

# Observations of He I D<sub>3</sub> at 5876 Å

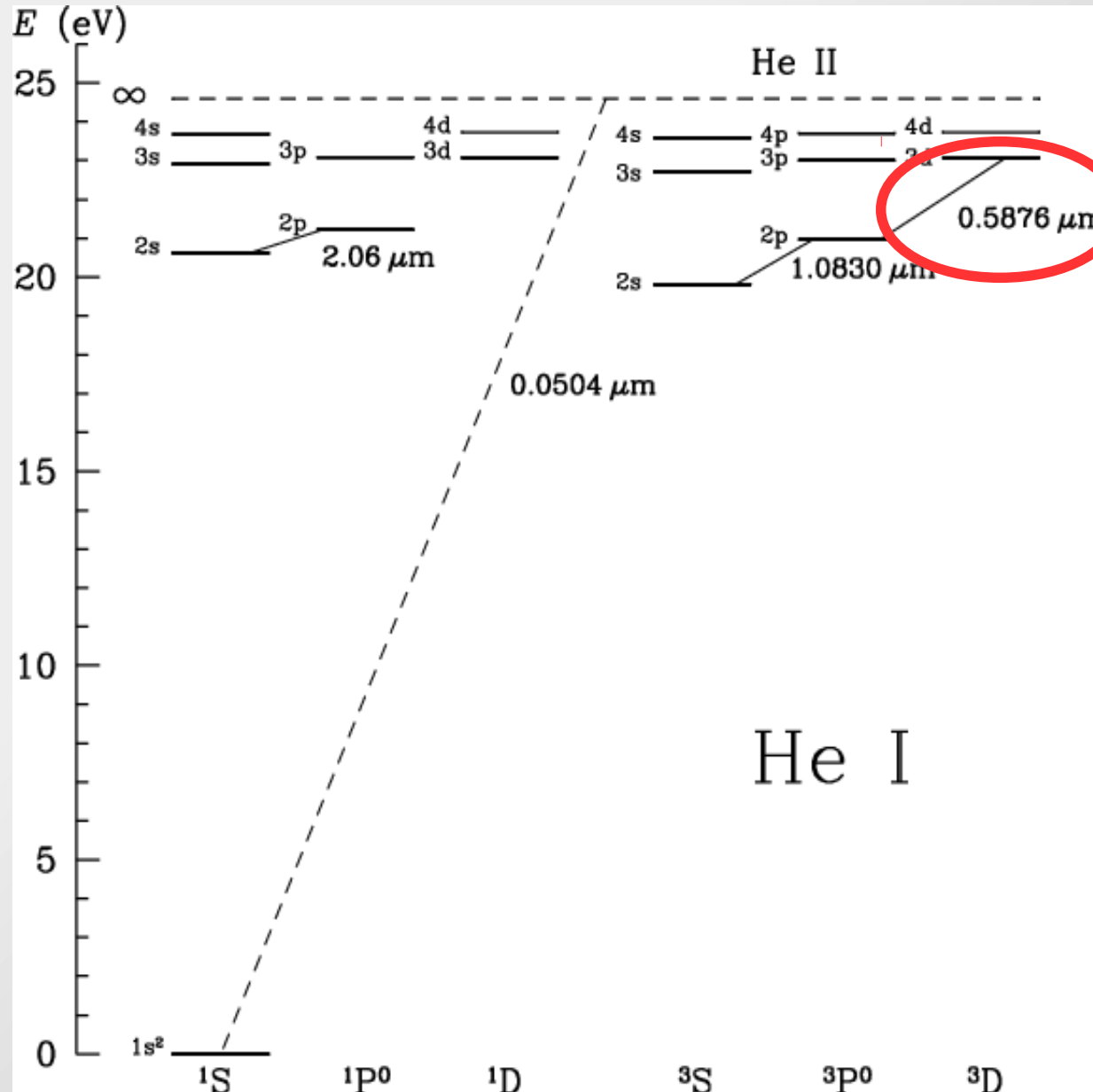
What can they teach us about chromosphere and corona?

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# Parahelium vs. Orthohelium



- Ionization potential  $\chi = 24.59$  eV
- Parahelium  $\uparrow\downarrow$   $S = 0$
- Orthohelium  $\uparrow\uparrow$   $S = 1$
- No radiative transitions between triplet and singlet states
- Singlet lines ten times weaker than triplet lines
- Triplets absorb photospheric photons

# Photoionization-recombination mechanism

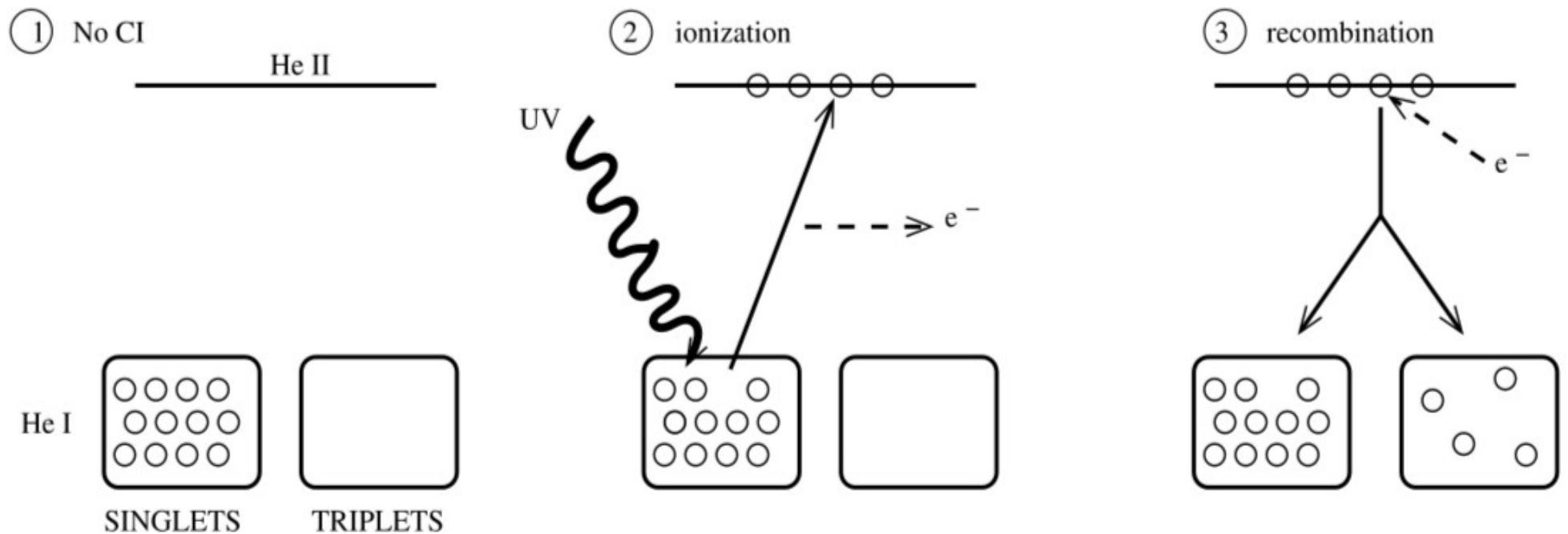
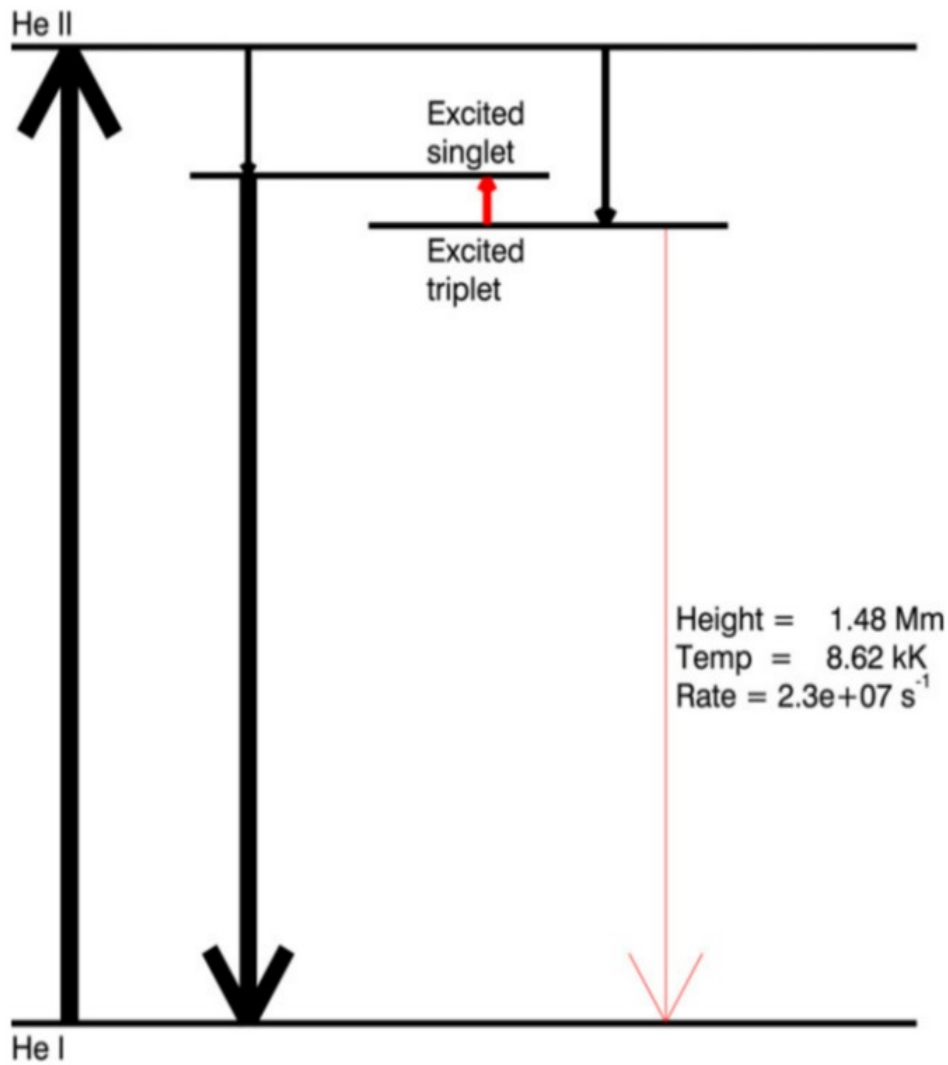


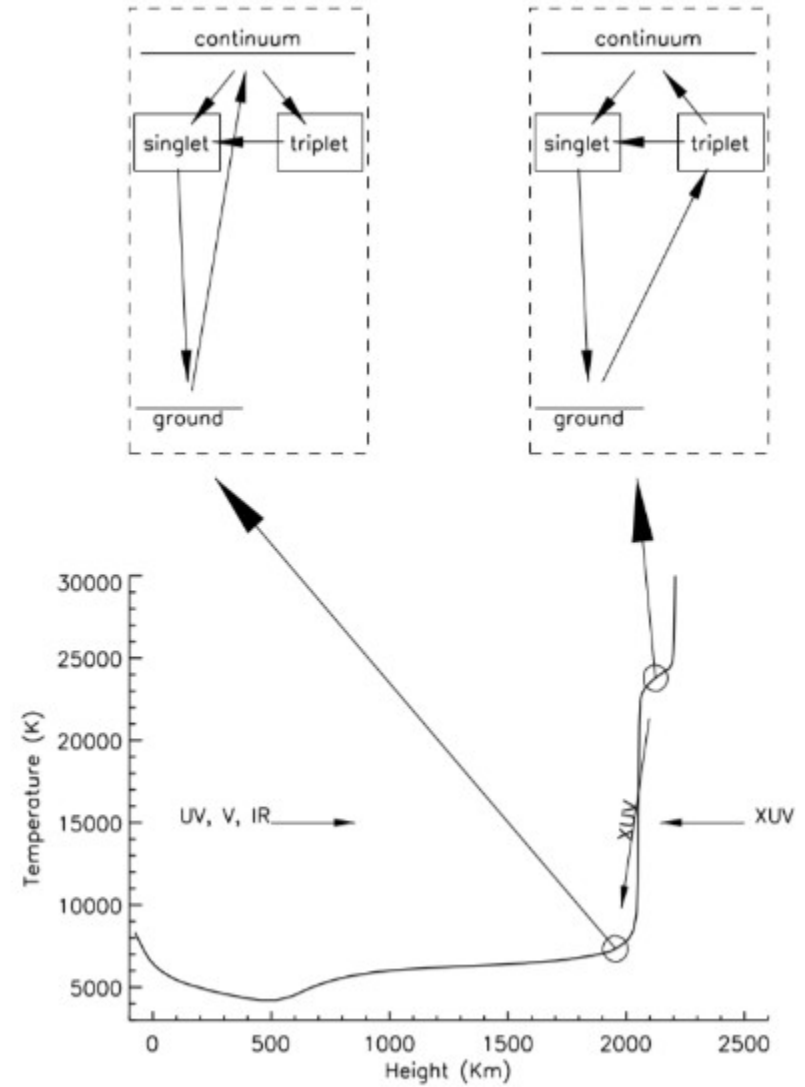
Figure from Centeno et al. 2008

(mechanism first proposed by Goldberg 1939)

# Radiative vs. collisional transitions



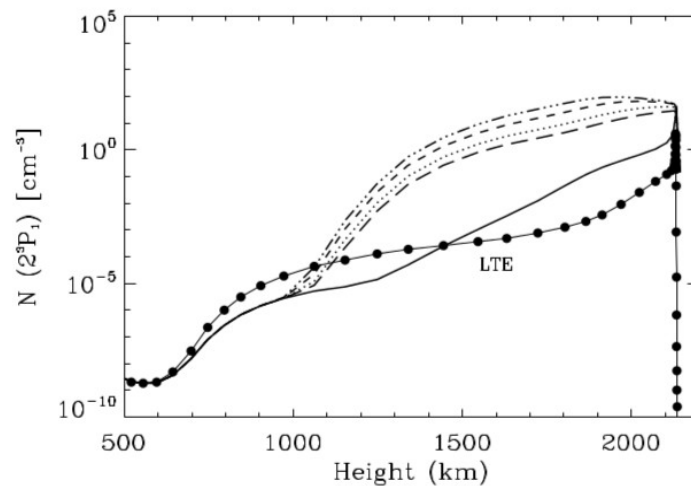
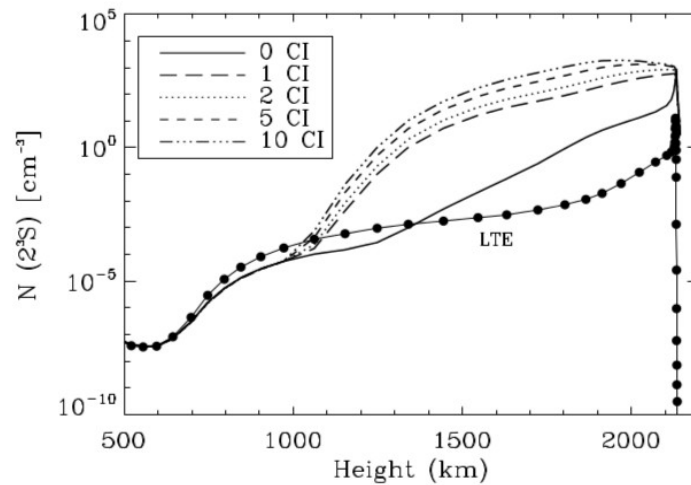
Golding, Carlsson & Leenaarts 2014



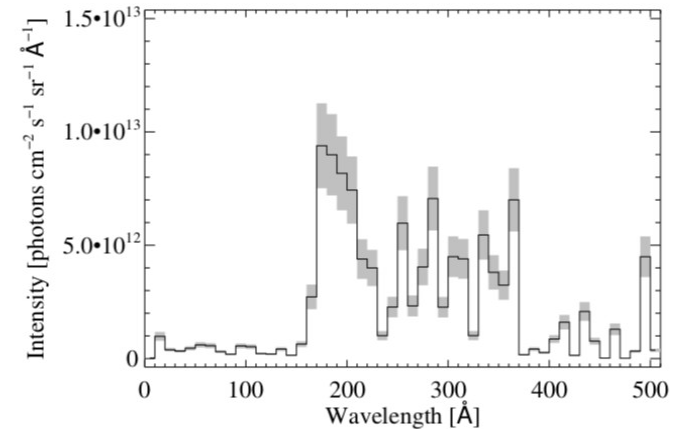
Andretta & Jones 1997

# Link to coronal EUV radiation

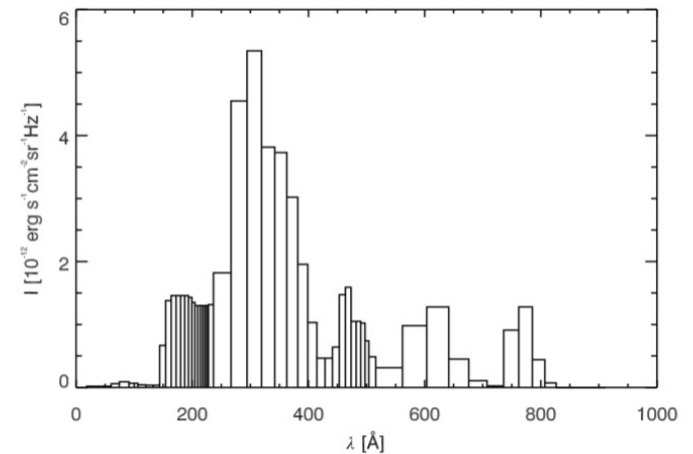
- D3 emission off-limb shows dark band at lower chromosphere
- D3 gets stronger in flares and prominences
- D3 disappears in coronal holes



Centeno et al. 2008

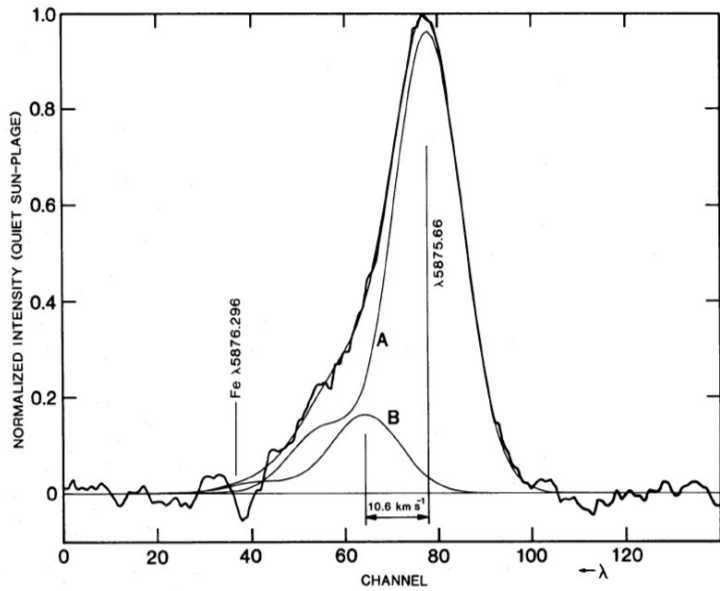


Mauas et al. 2005



Golding, Carlsson & Leenaarts 2014, using data from Tobiska 1991

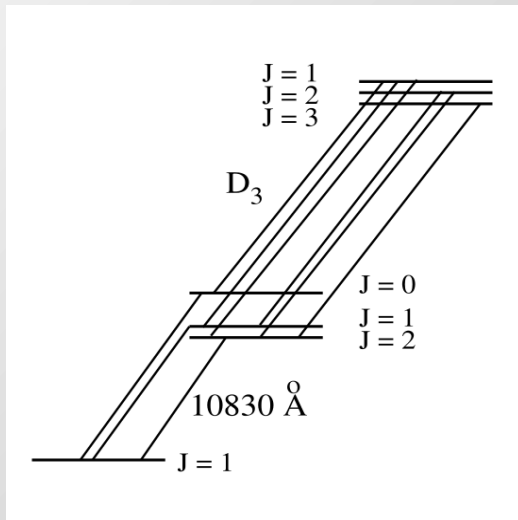
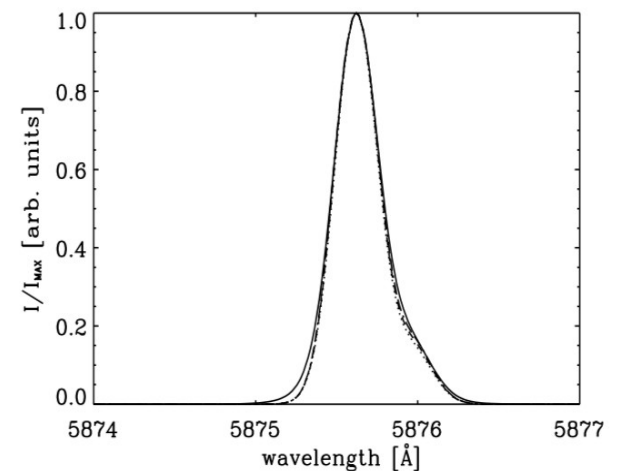
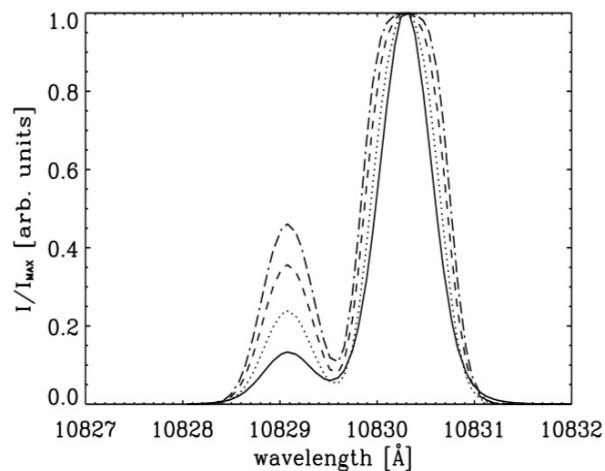
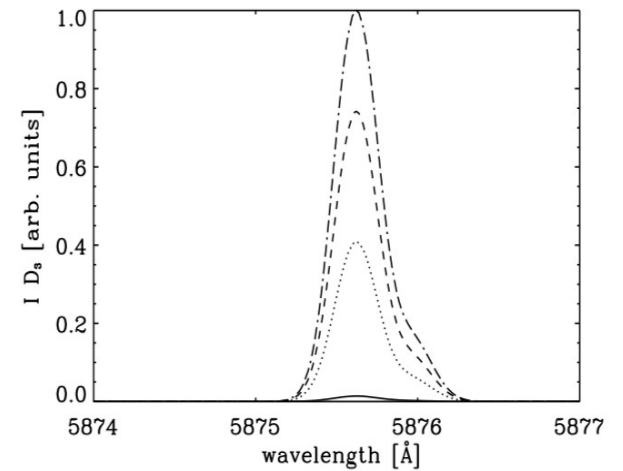
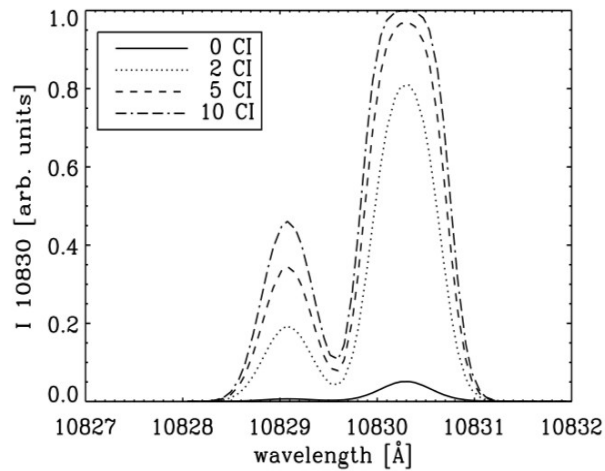
# He triplet line profiles



Landman 1981: observed He D3 line profile in solar plages

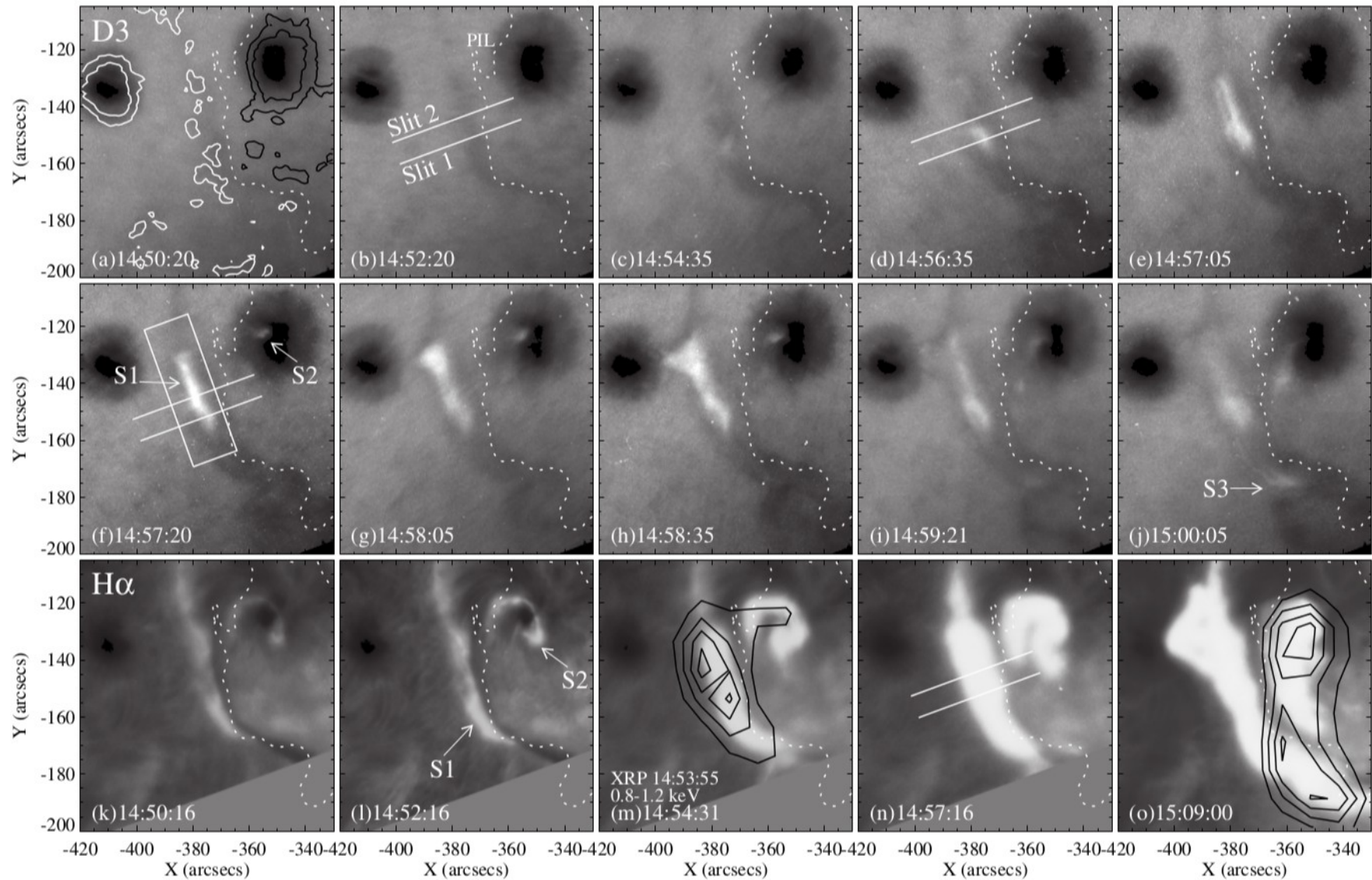


Centeno 2008: computed He triplet line profiles with coronal irradiance



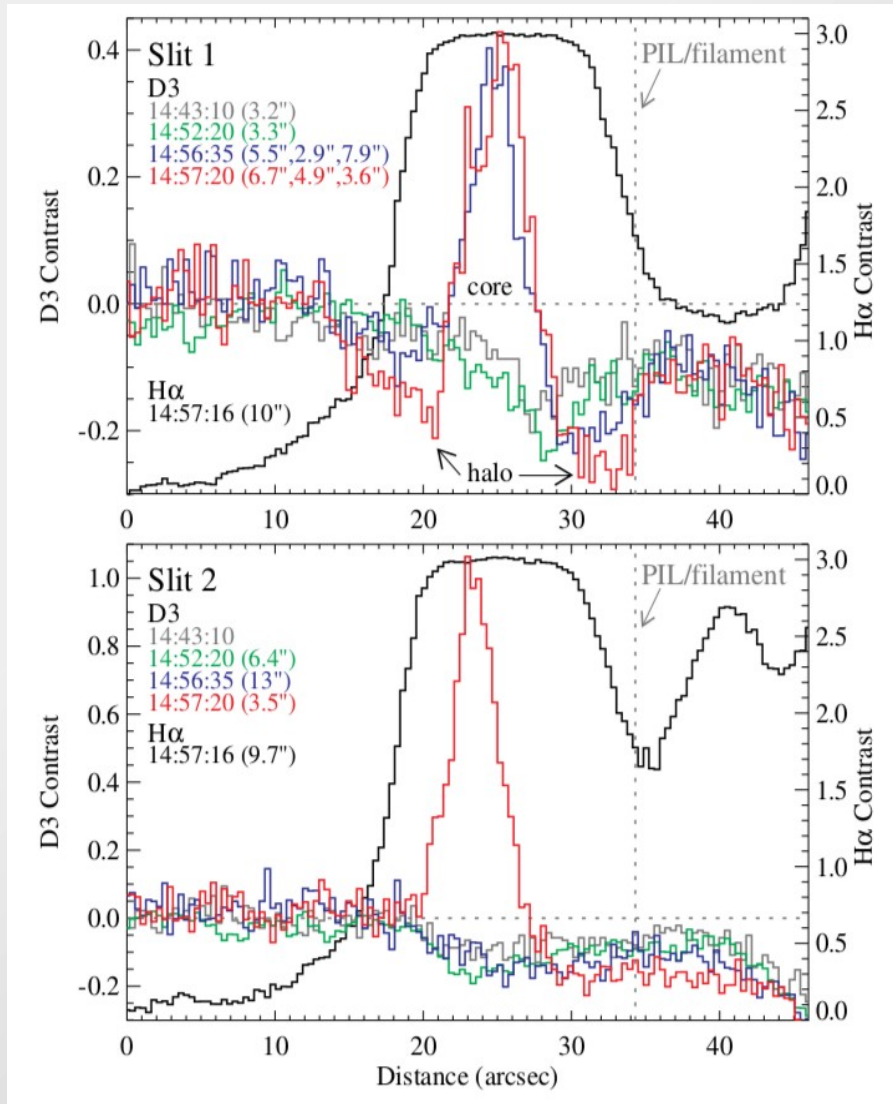
# Observations of D3

He I D3 observation of the 1984 May 22 M6.3 solar flare



# Observations of D<sub>3</sub>

He I D<sub>3</sub> observation of the 1984 May 22 M6.3 solar flare



- D<sub>3</sub> gets optically thick in flares
- Very rare to turn into emission on-disk (BLF)
- D<sub>3</sub> sensitive probe for flare development
- D<sub>3</sub> diagnostic for main flare energy source
- D<sub>3</sub> excellent tracer of electron precipitation in the chromosphere
- “Therefore, new D<sub>3</sub> flare observations using the modern instruments and further modeling efforts especially on the nonthermal effects on the D<sub>3</sub> line are highly desired, and will shed new light on the flare impact on the low atmosphere.”

Liu et al. 2013

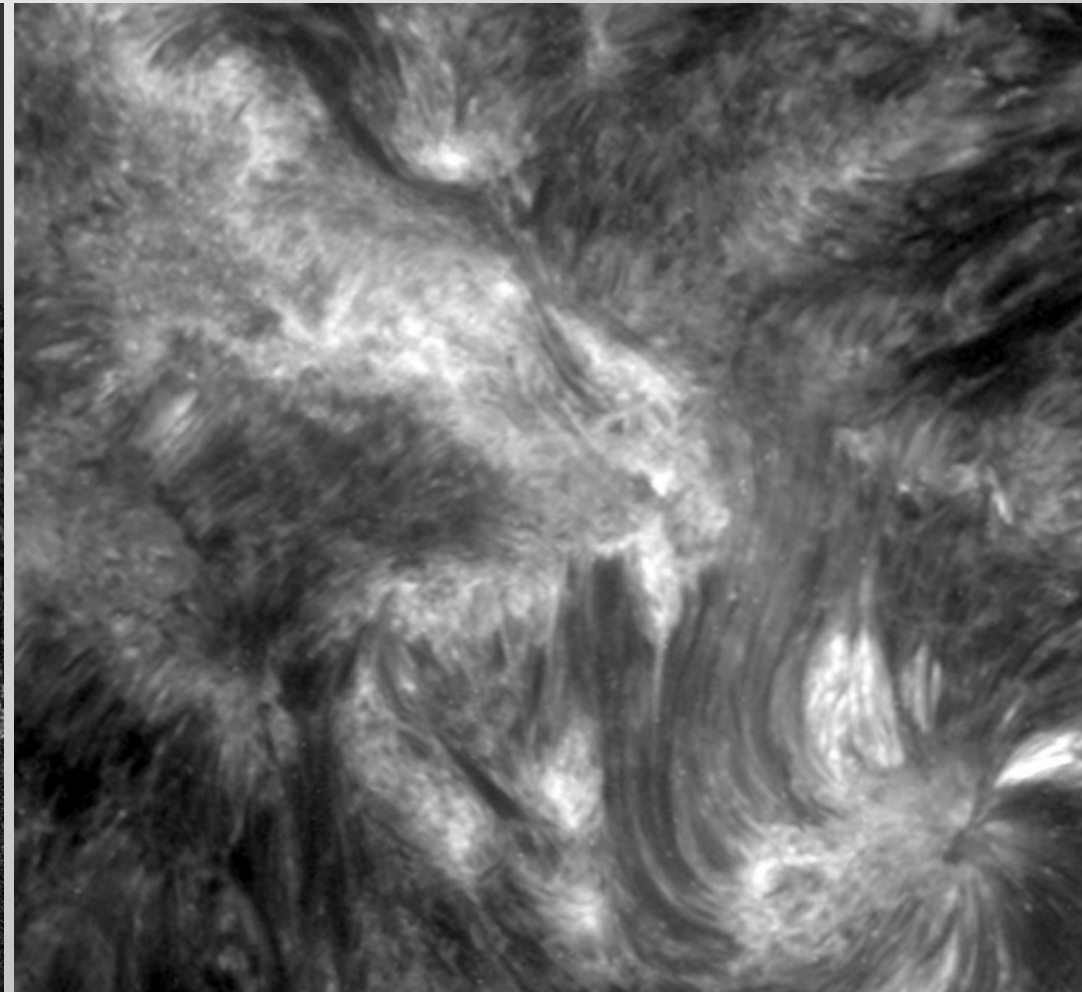


# Observations of D3

IBIS data not (yet) published



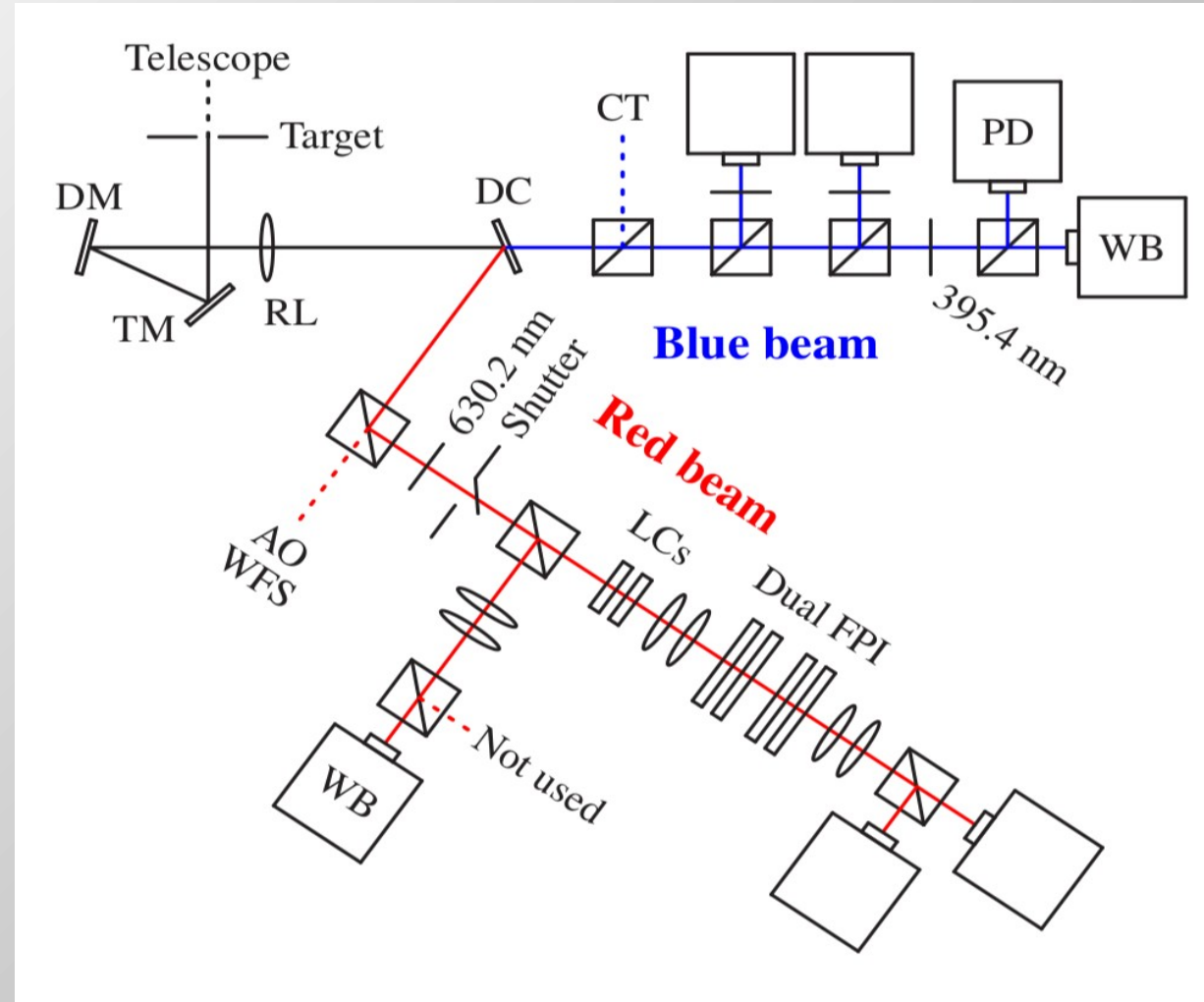
He I D<sub>3</sub> 5876 Å  
DST/IBIS



He II 304 Å  
SDO/AIA

Kevin Reardon

# Observations of D<sub>3</sub> with CRISP (SST)



# Conclusion

D3 observations interesting for

- Flares
- Coronal irradiance
- Link between chromosphere and corona