

# STELLAR ROTATION FROM UV MEASUREMENTS

## WHY WE NEED UV BAND OBSERVATIONS

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# Contents

- Why studying stellar rotation?
- Why study the Sun as a star?
- Why using UV observations?

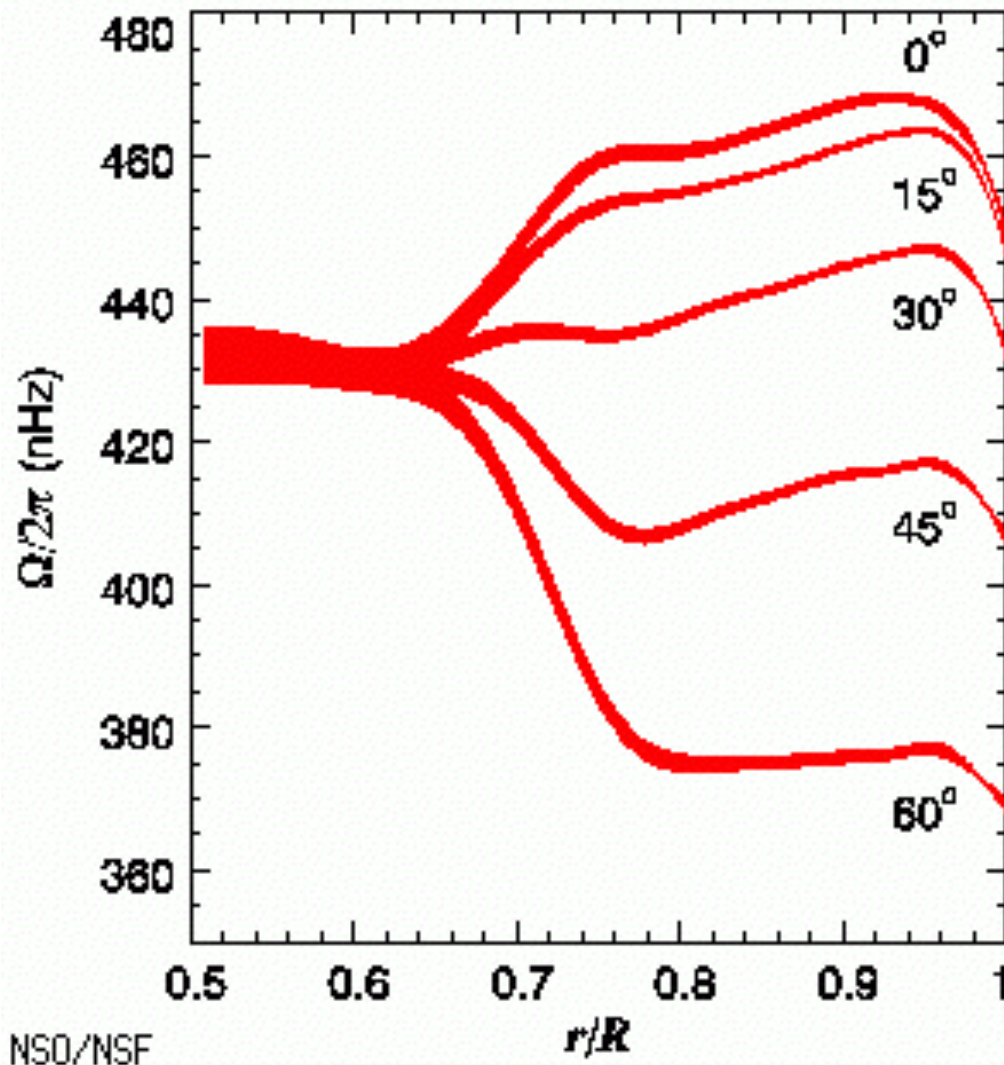
# Why rotation?

- Stellar magnetism! Rotation and differential rotation are two key ingredients of dynamo effect

## Why Sun-as-a-Star?

- We can learn a great deal about the Sun without actually making images
- We can also calibrate simple time-series signatures against image reality on the Sun
- Doing so, we can understand stellar time-series

# Importance of differential rotation in dynamo



Lat 15: ~447 nHz

Lat 30: ~432 nHz



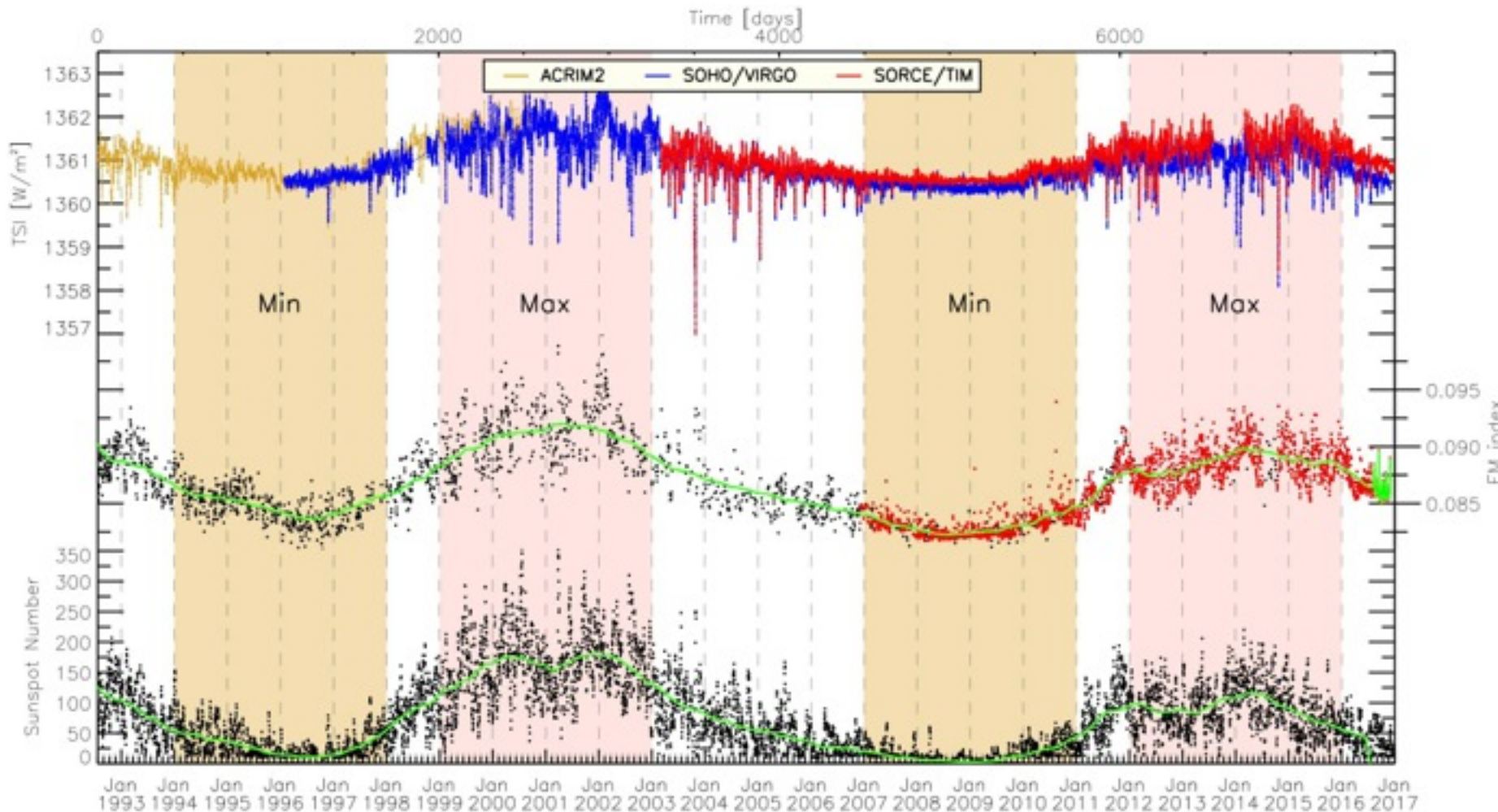
Lat 15: 25.89 days

Lat 30: 26.79 days

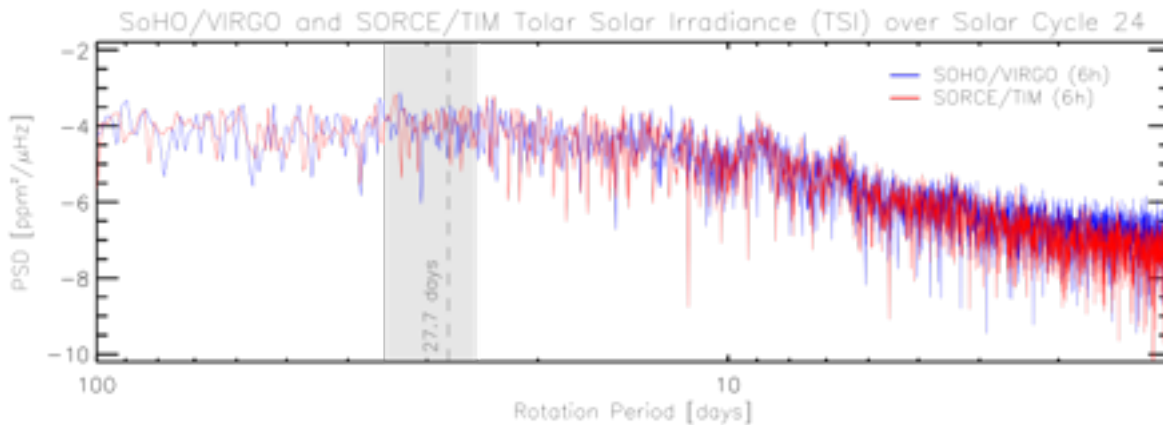
(synodic)

# Rotation in the visible

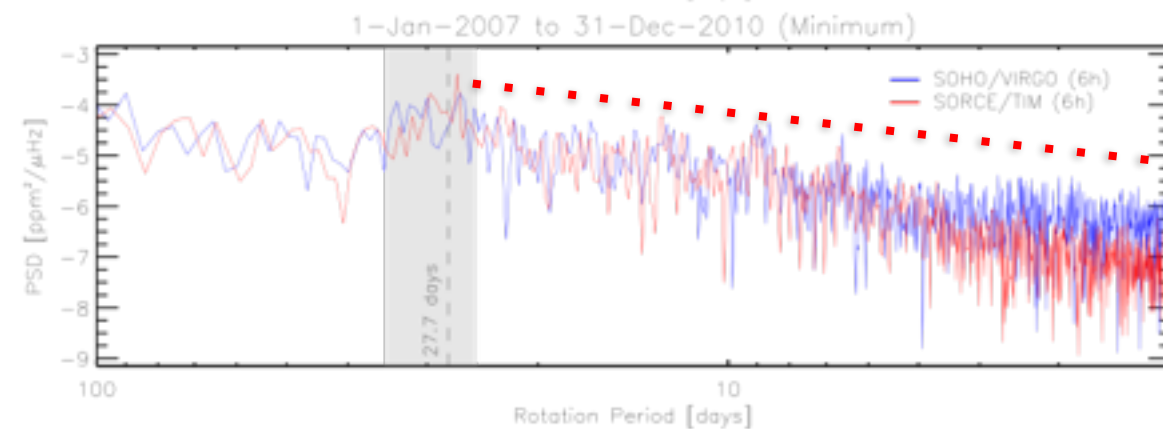
TOTAL SOLAR IRRADIANCE (TSI) combined for CYCLE 23 & 24



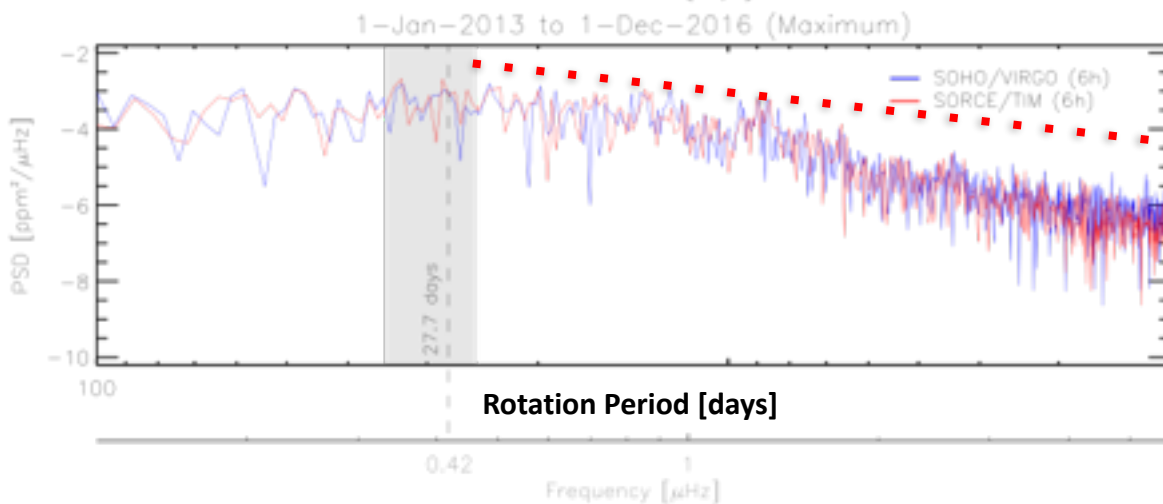
Do Nascimento et al. (2017)



Power Spectra Density  
for the TSI over  
a complete  
solar magnetic cycle



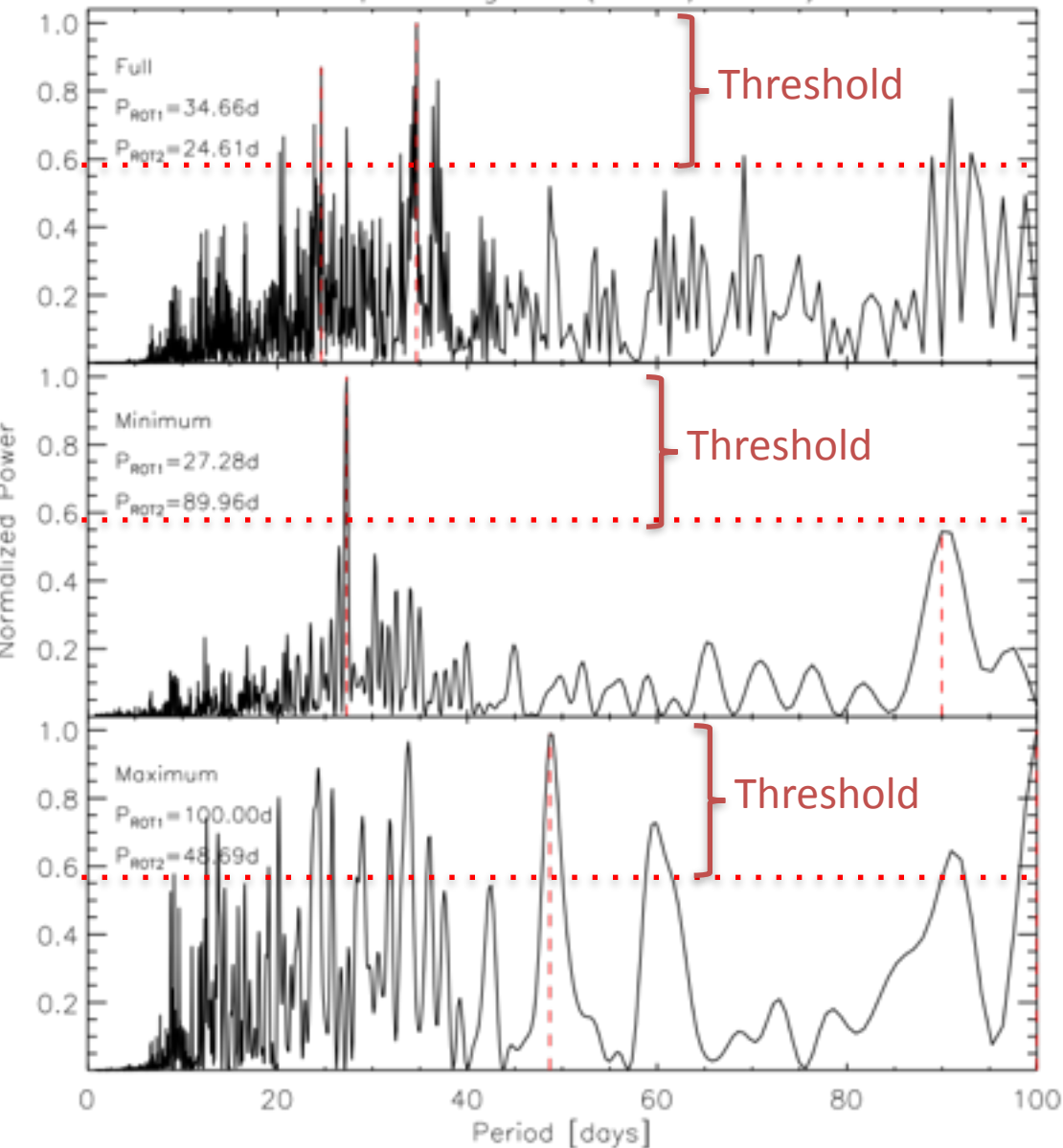
Rotation signature at  
minimum epoch



Rotation signature at  
maximum epoch

**=> Rotation signature not  
very clear  
in the visible**

LS periodogram (SOHO/VIRGO)



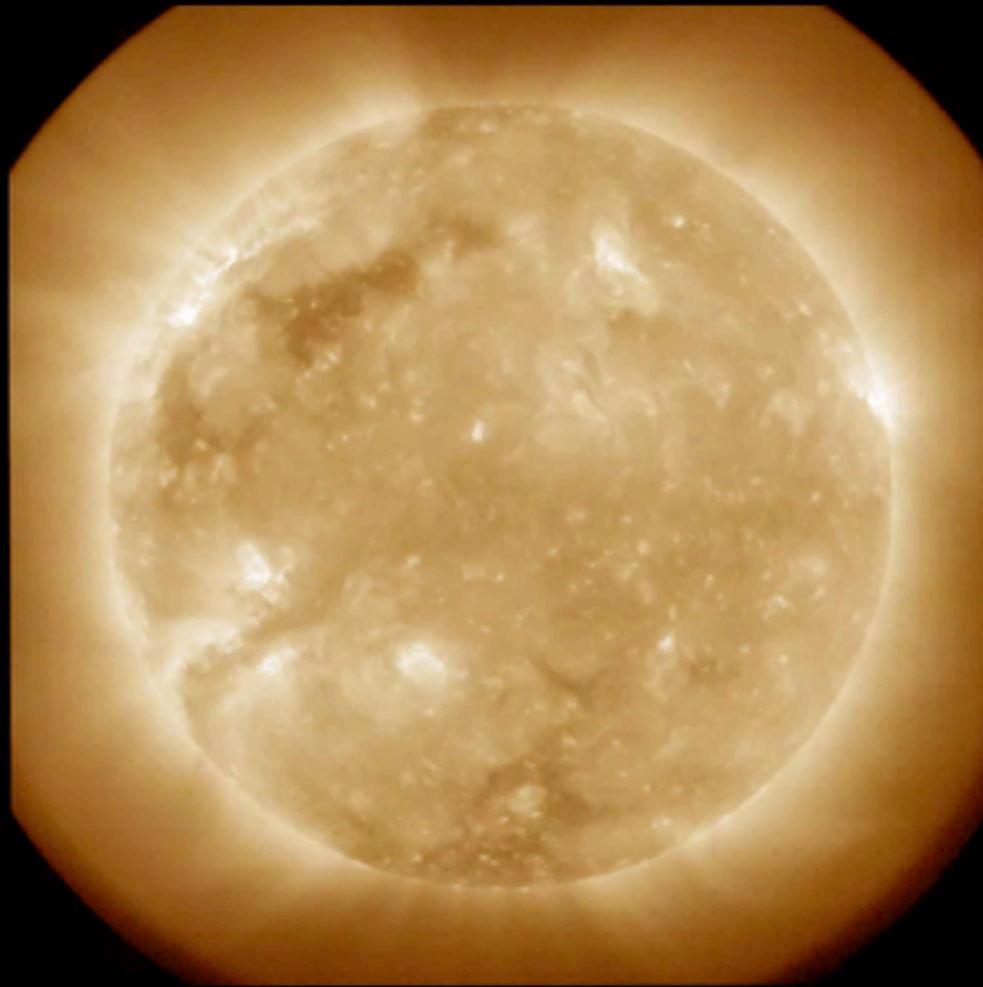
Lomb Scargle Periodogram  
for the TSI over  
a complete  
solar magnetic cycle

Lomb Scargle Periodogram  
for the **Minimum** epoch

Lomb Scargle Periodogram  
for the **Maximum** epoch

=> Rotation signature not  
very clear  
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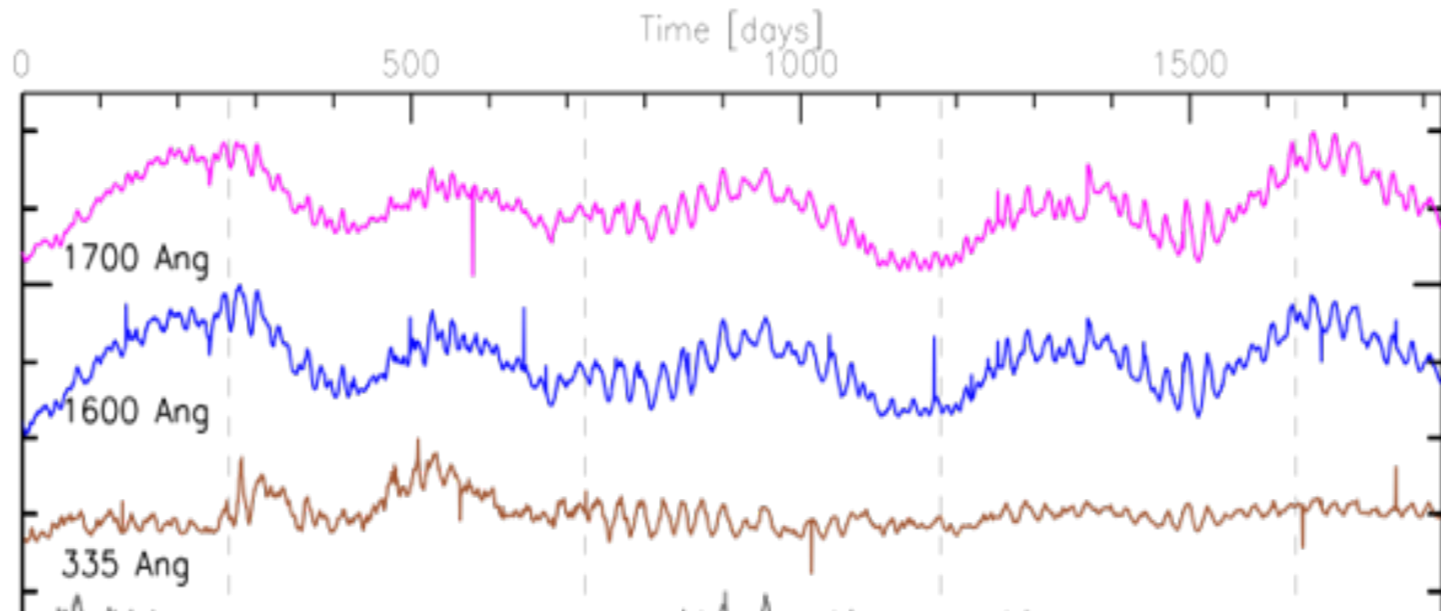
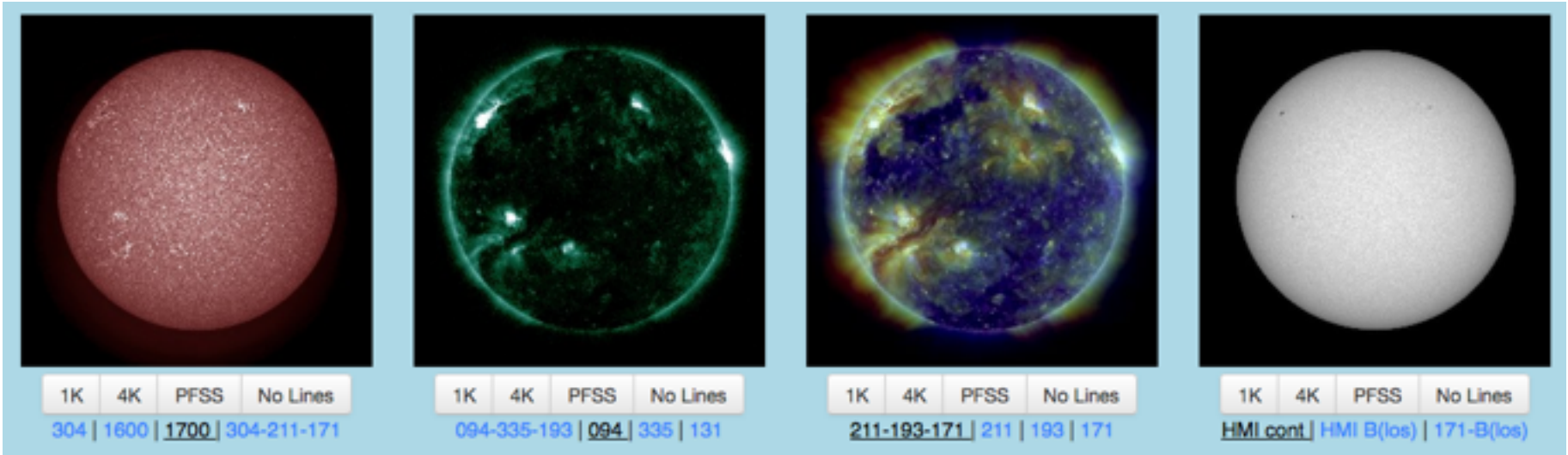
# A look at UV (and EUV) data: AIA data





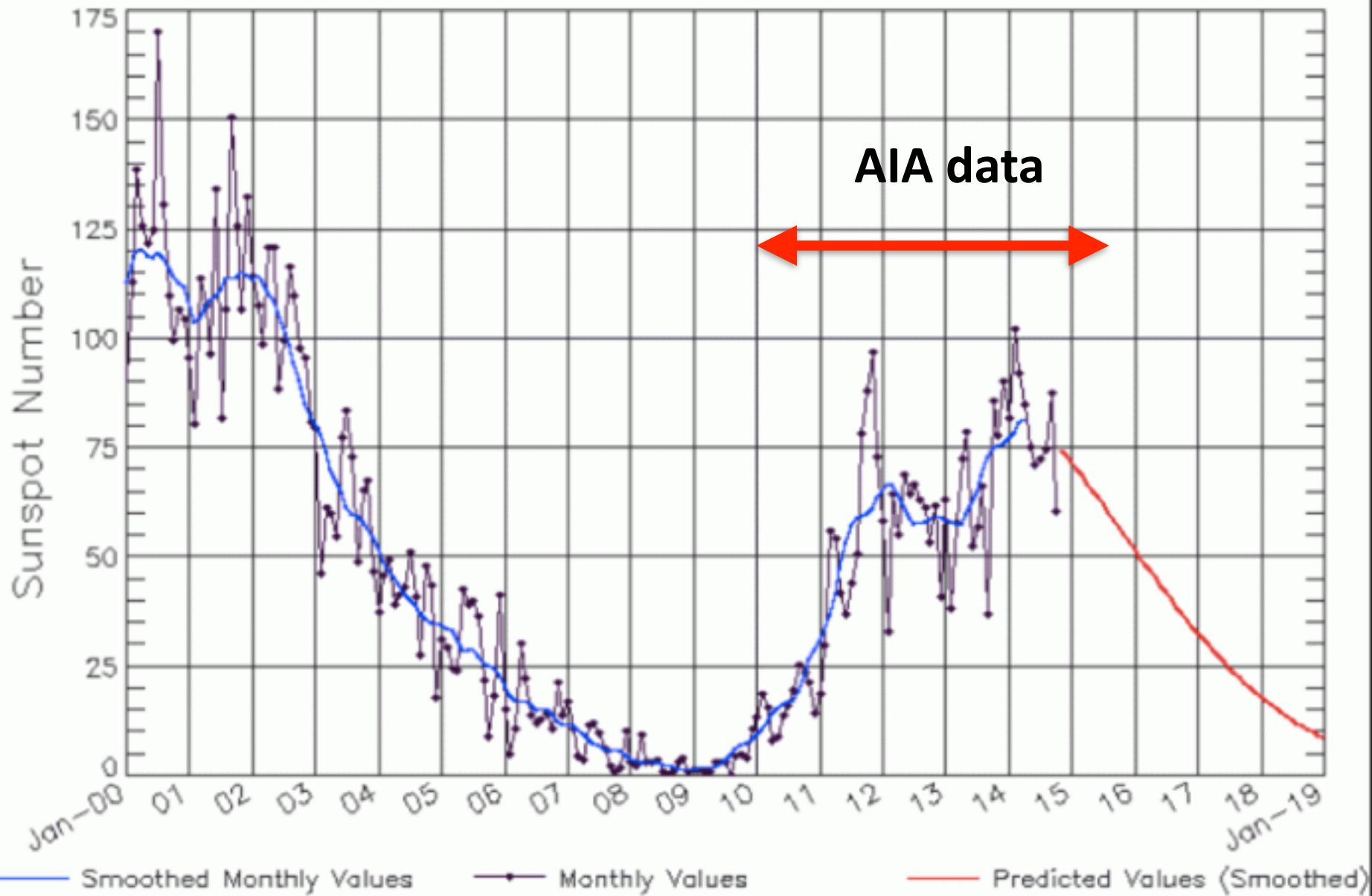
# Rotation in the UV

UV light curve from SDO images: 2010 - 2015

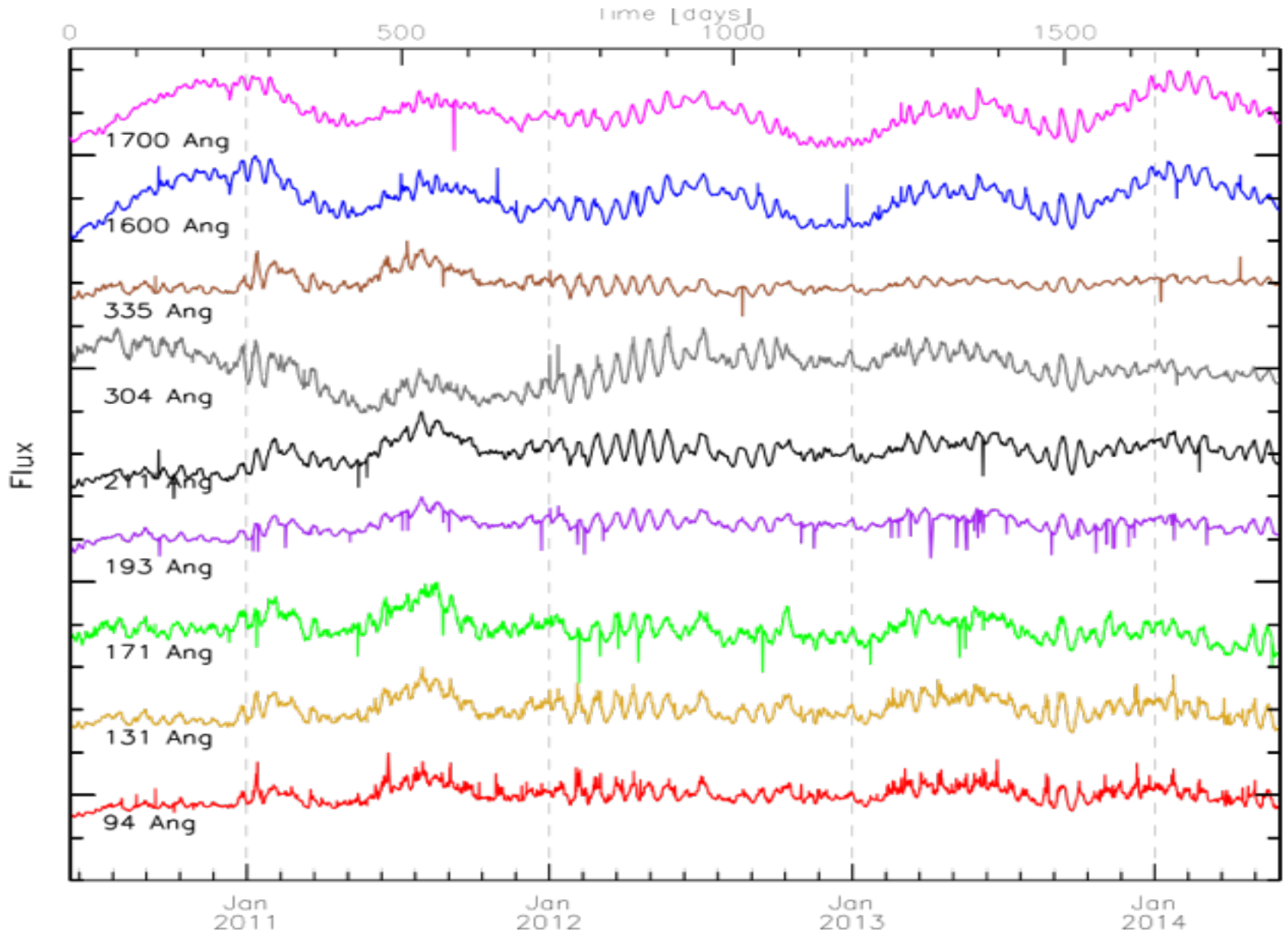


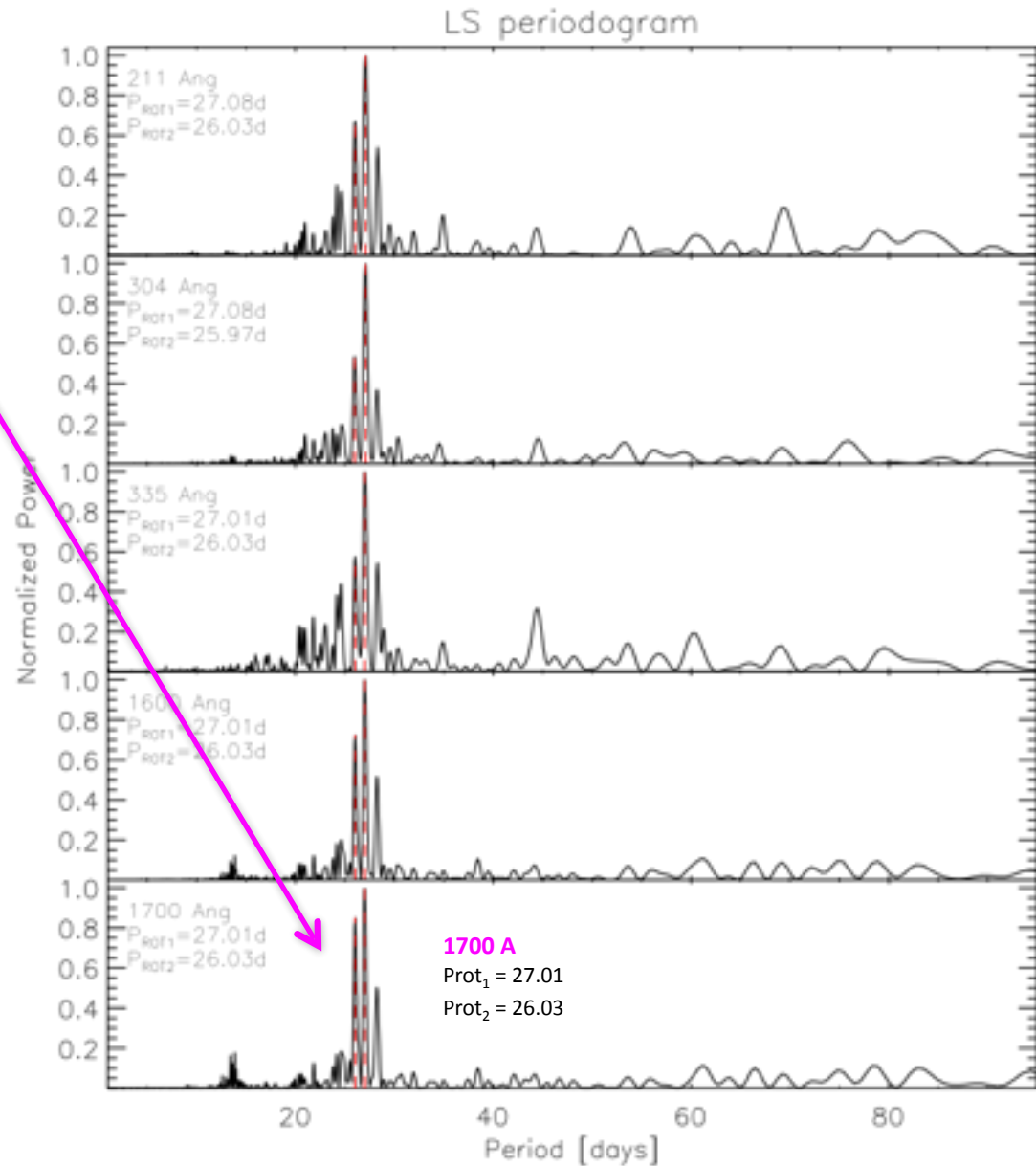
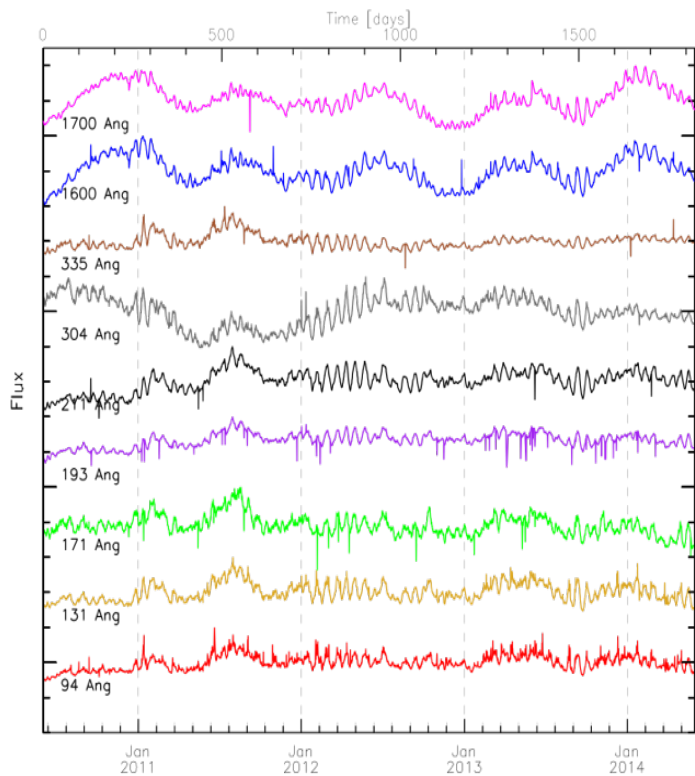
# ISES Solar Cycle Sunspot Number Progression

Observed data through Oct 2014



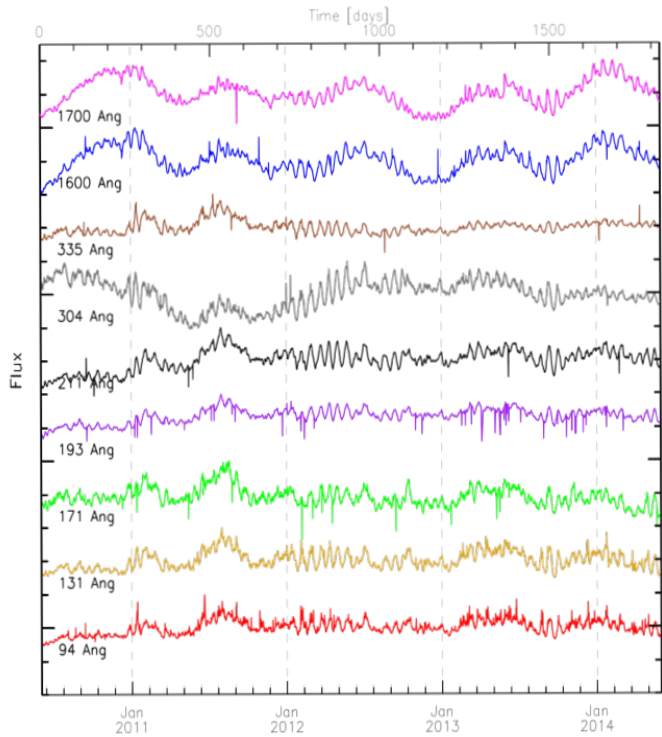
# (E)UV light curve from SDO images: 2010 - 2015



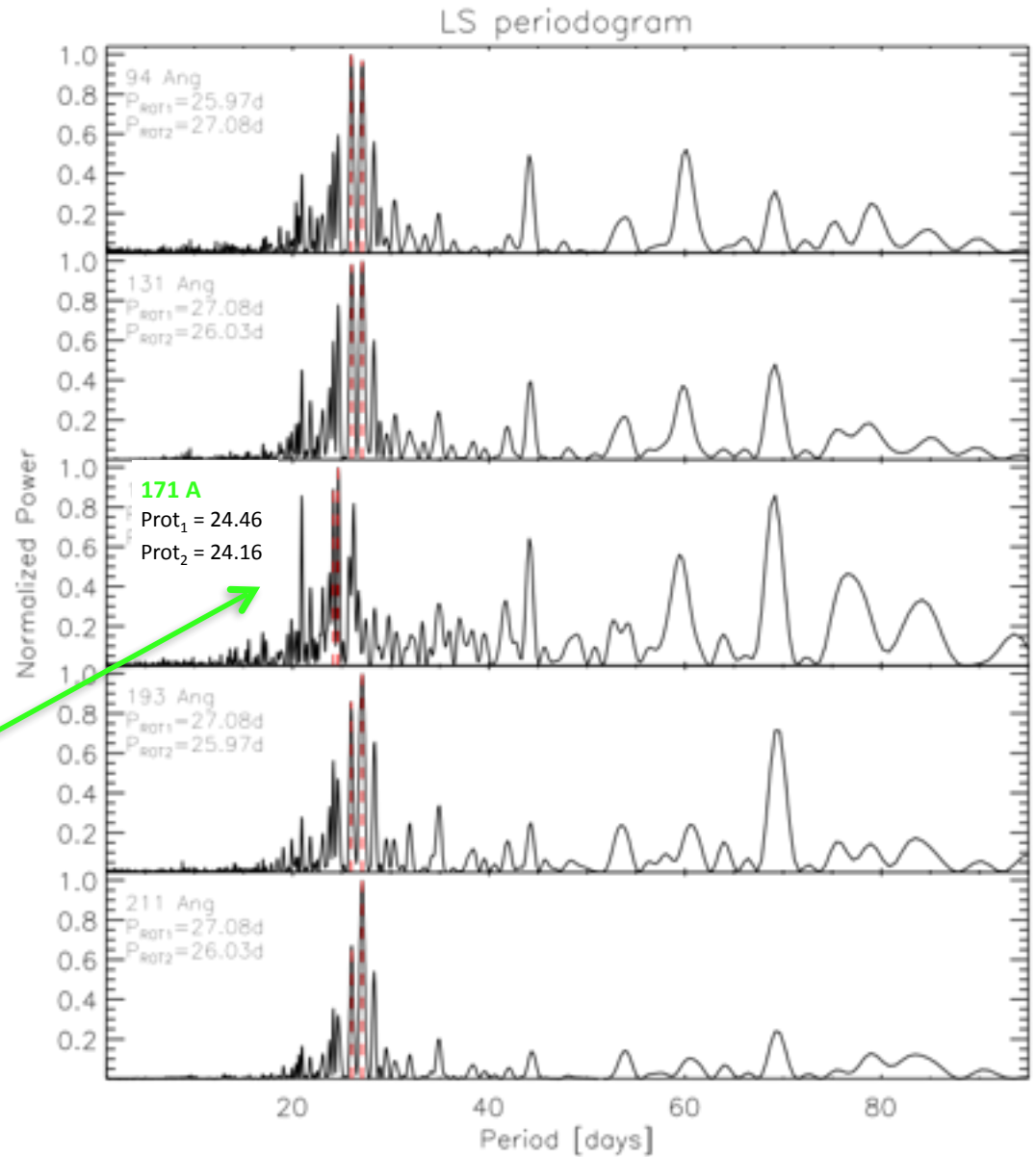


**=> Rotation signature  
much clearer  
in the UV !!!**

**1700 A**  
Prot<sub>1</sub> = 27.01  
Prot<sub>2</sub> = 26.03



**=> Rotation signature  
much clearer  
in the EUV !!!  
(and perhaps differential rotation)**



# Rapid conclusions

Clear signature of stellar rotation in UV

Signature of differential rotation? (better than in optical anyway)

Not only rotation but stellar magnetic activity too (comparison with optical could be interesting)

Routine, long-term but short exposure, photometric or low-res spectroscopic, multi-object observations  
=> great scientific return!

Feasible with LUVOIR?