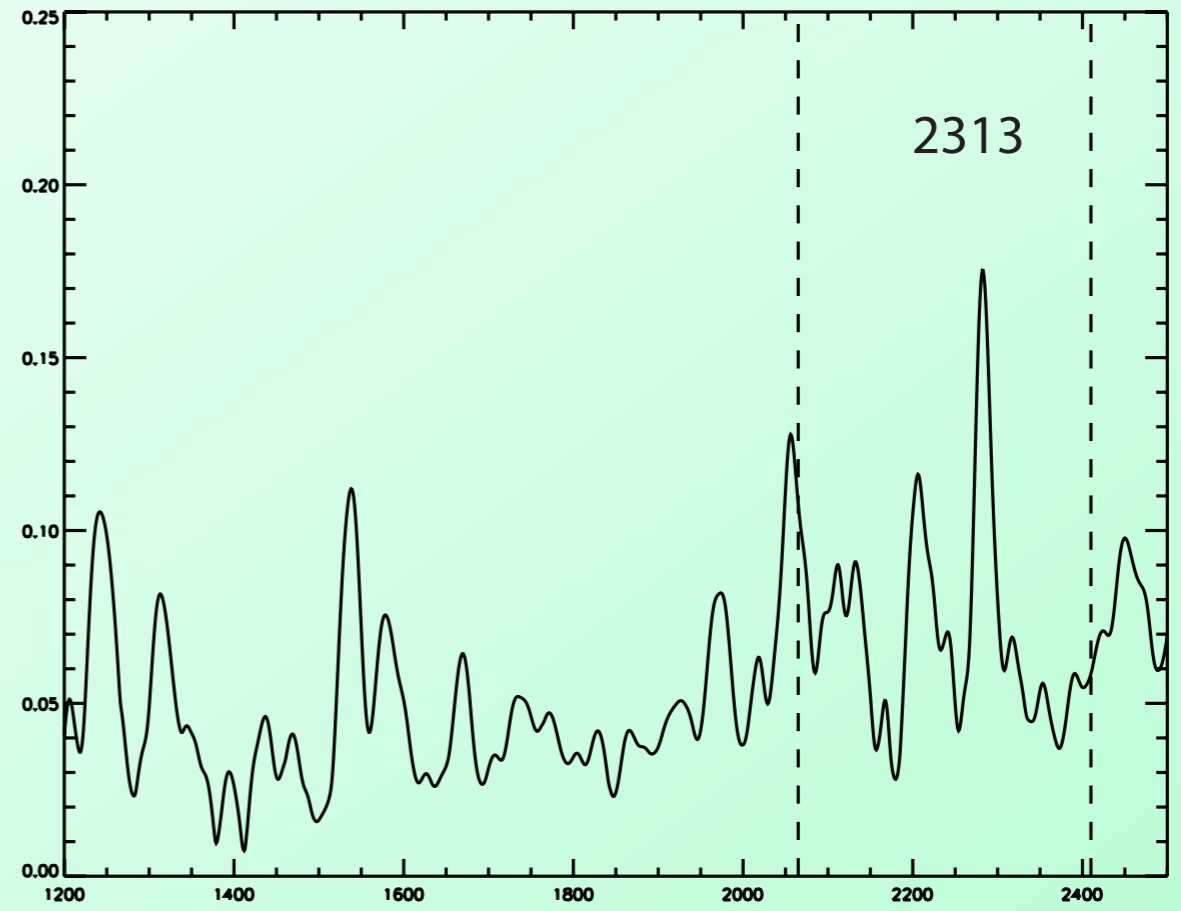
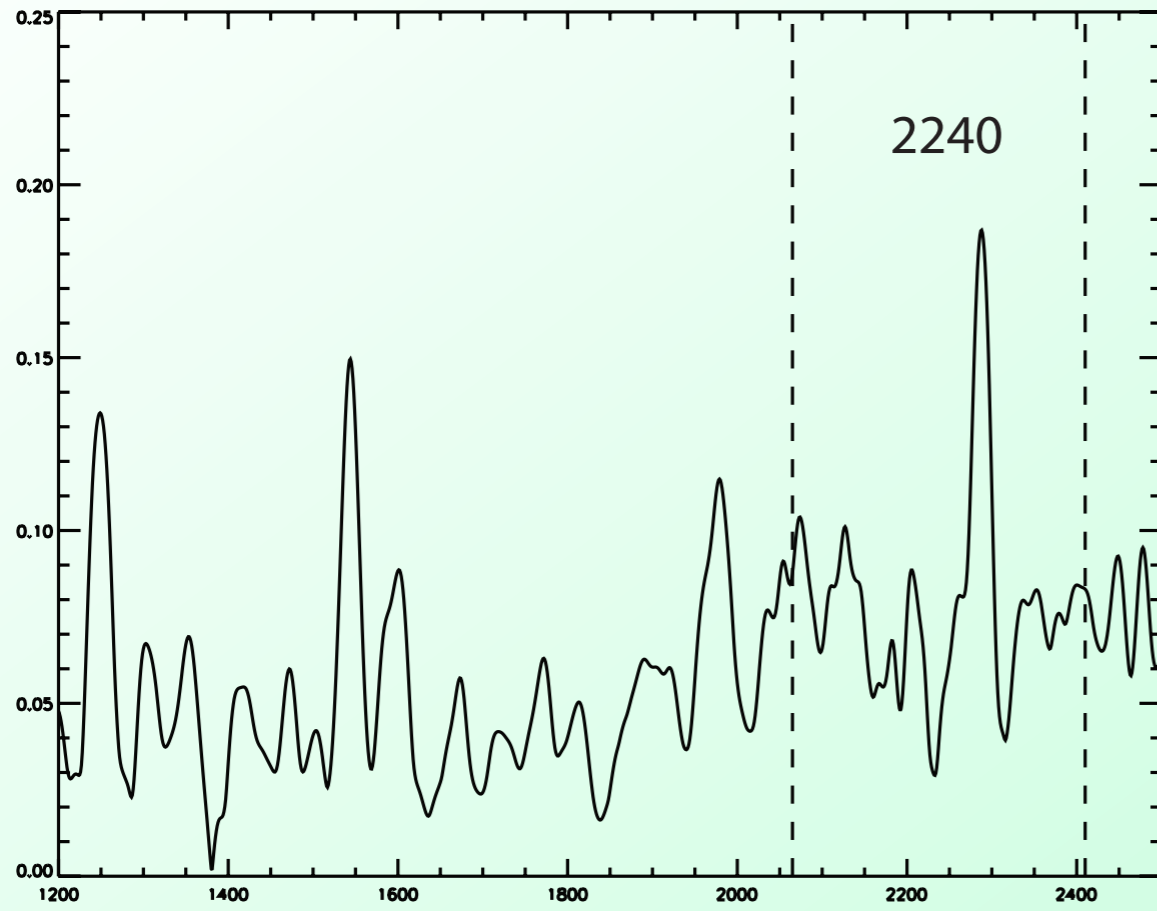




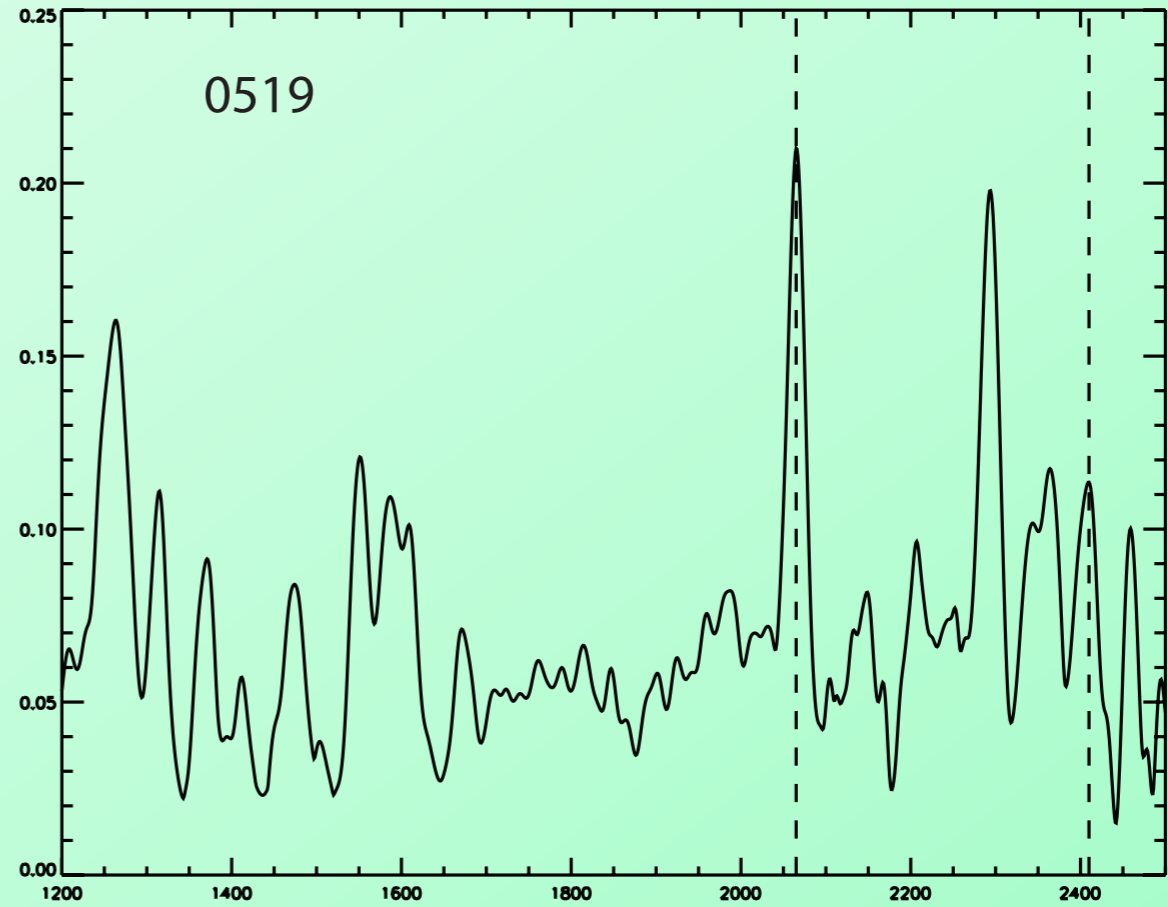
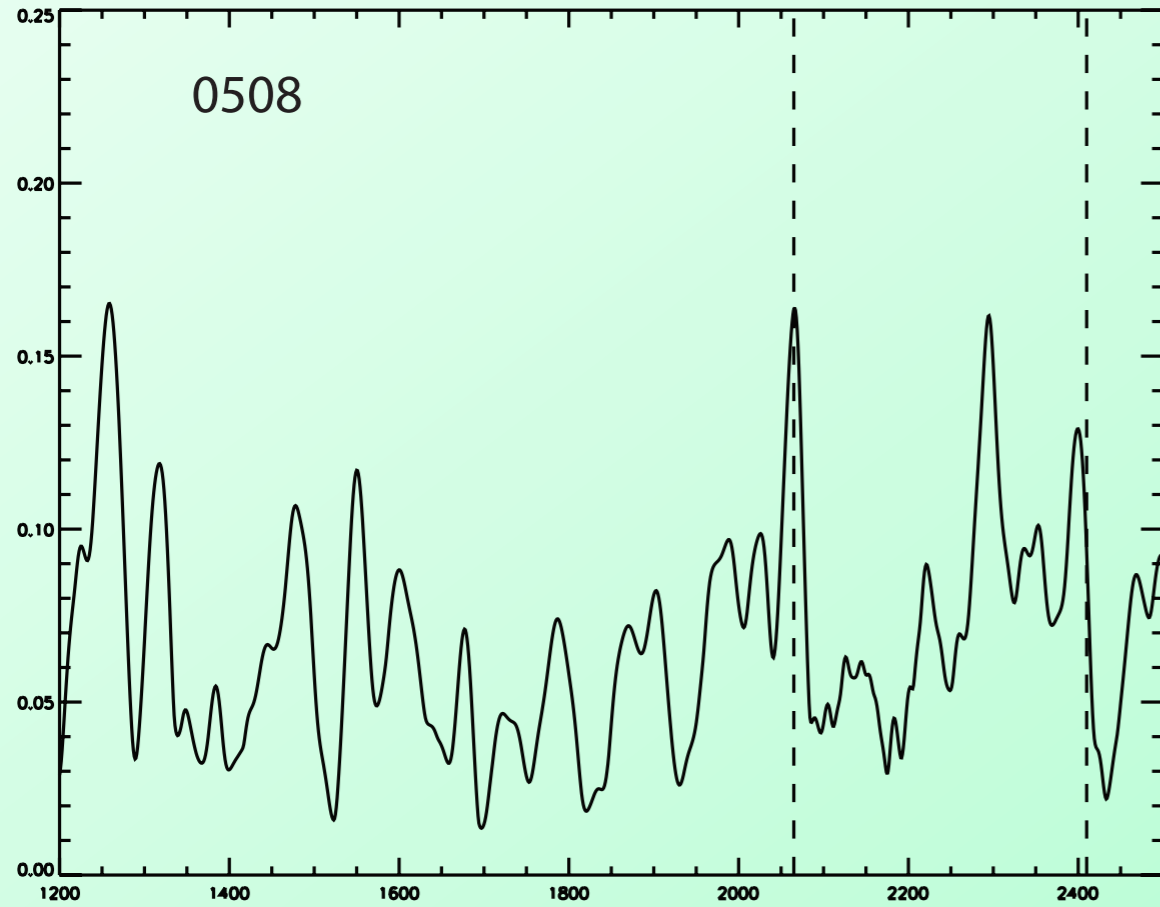
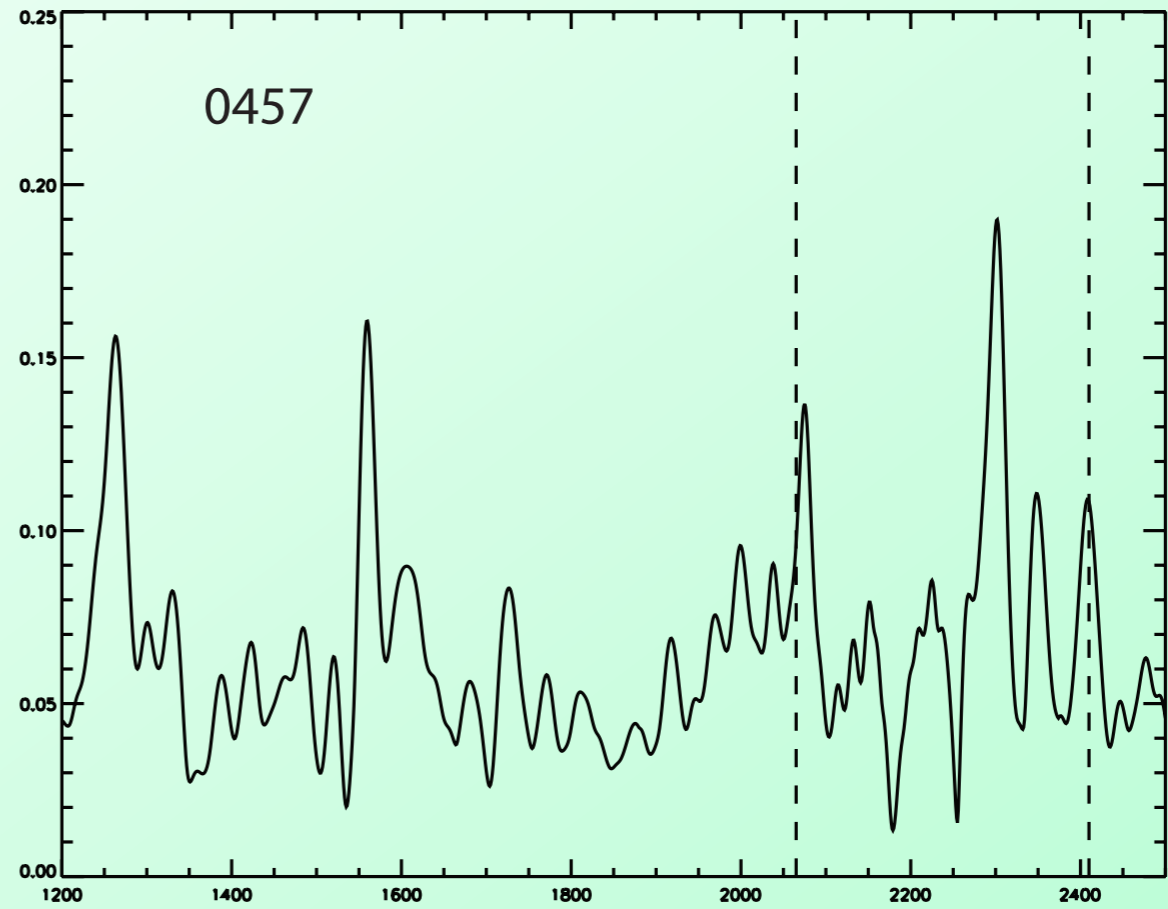
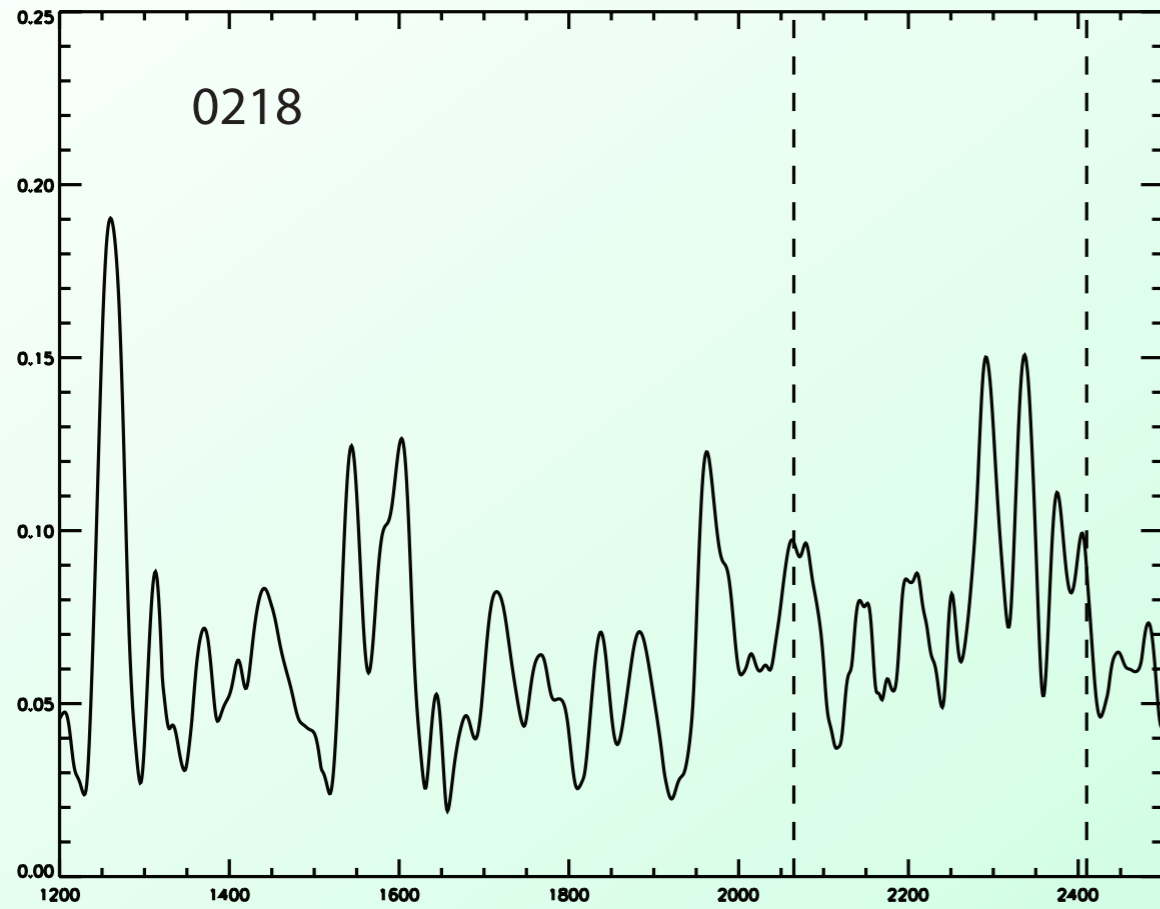




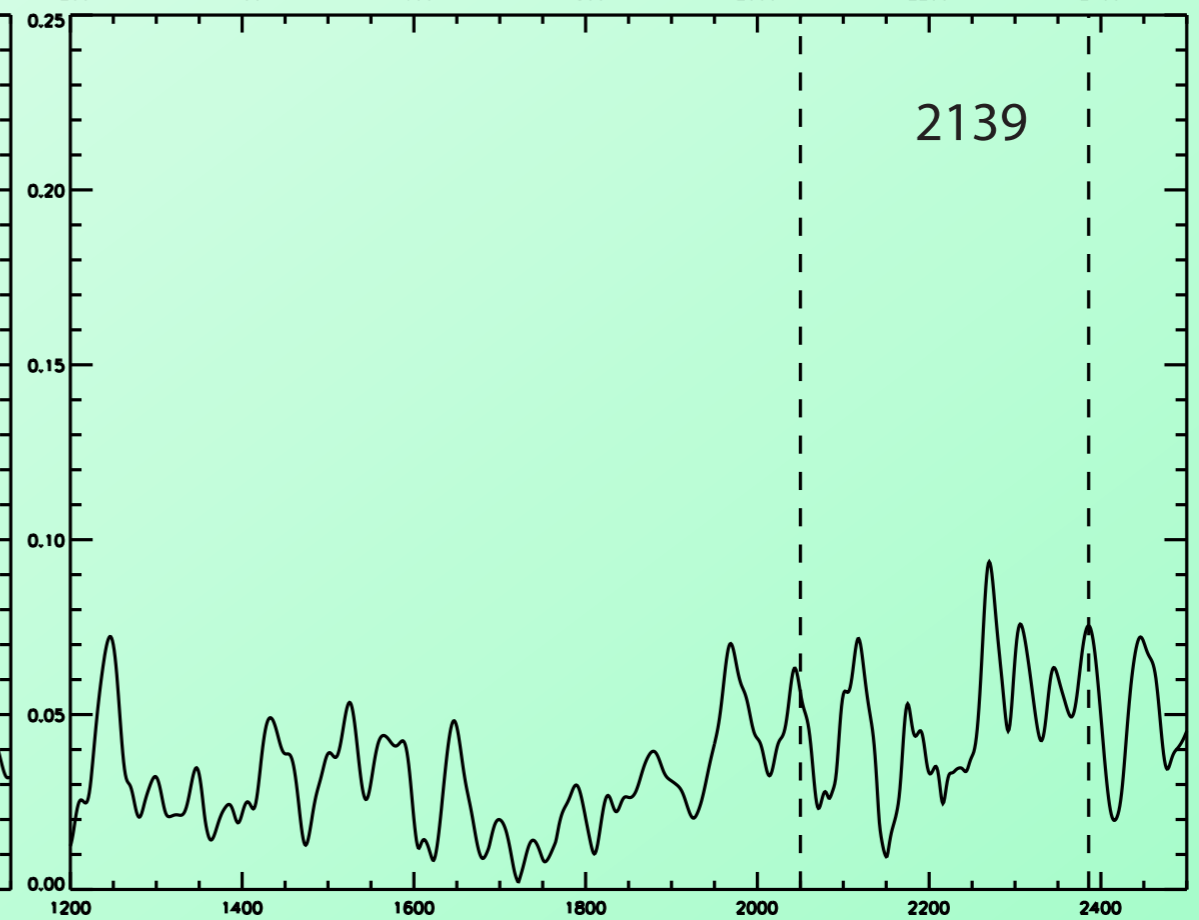
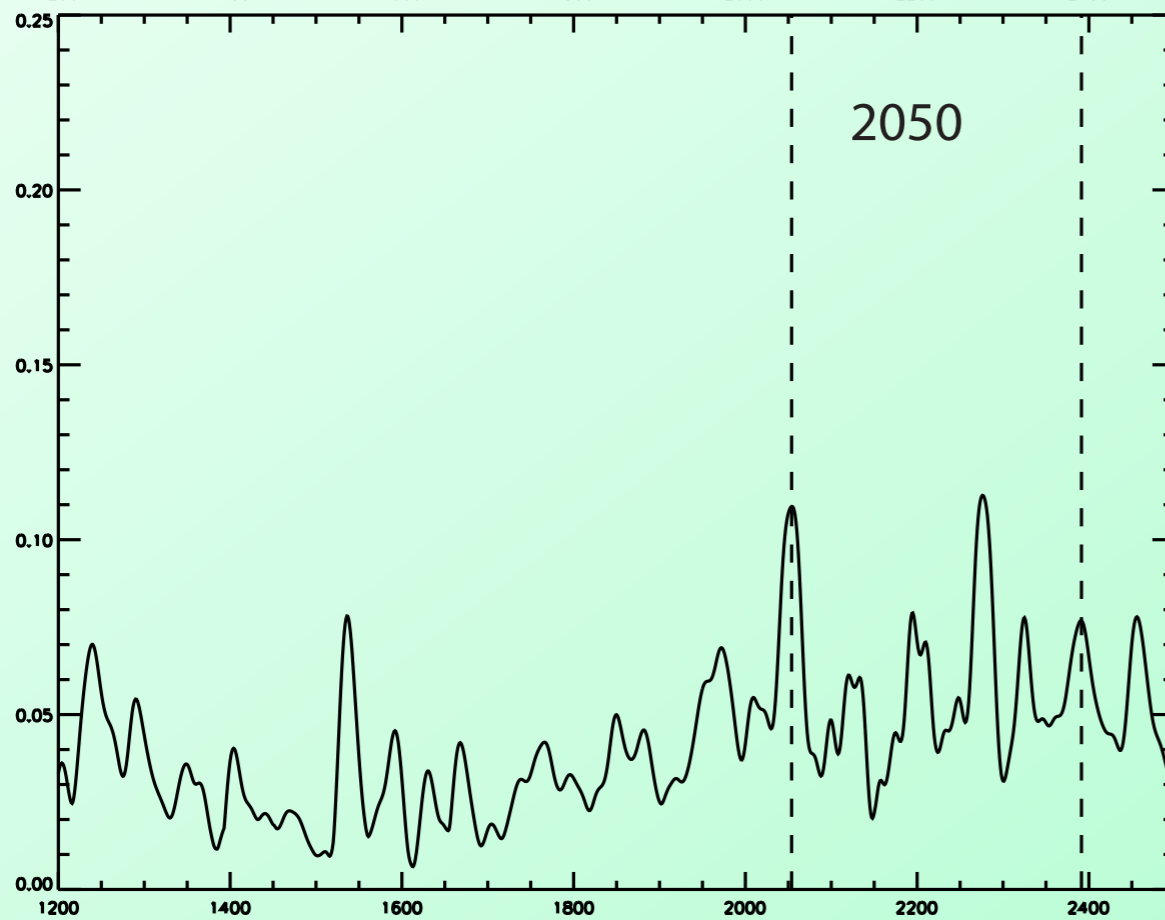
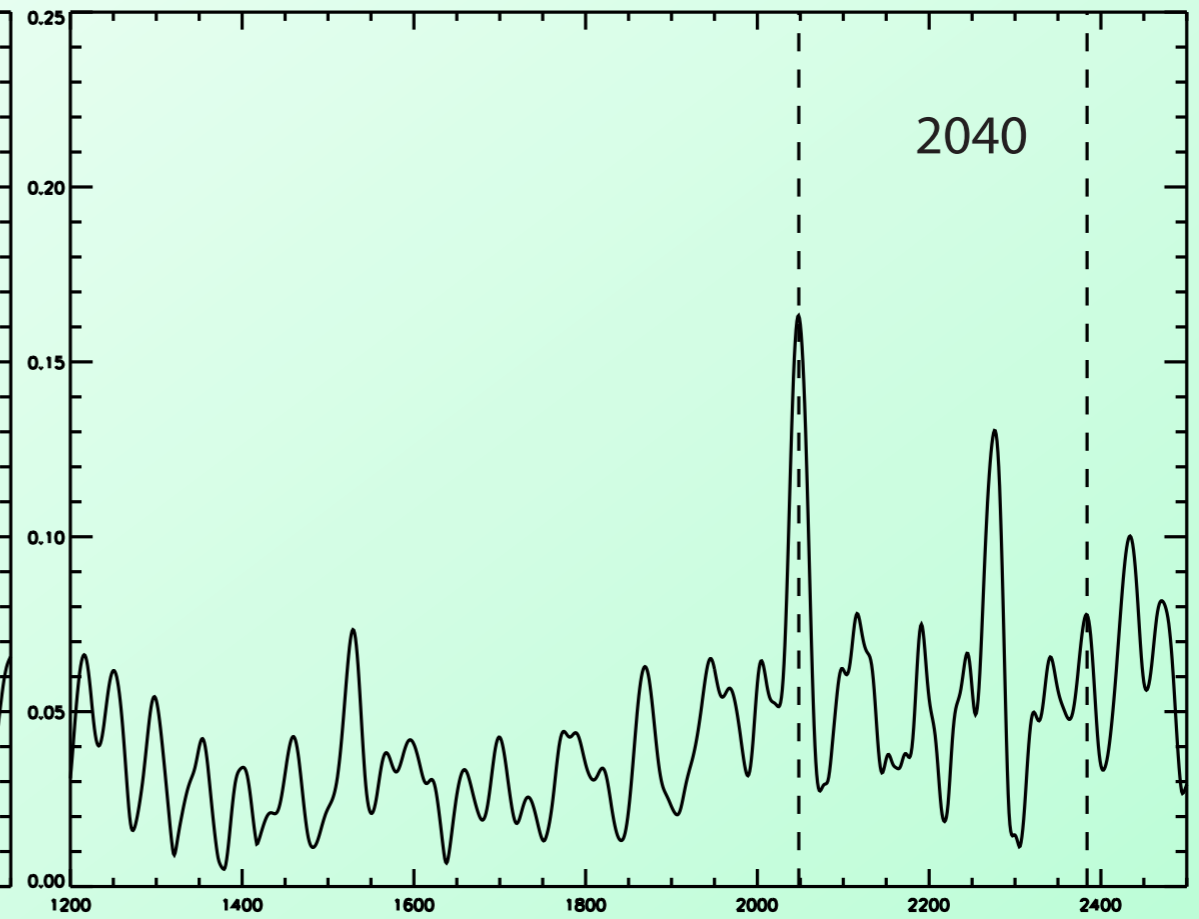
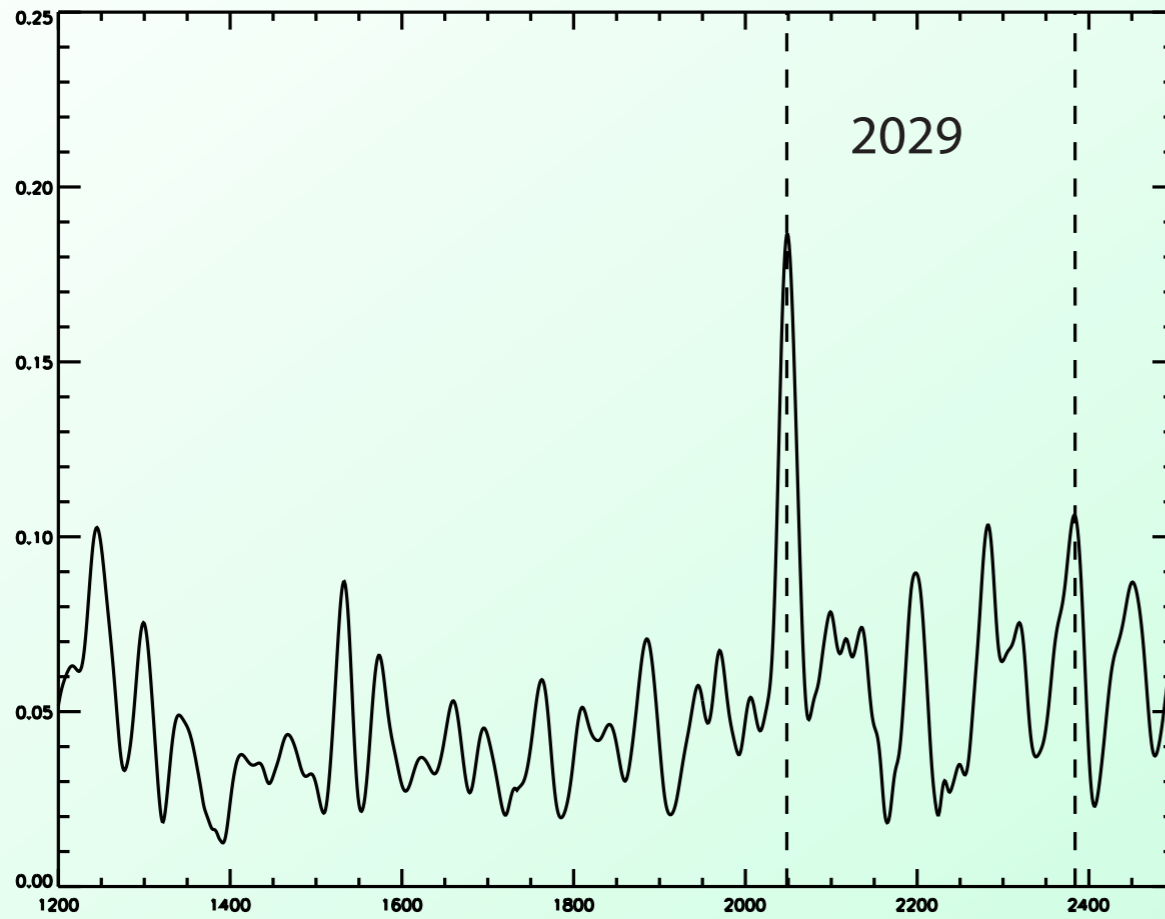
# 13-14 Feb 2010

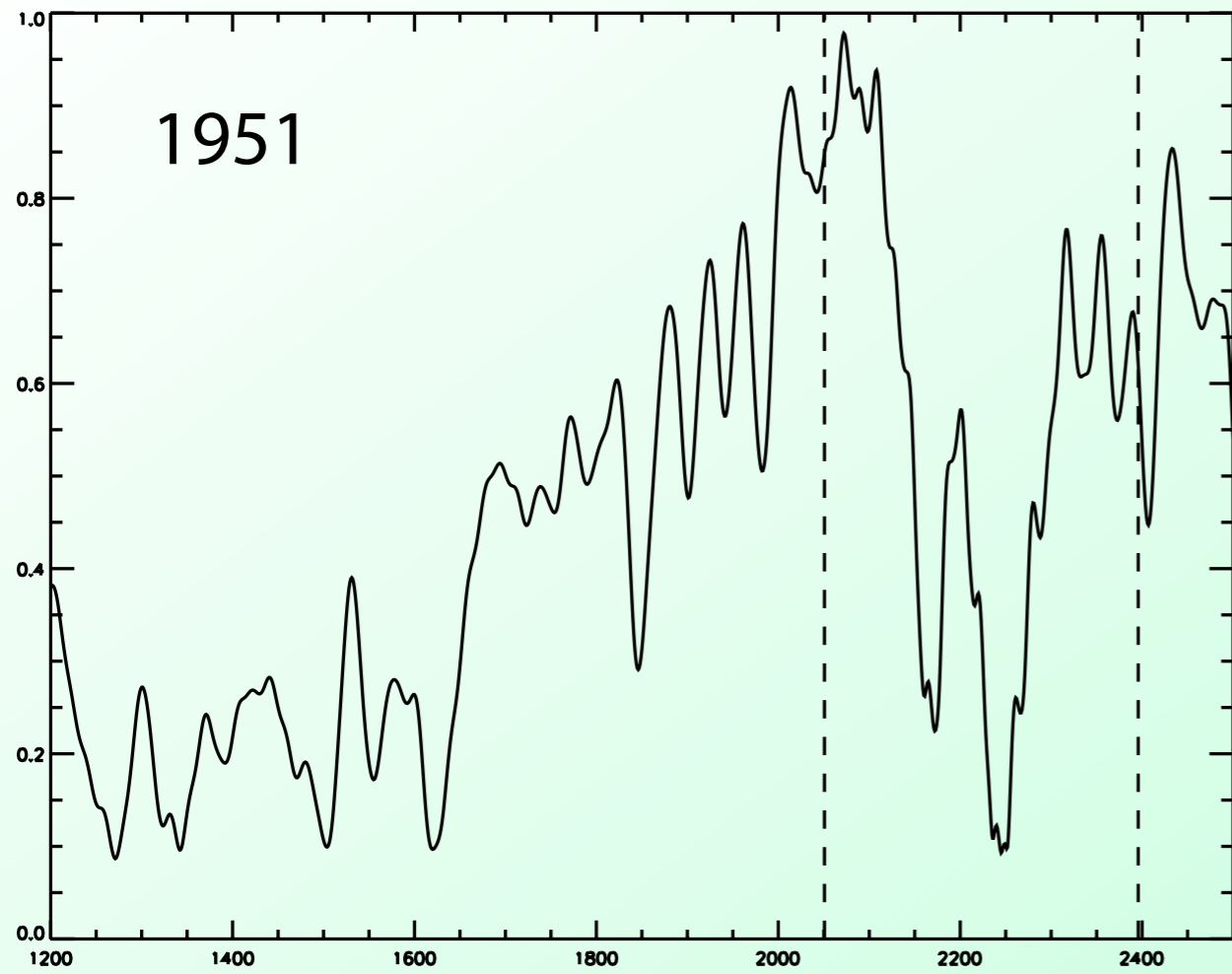


18 Feb 2010

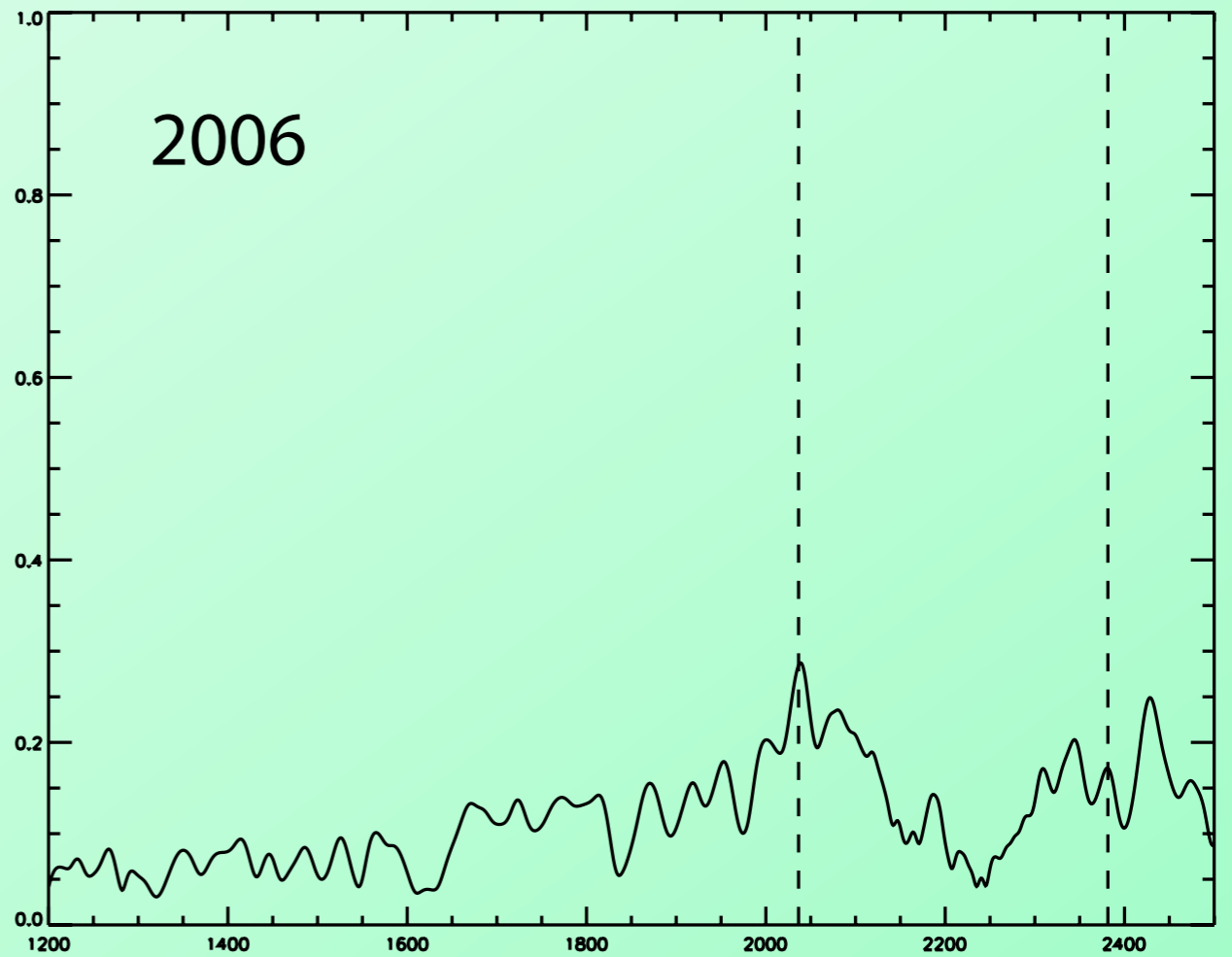
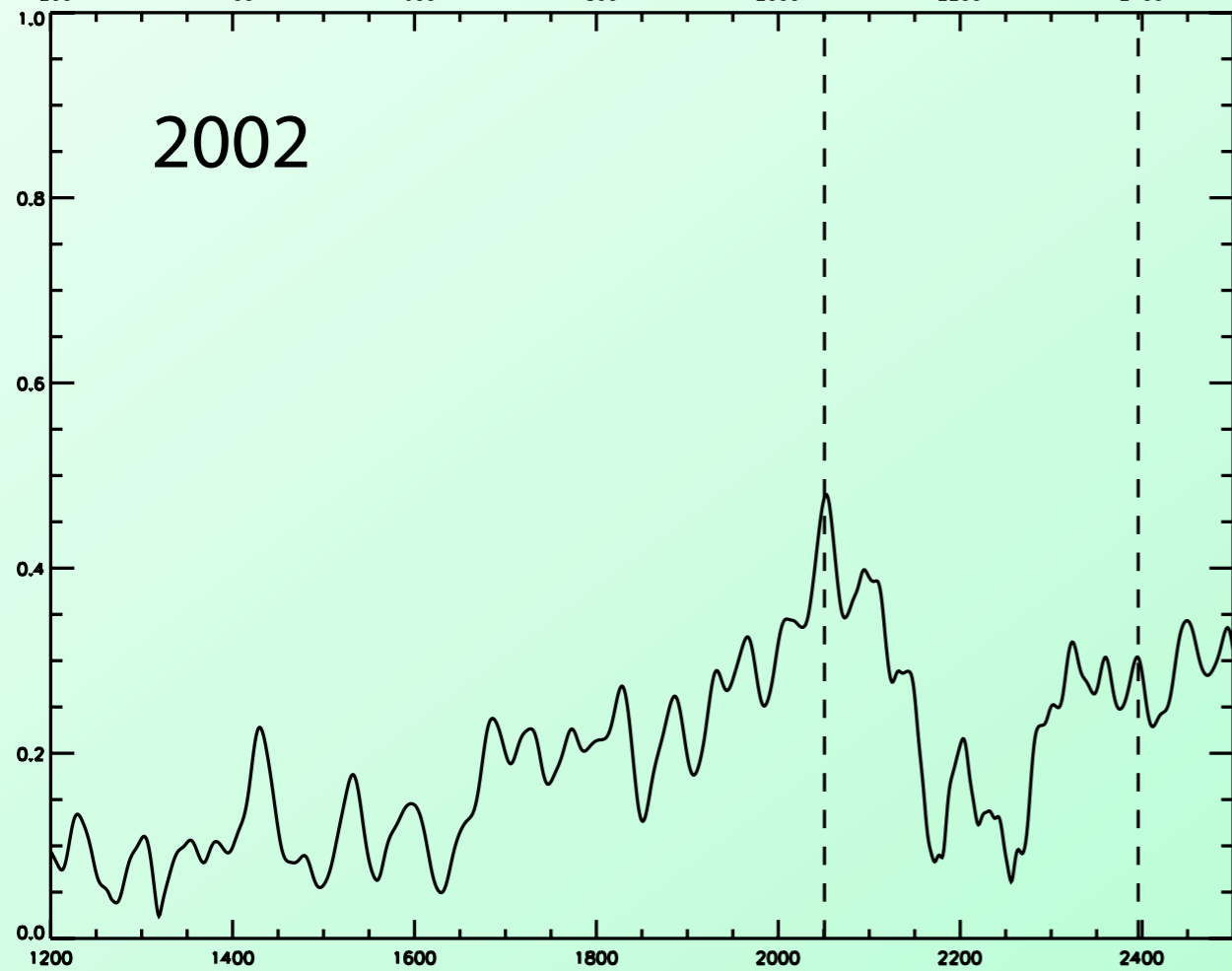


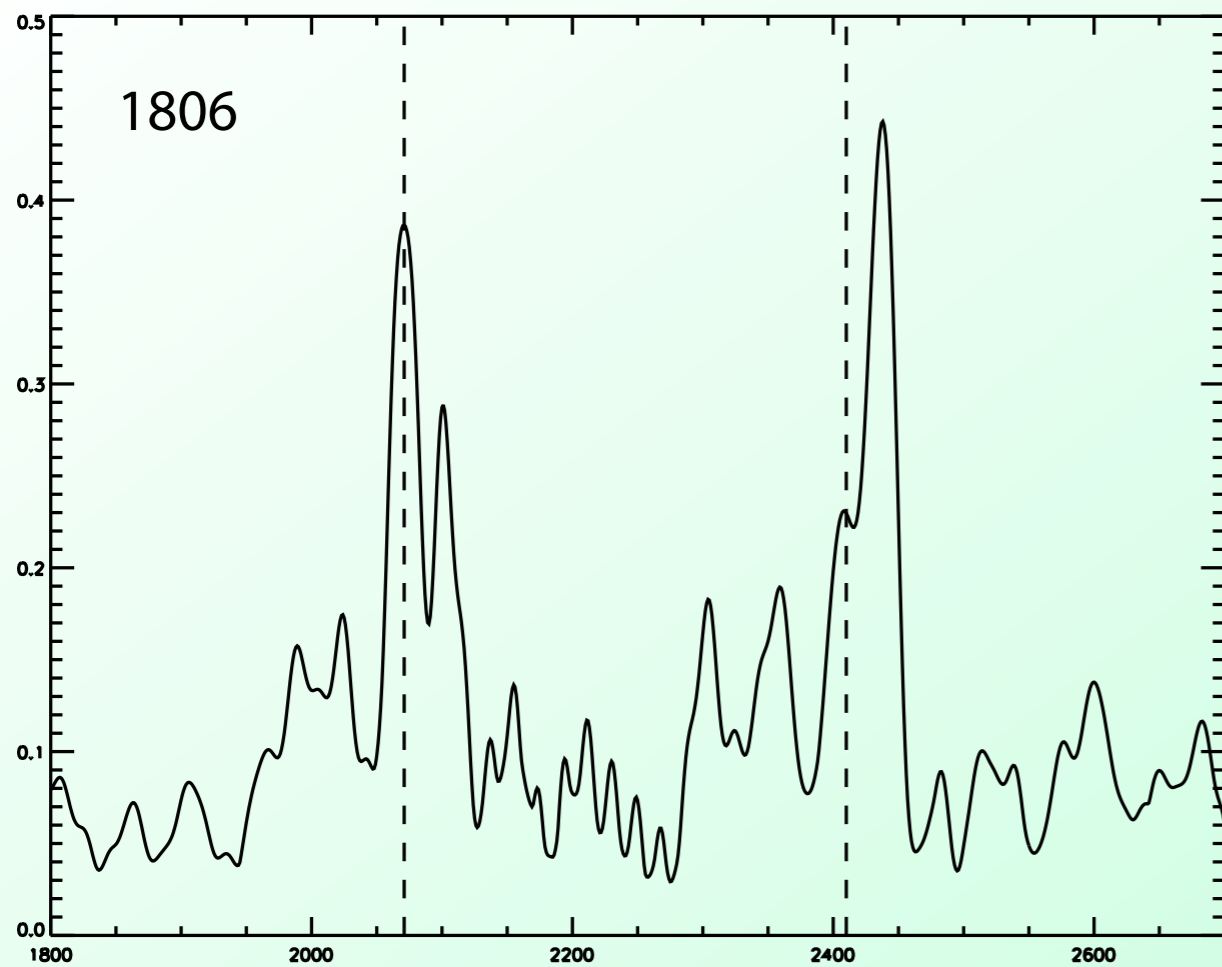
# 17 Mar 2010





17 Mar 2010

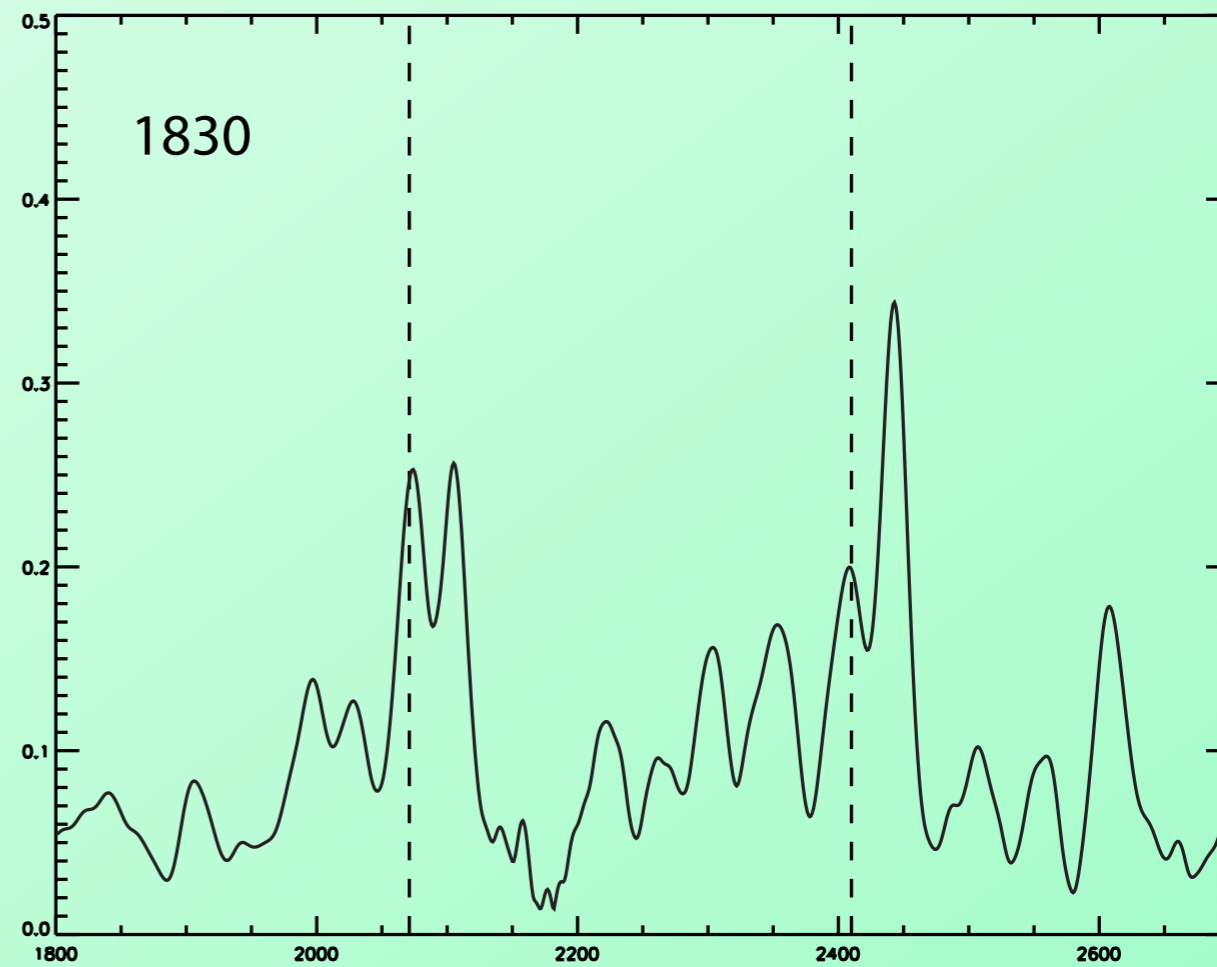
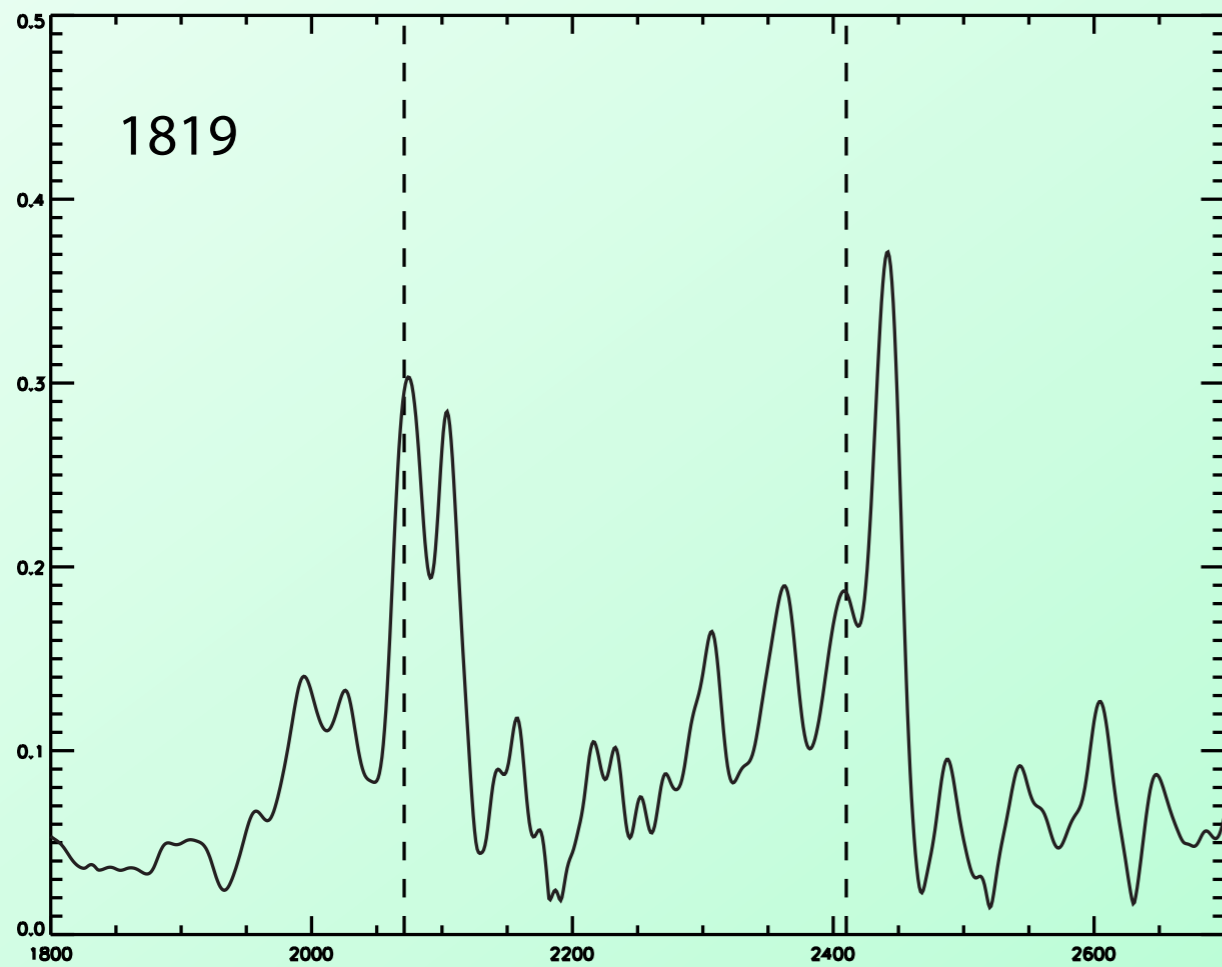




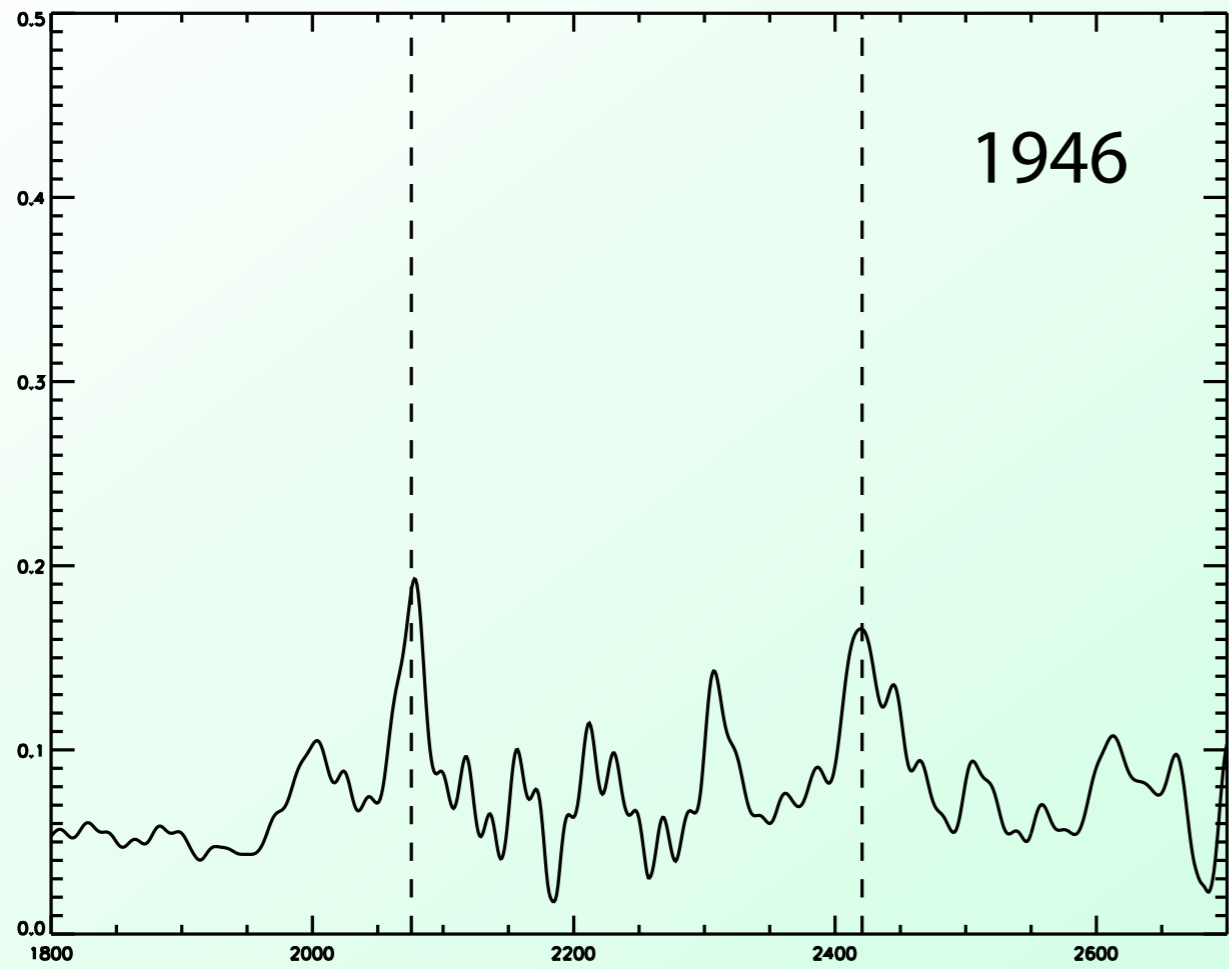
20 Dec 2003

Area of 3726.04 Å Peak

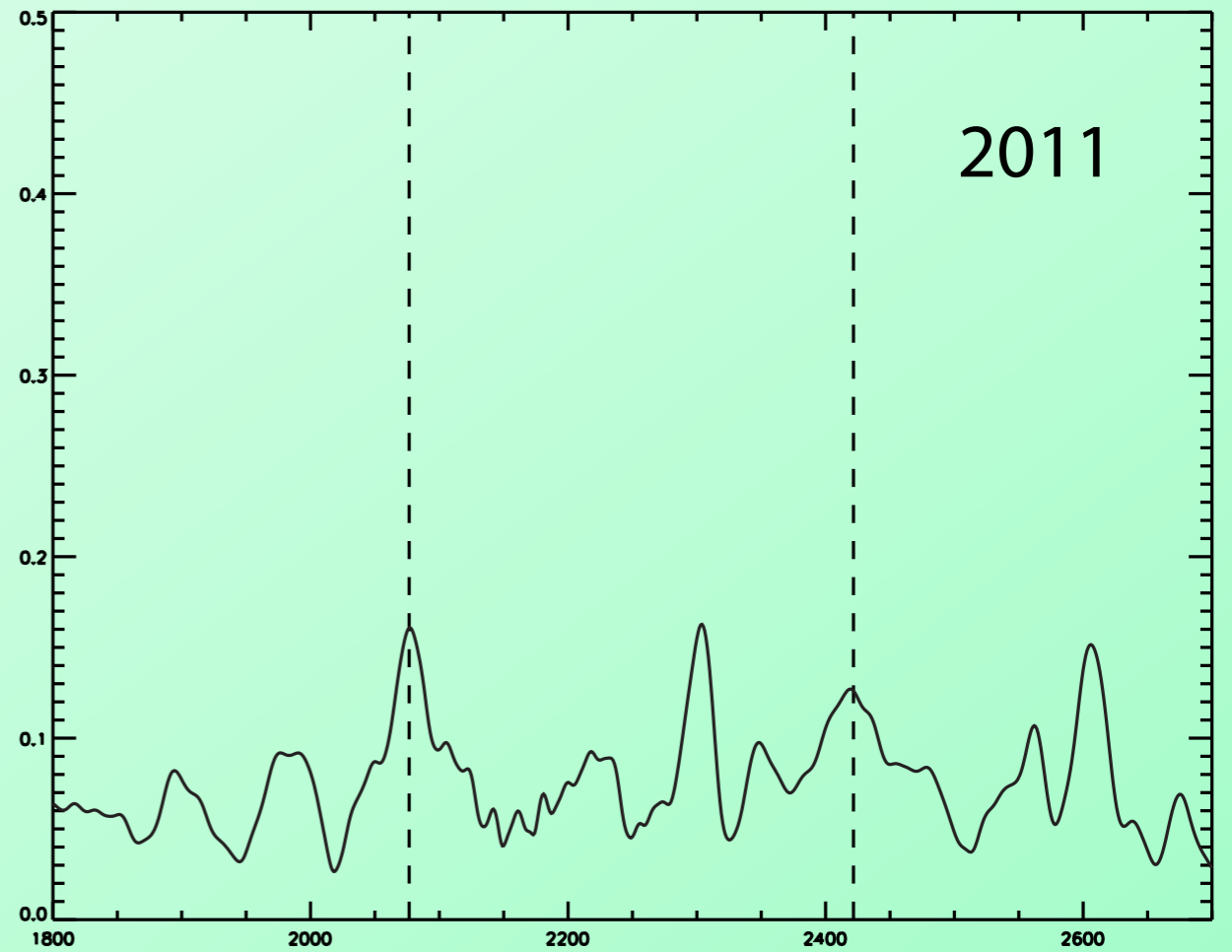
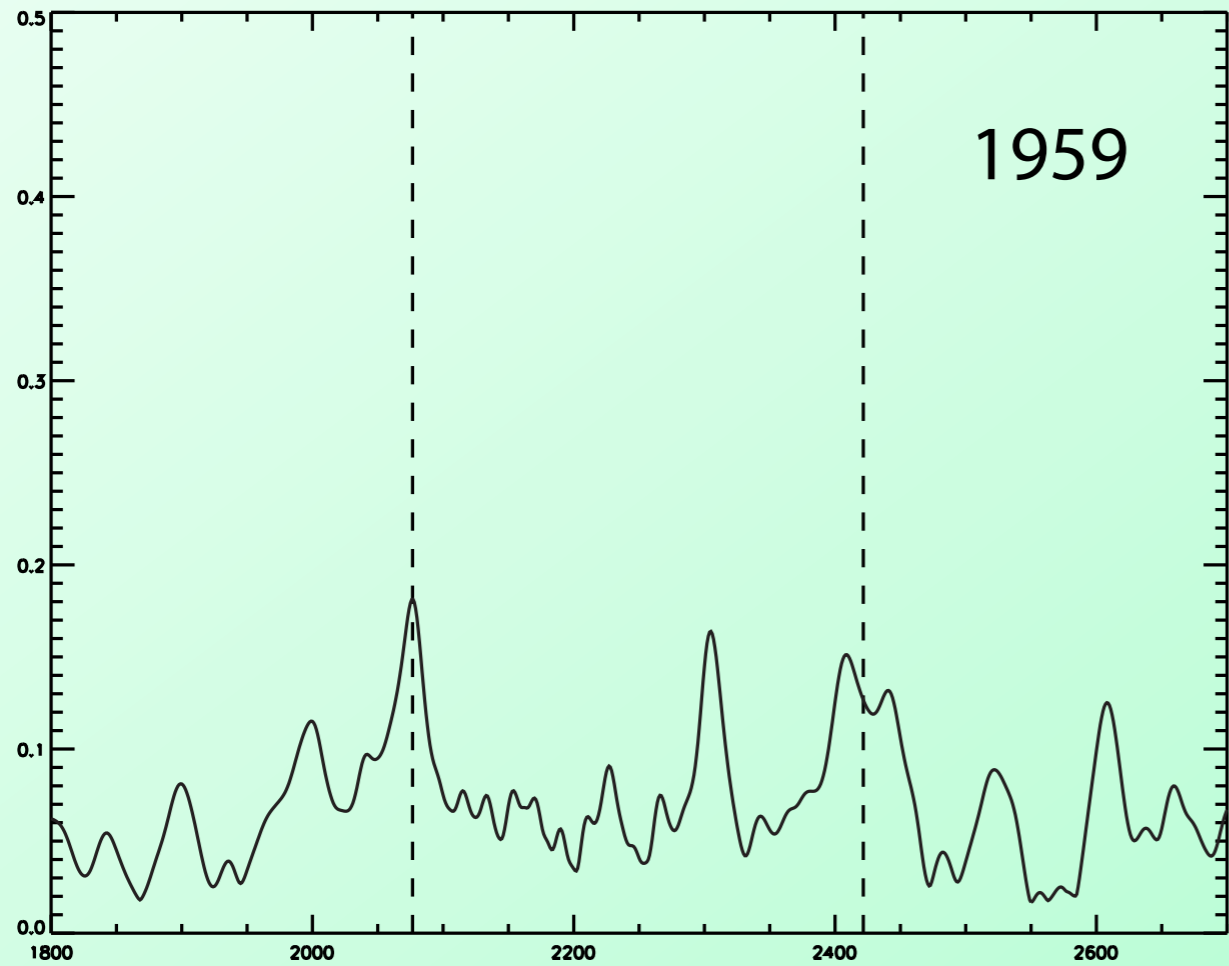
	Terrestrial	Galactic
1806	8.06	2.15
1819	6.94	2.47
1830	4.42	2.21



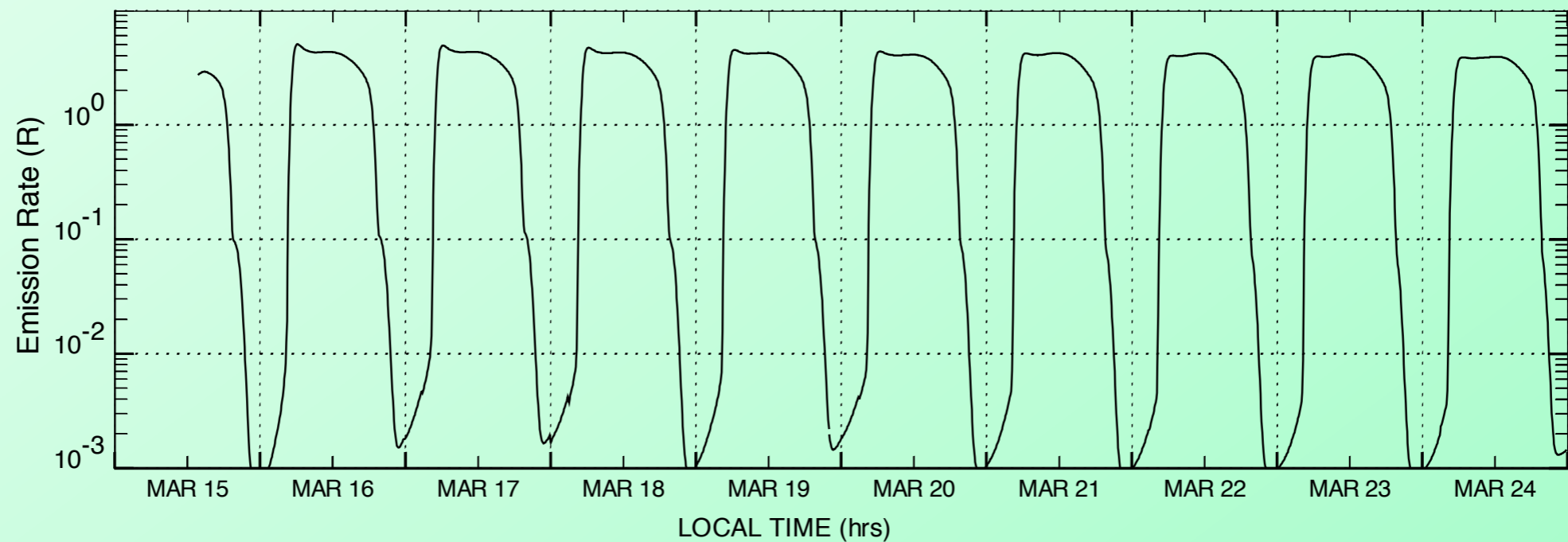
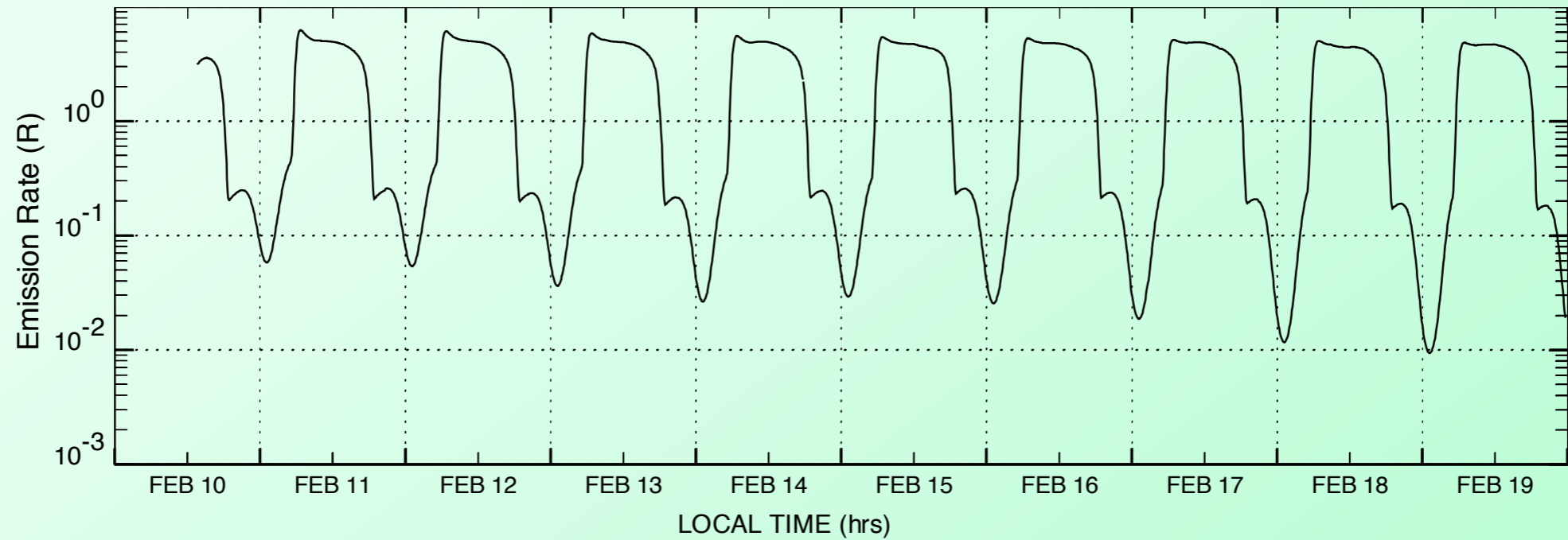




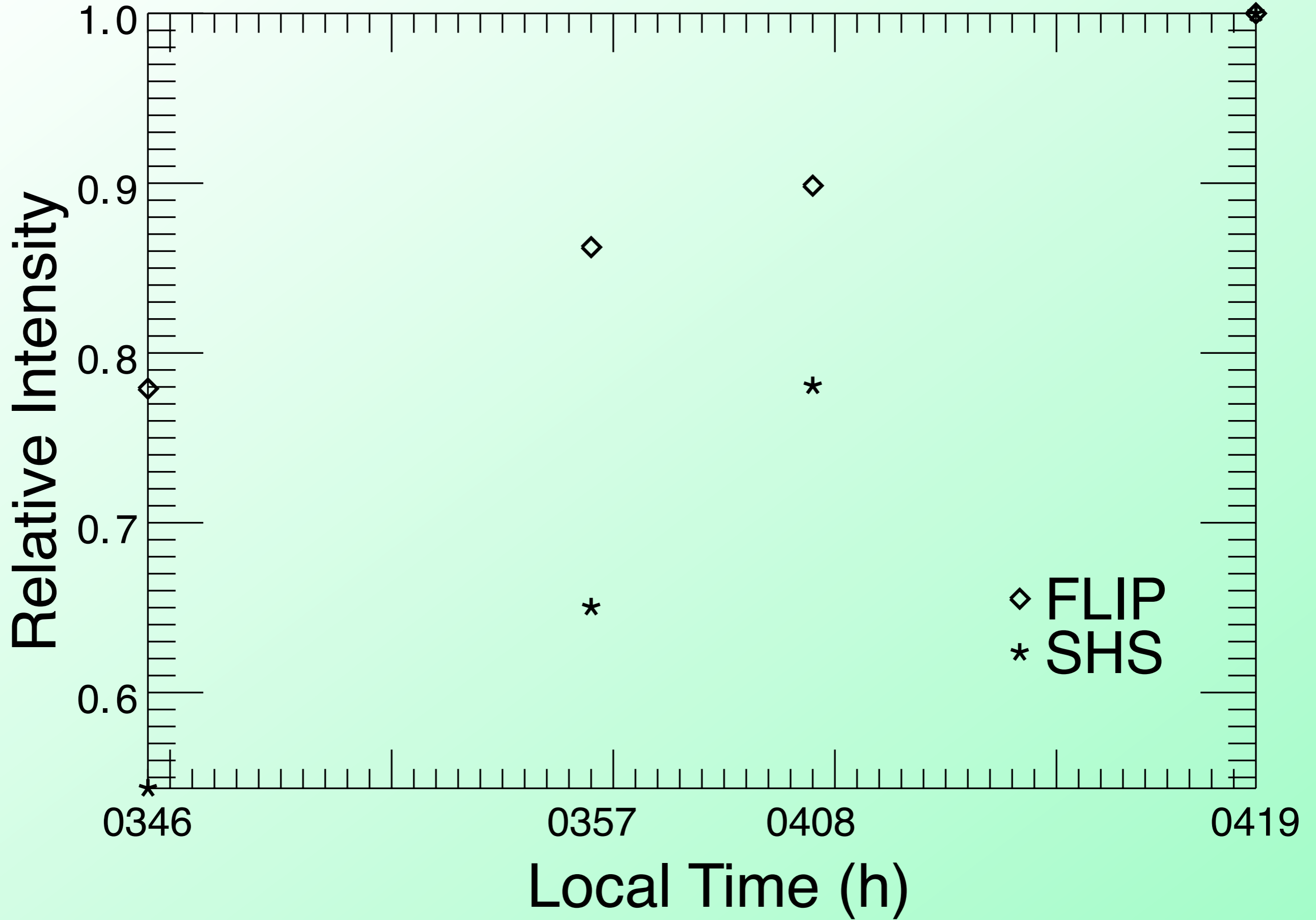
21 Dec 2003



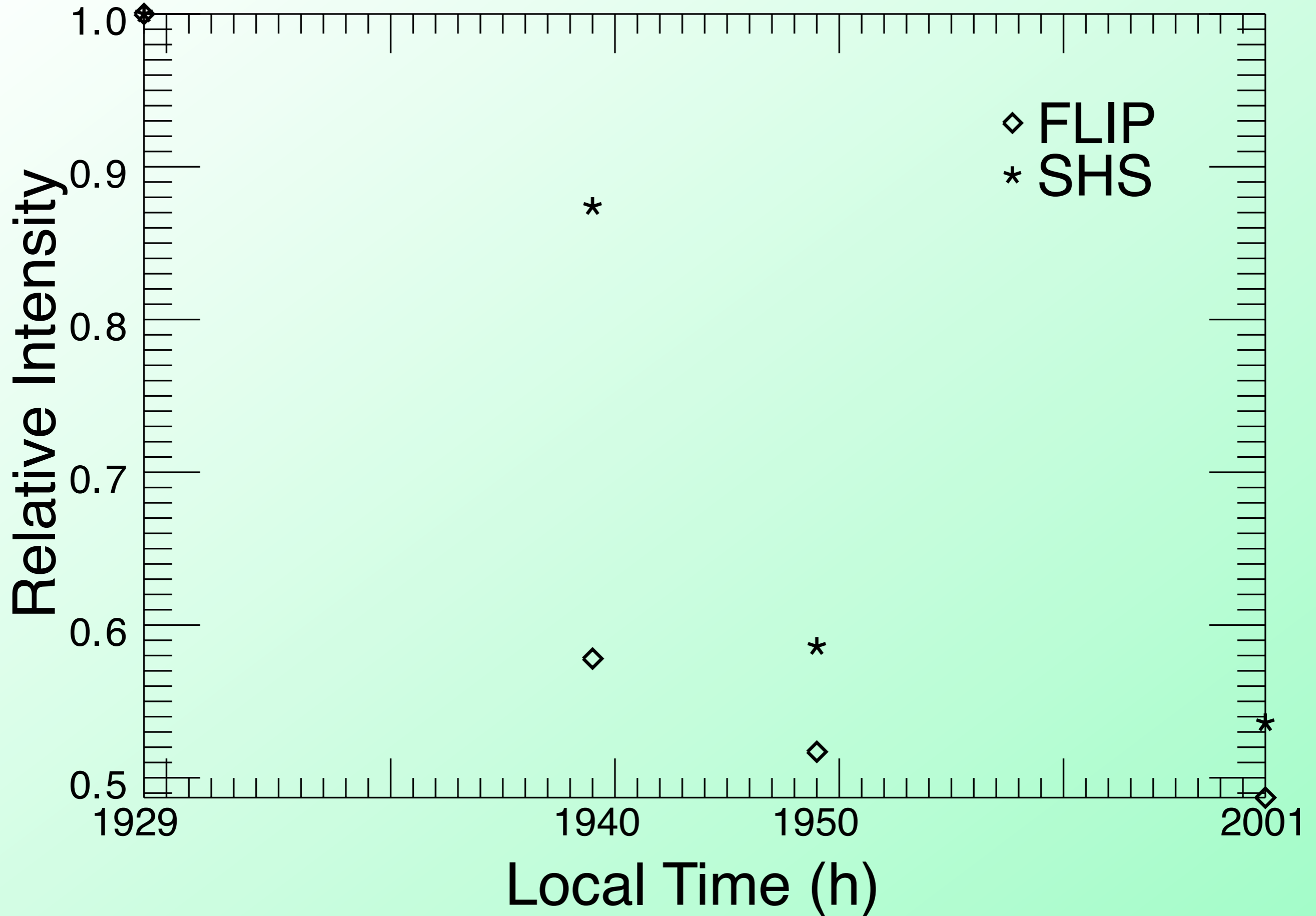
# Conjugate Point Modeling

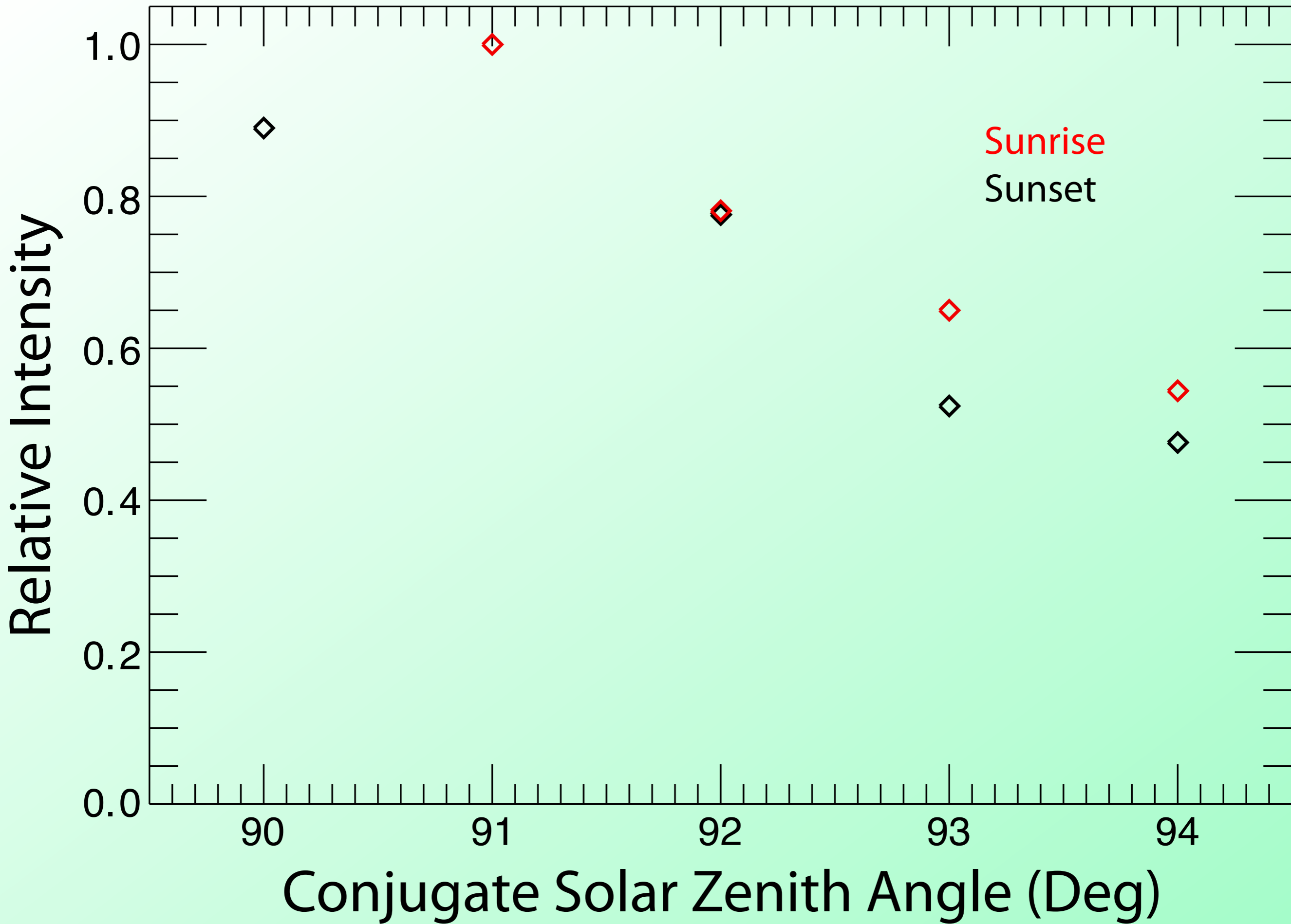


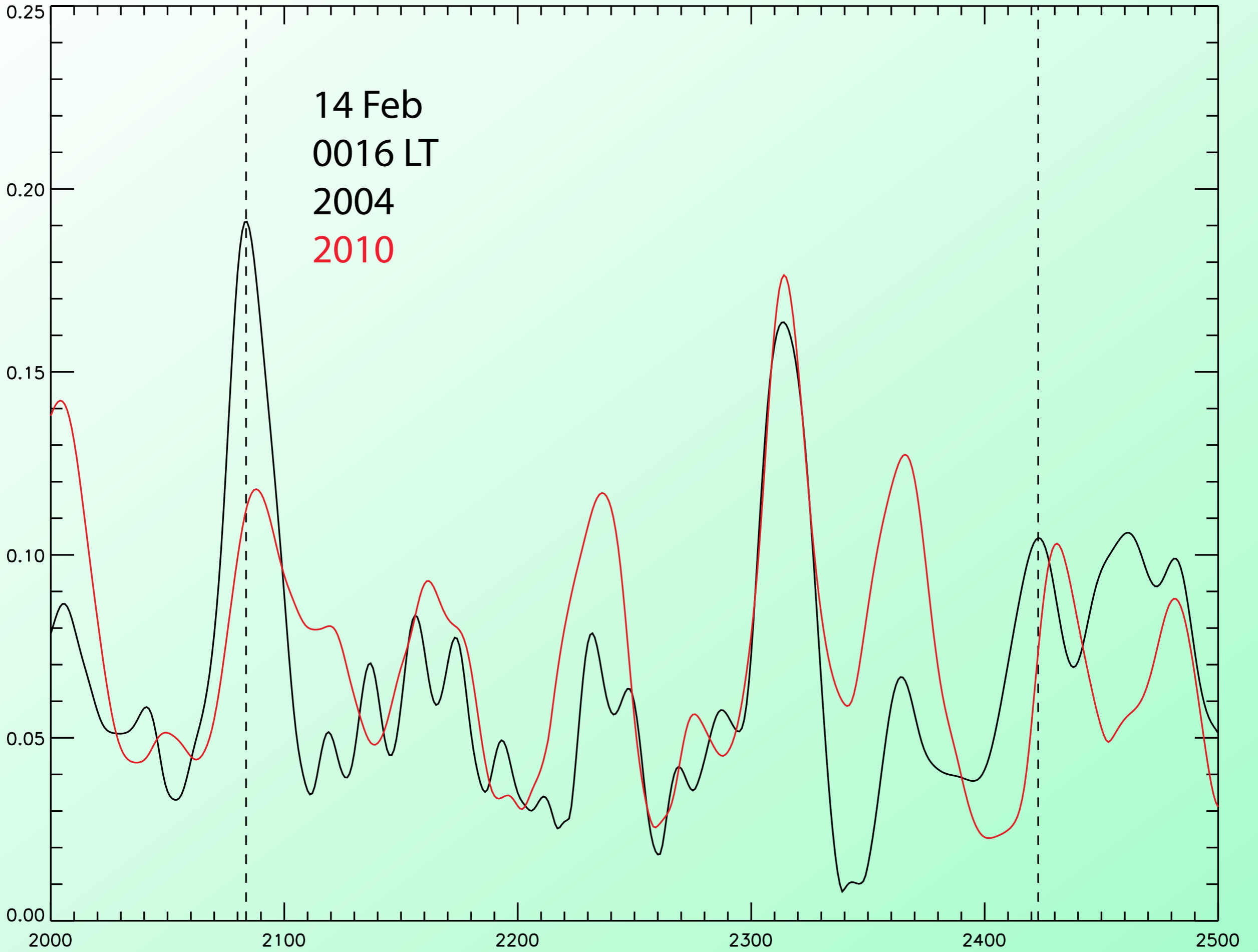
18 Feb 2010



17 Mar 2010







# Future Work

- Absolute intensity calculations for the SHS observations are underway
- Why do repeat (same day/time) measurements not agree?
- Continue to take direct atmospheric observations and harvest from galactic data
- Simultaneous  $3727\text{\AA}$  and  $7320\text{\AA}$  O<sup>+</sup> observations could give a more complete picture of electron and neutral density

# Conclusions

- 3727Å doublet under quiescent conditions has been observed with the SHS at the Pine Bluff Observatory
- Sunlight at conjugate point plays a large role in observed emission
- This presentation is way more gnarly than anything Jonathan Snively is going to show now
- This research has been sponsored by NSF CEDAR Postdoc Grant ATM-725239