

Massive Stars and atomic data in the IR

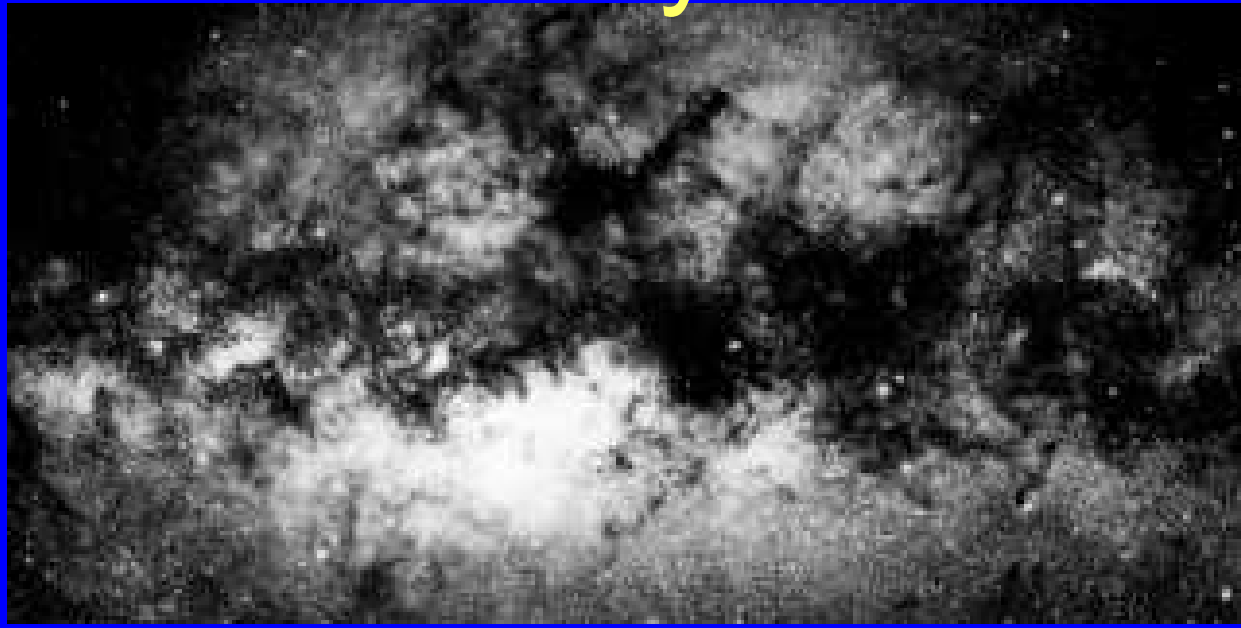
Paco Najarro

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Outline

- Why and when the IR. Diagnostic metal lines in massive stars IR spectra.
- Relevance of atomic data:
 - The 2.115 NIII/OIII/CIII feature. Importance of packing.
 - HI collisions
 - HI broadening
 - Charge exchange

Why in the Infrared?



Center of the MW

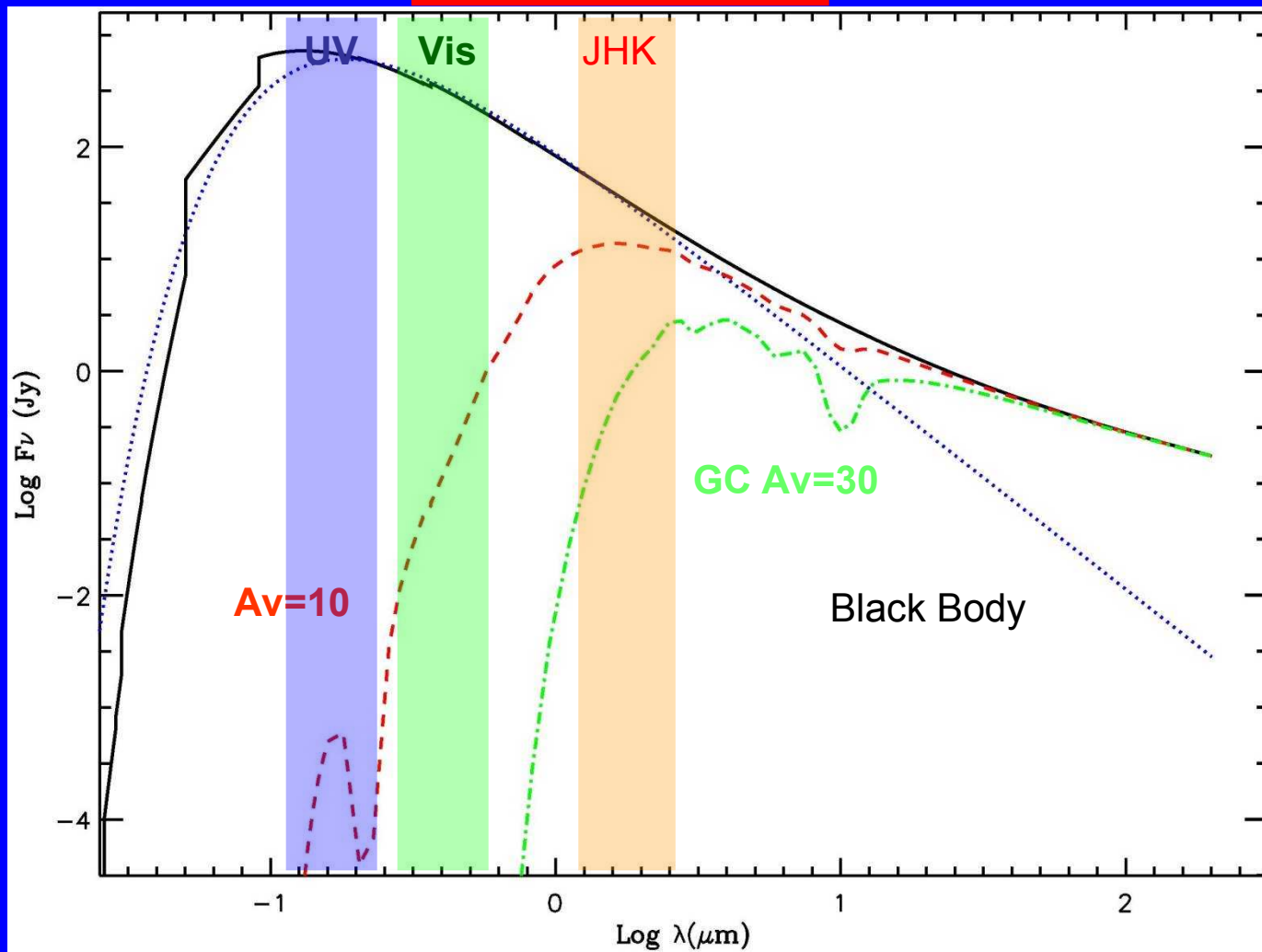
Optical



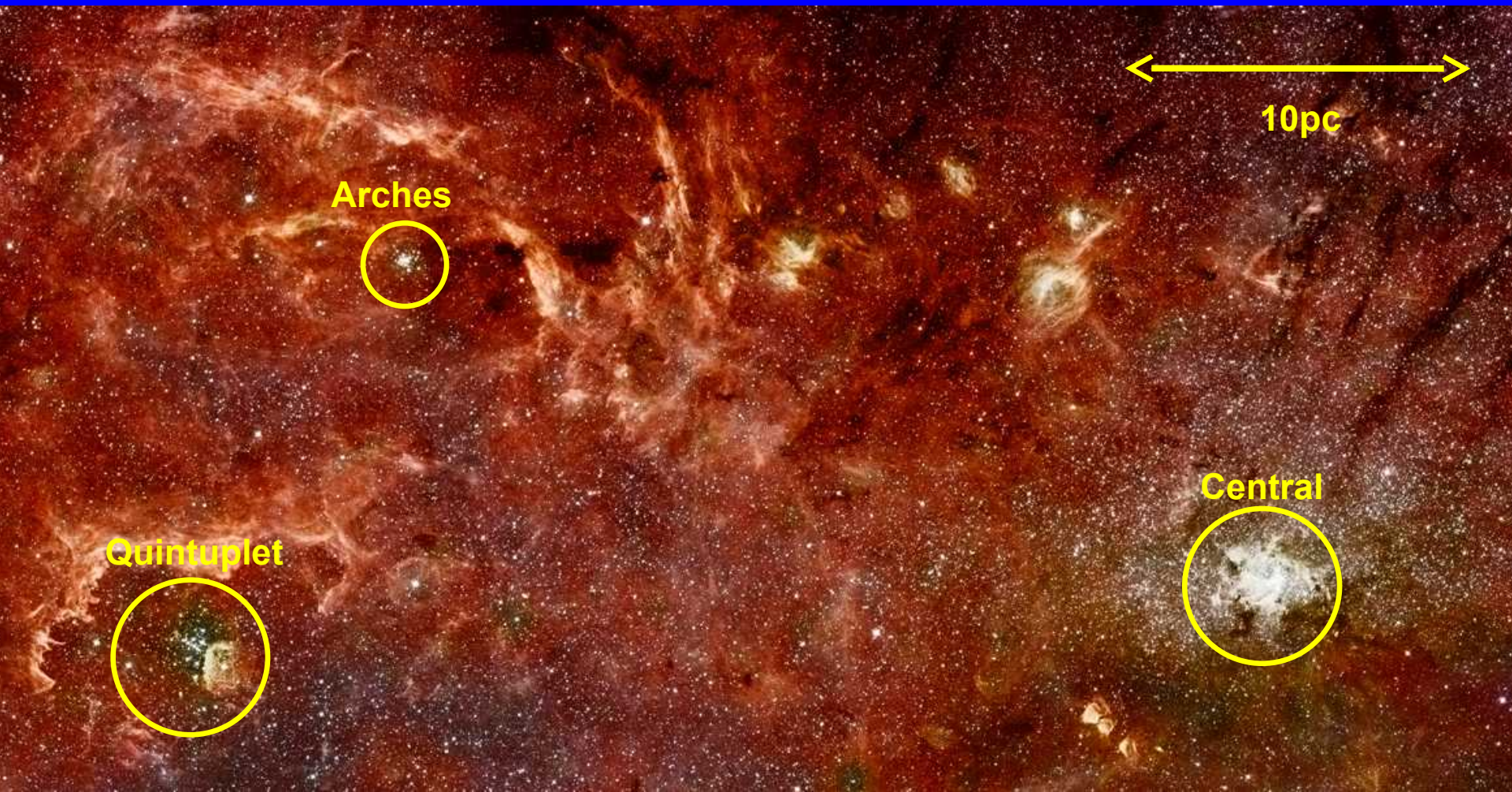
NIR 2MASS

Going Infrared: Sometimes the only way!!

Extinction !

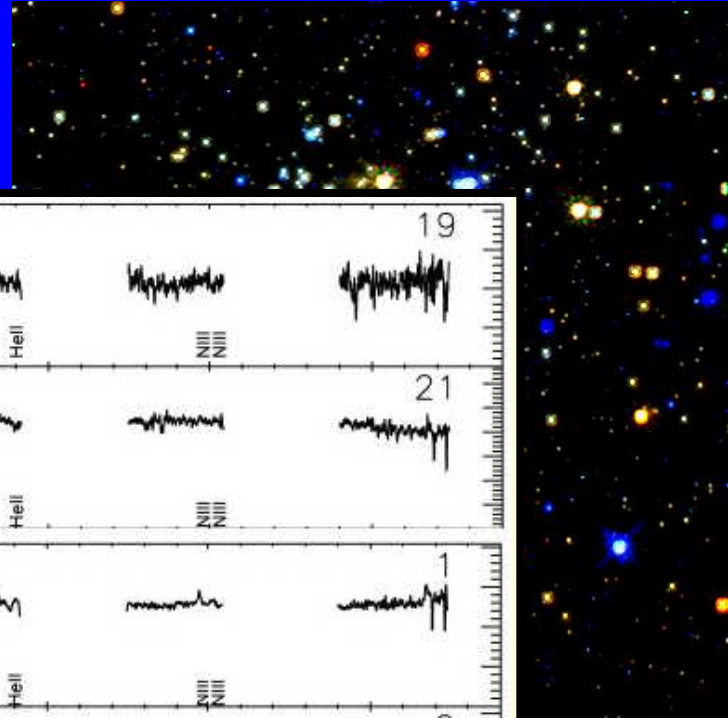
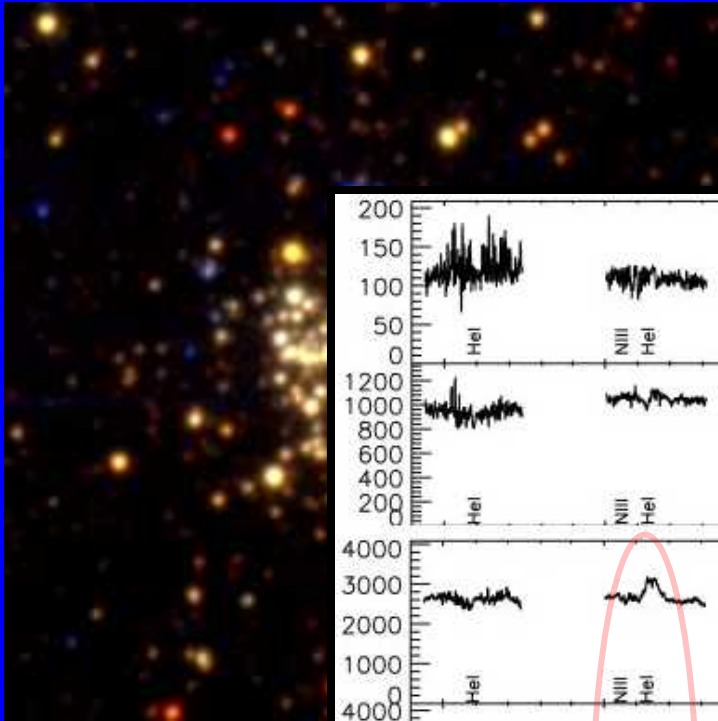


IR view of the GC



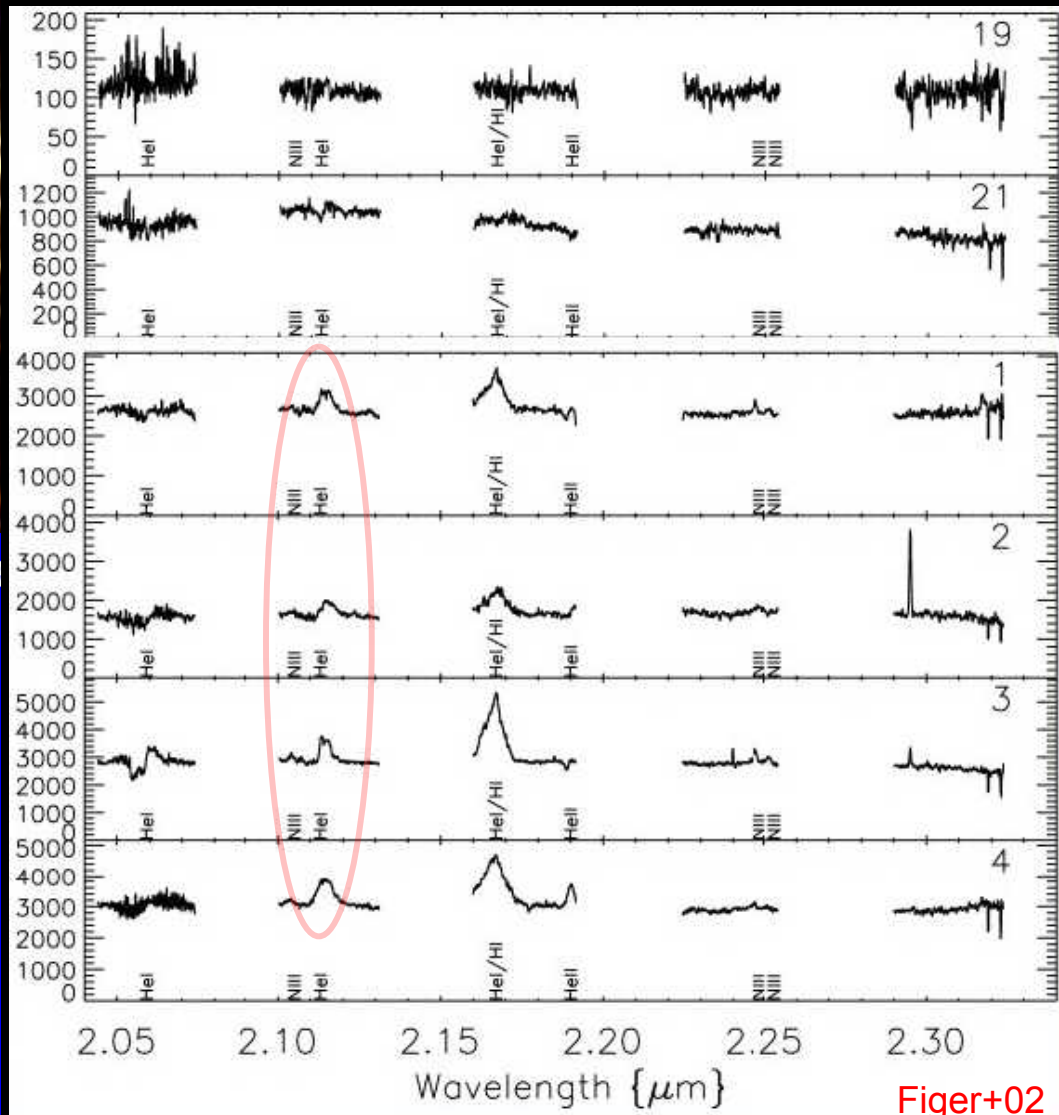
Hubble: NASA, ESA, & D. Q. Wang (U. Mass, Amherst); Spitzer: NASA, JPL, & S. Stolovy (SSC/Caltech)

The Arches Cluster



Serabyn+ 9

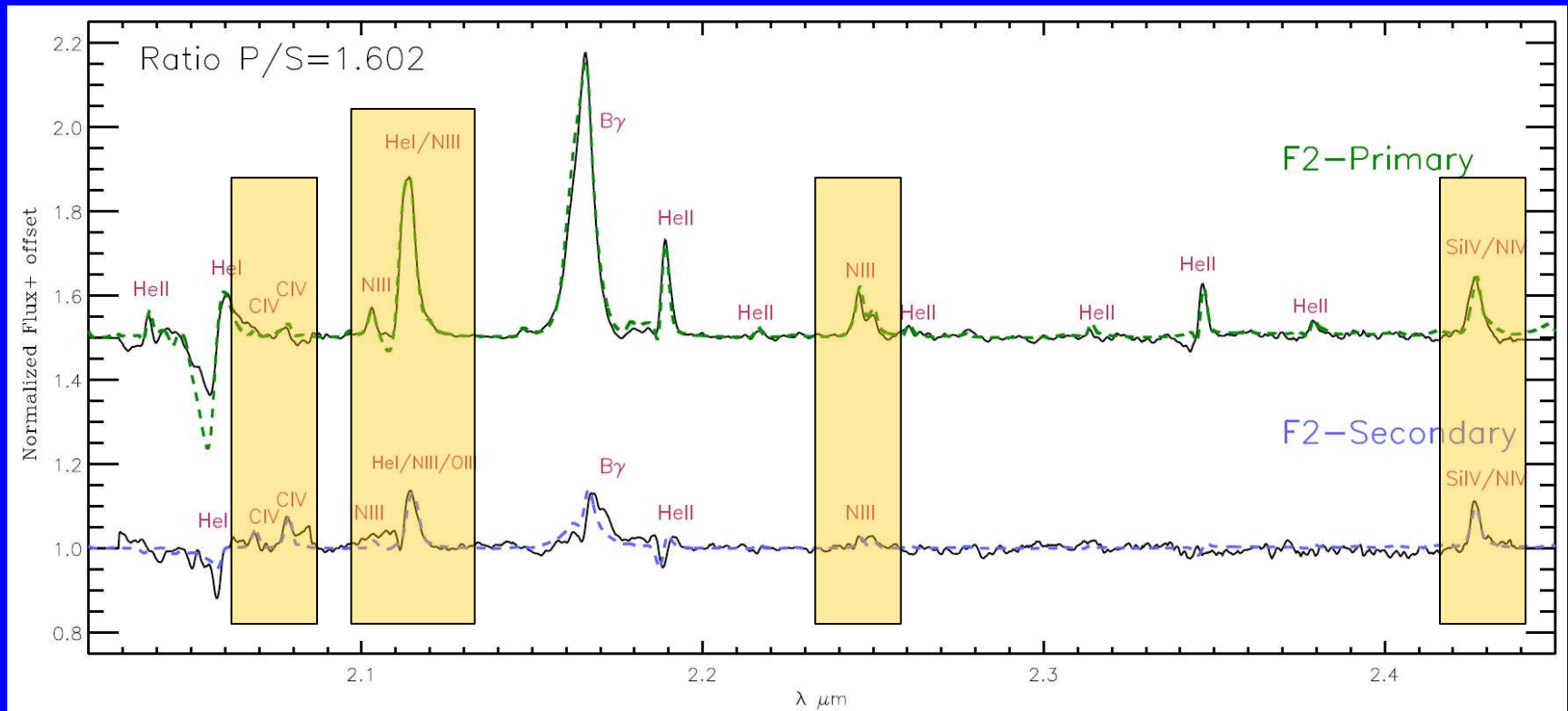
IOS



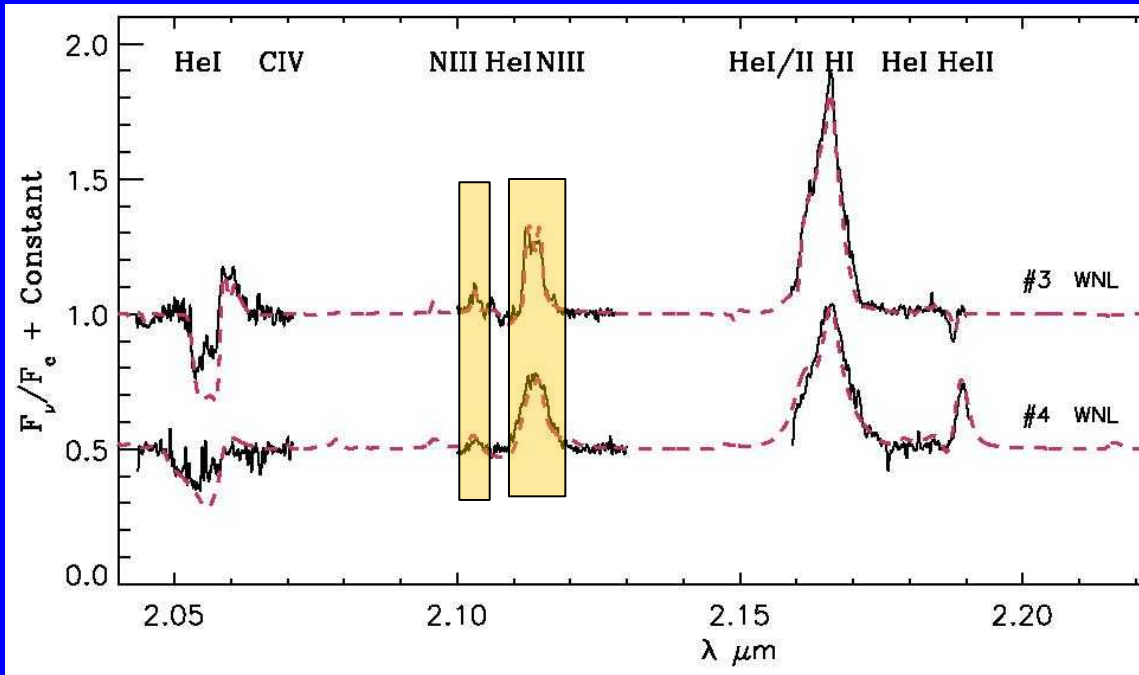
Figer+02

The Arches Cluster

F2 a massive binary in the Arches Cluster Lohr+2018



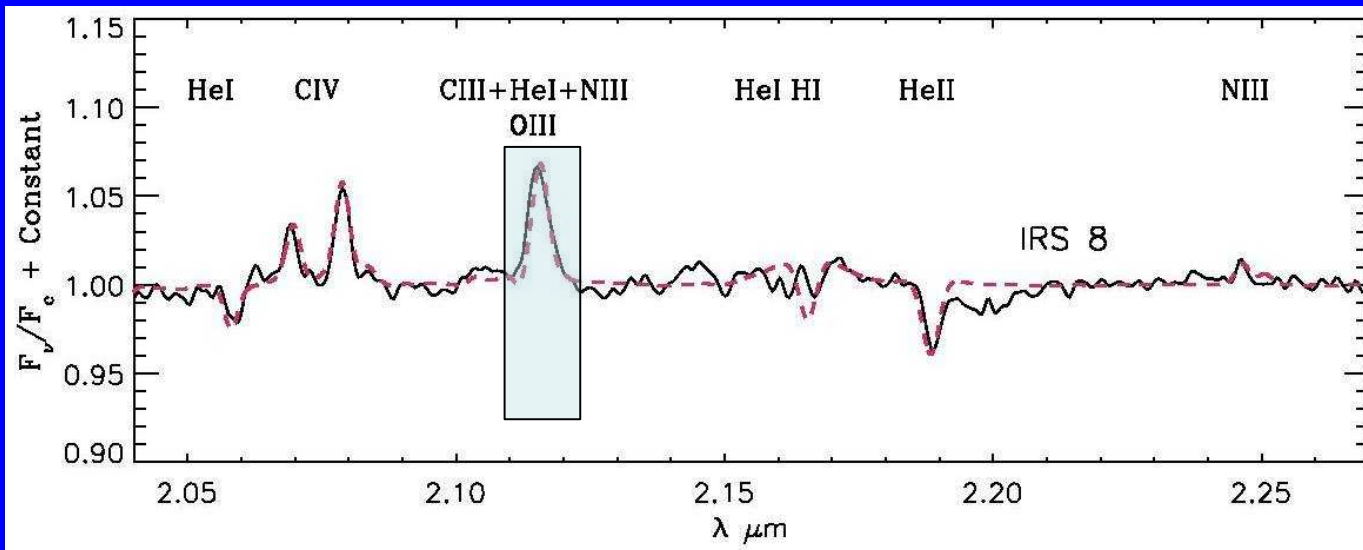
α elements from WNh and Olf stars



WNhs (indirect)

Oxygen from Nitrogen

Najarro+04



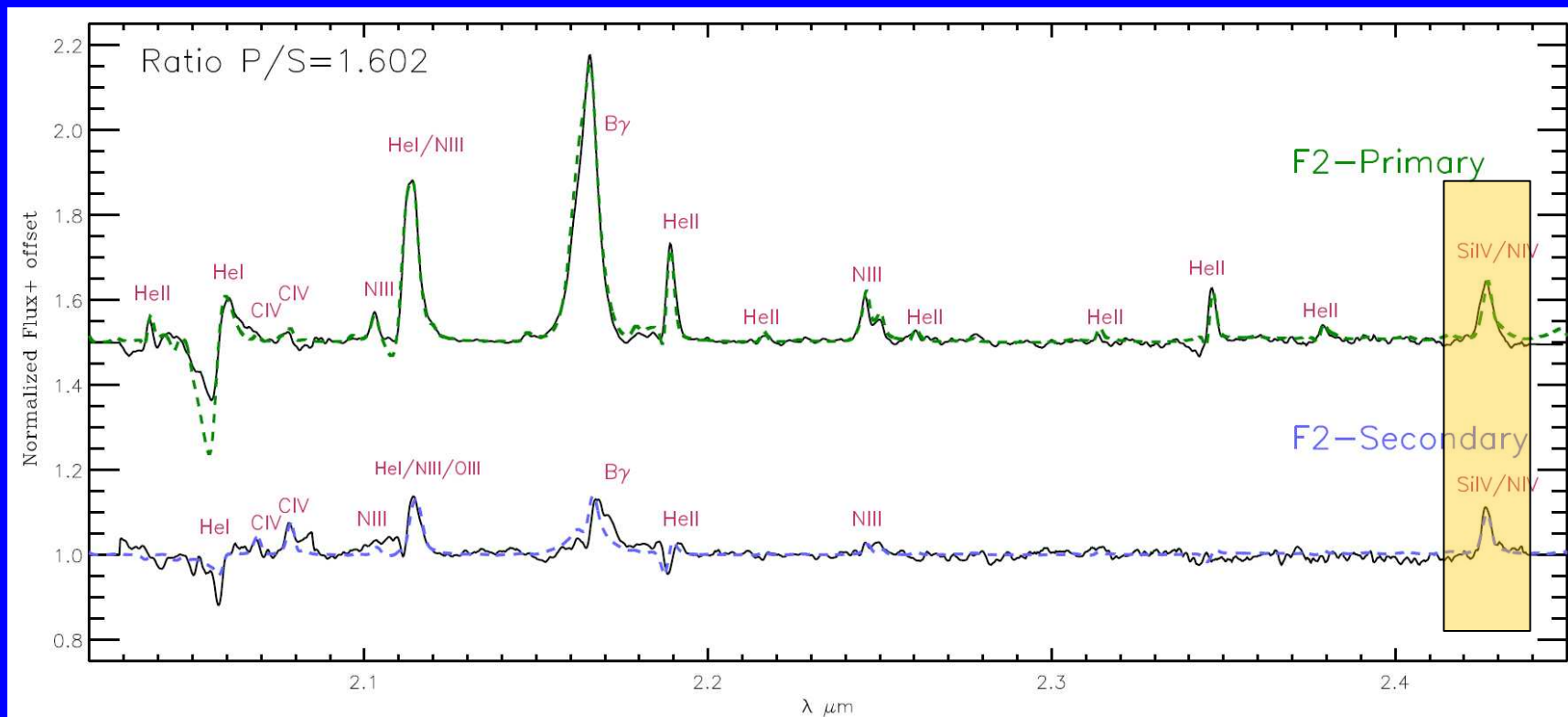
Olf (direct)

Oxygen

Geballe+06

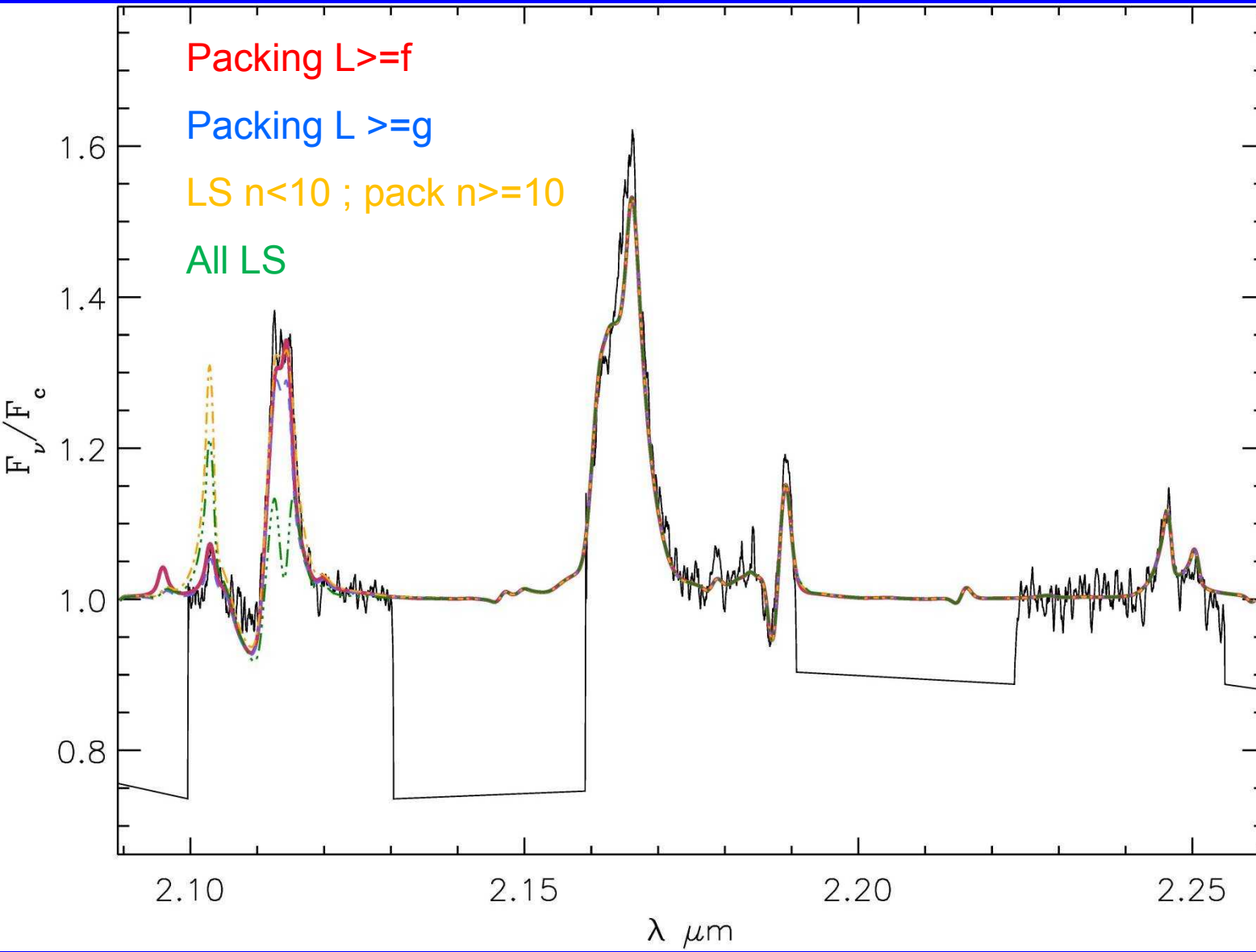
α elements from WNh and Olf stars

Si from WNhs + O stars

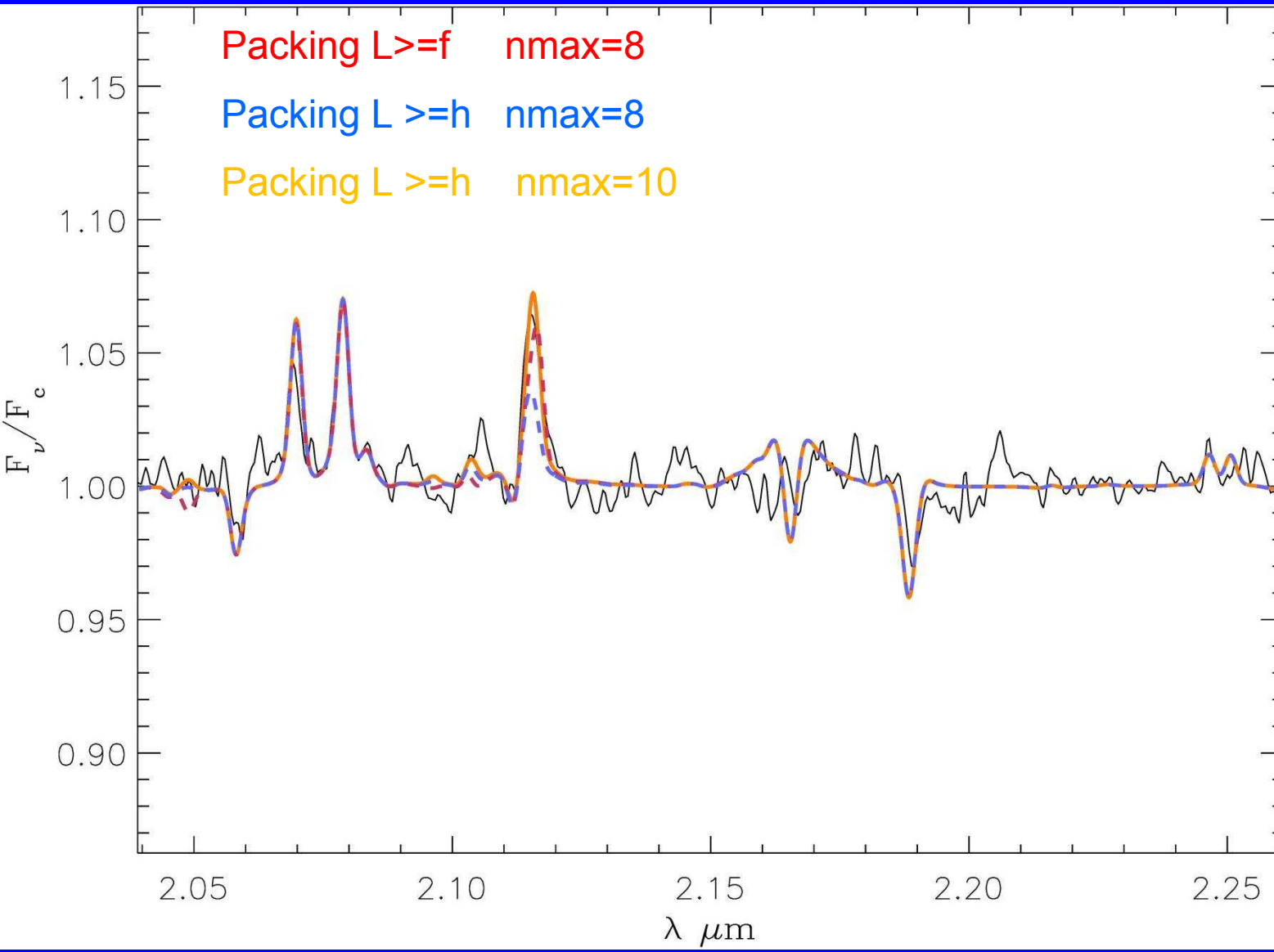


Lohr+18

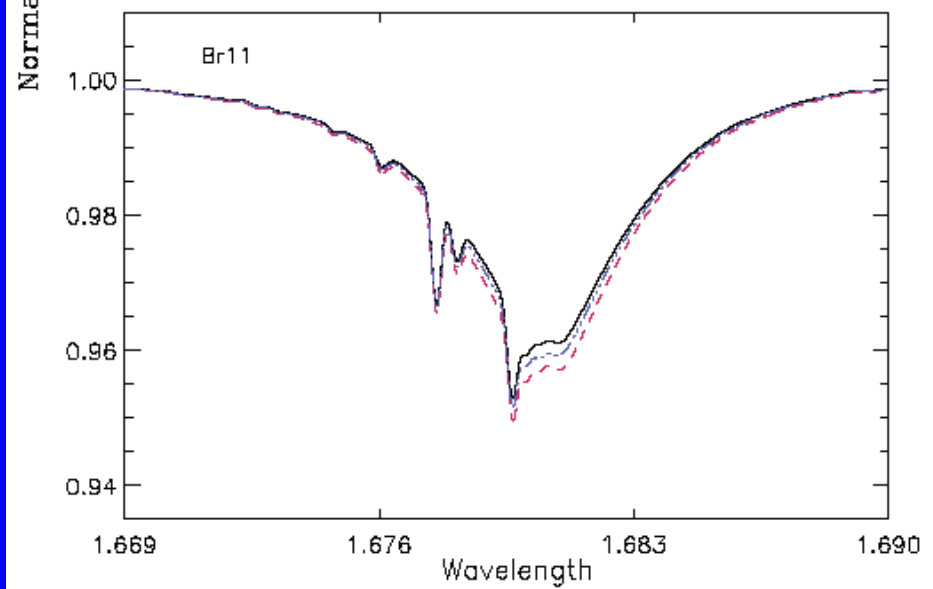
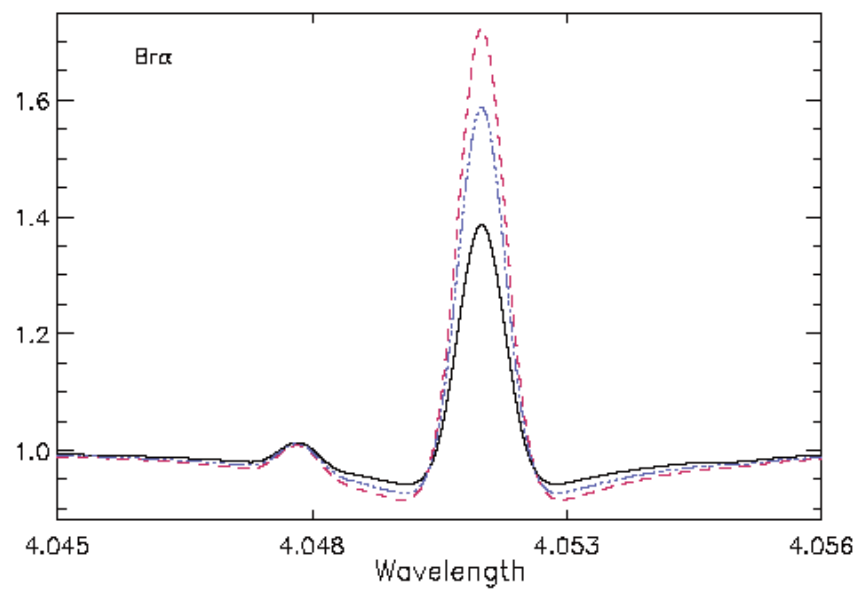
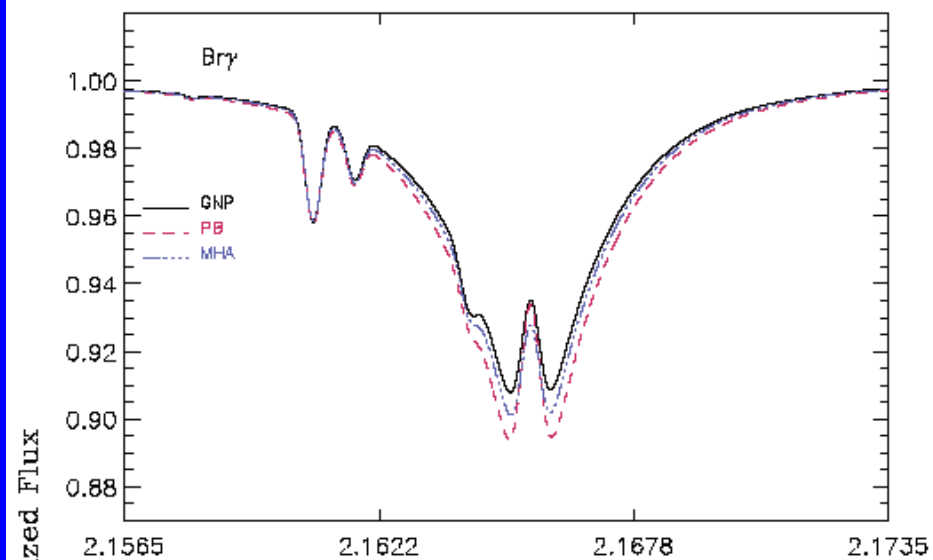
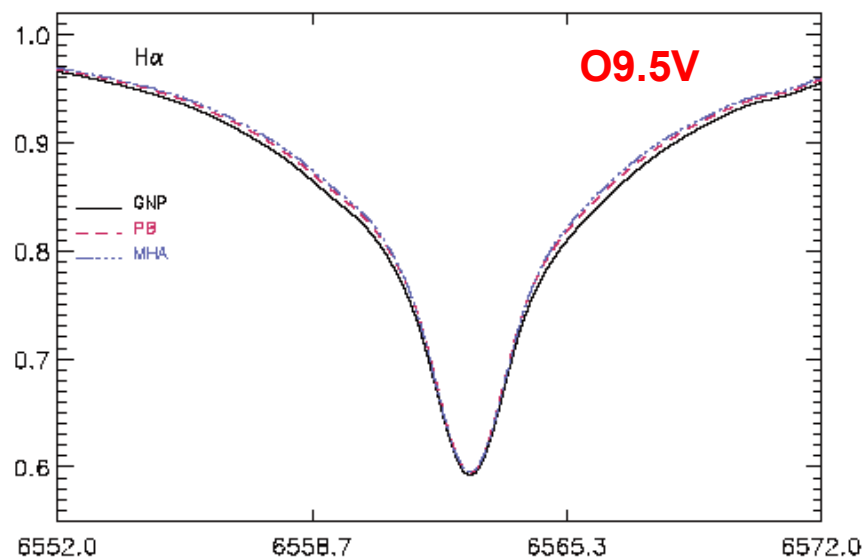
NIII 8-7 importance of packing



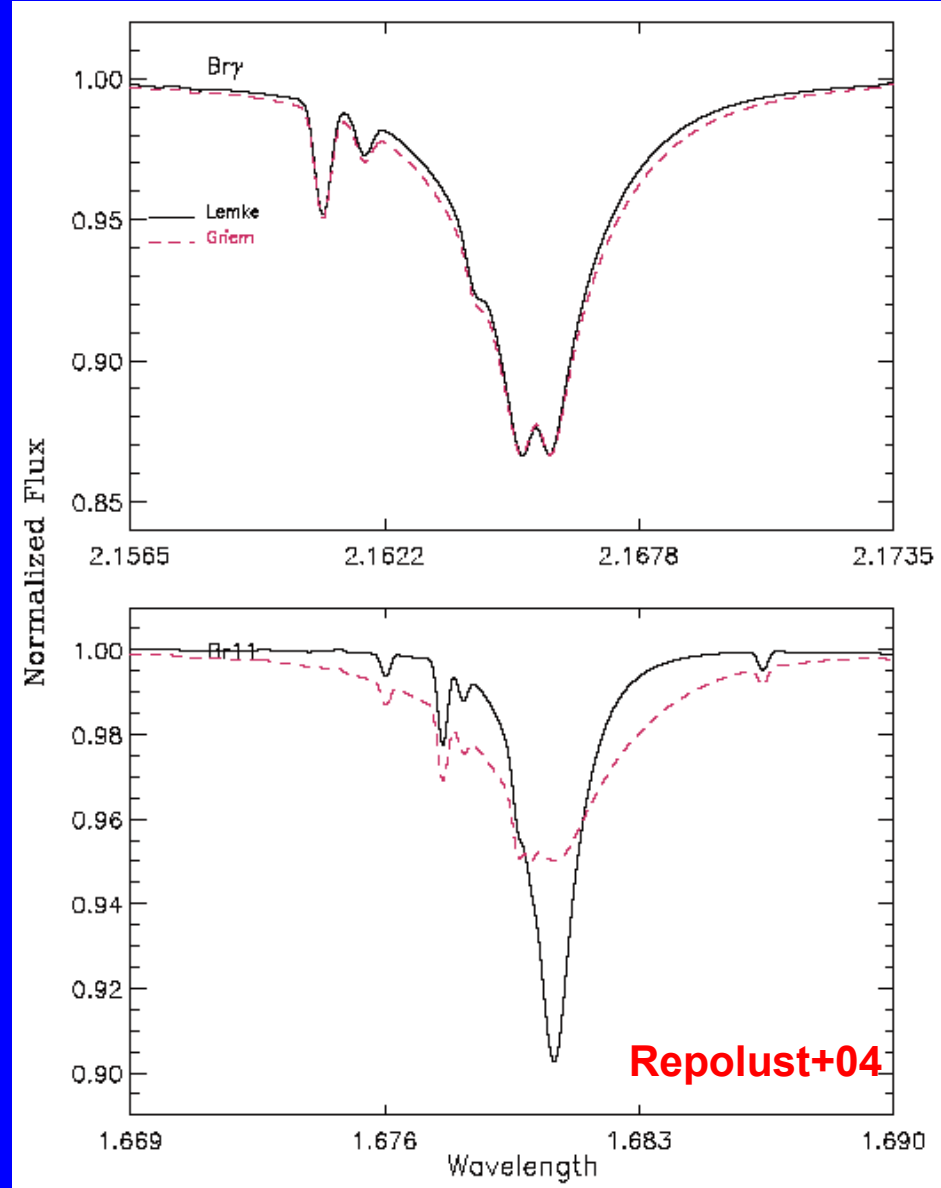
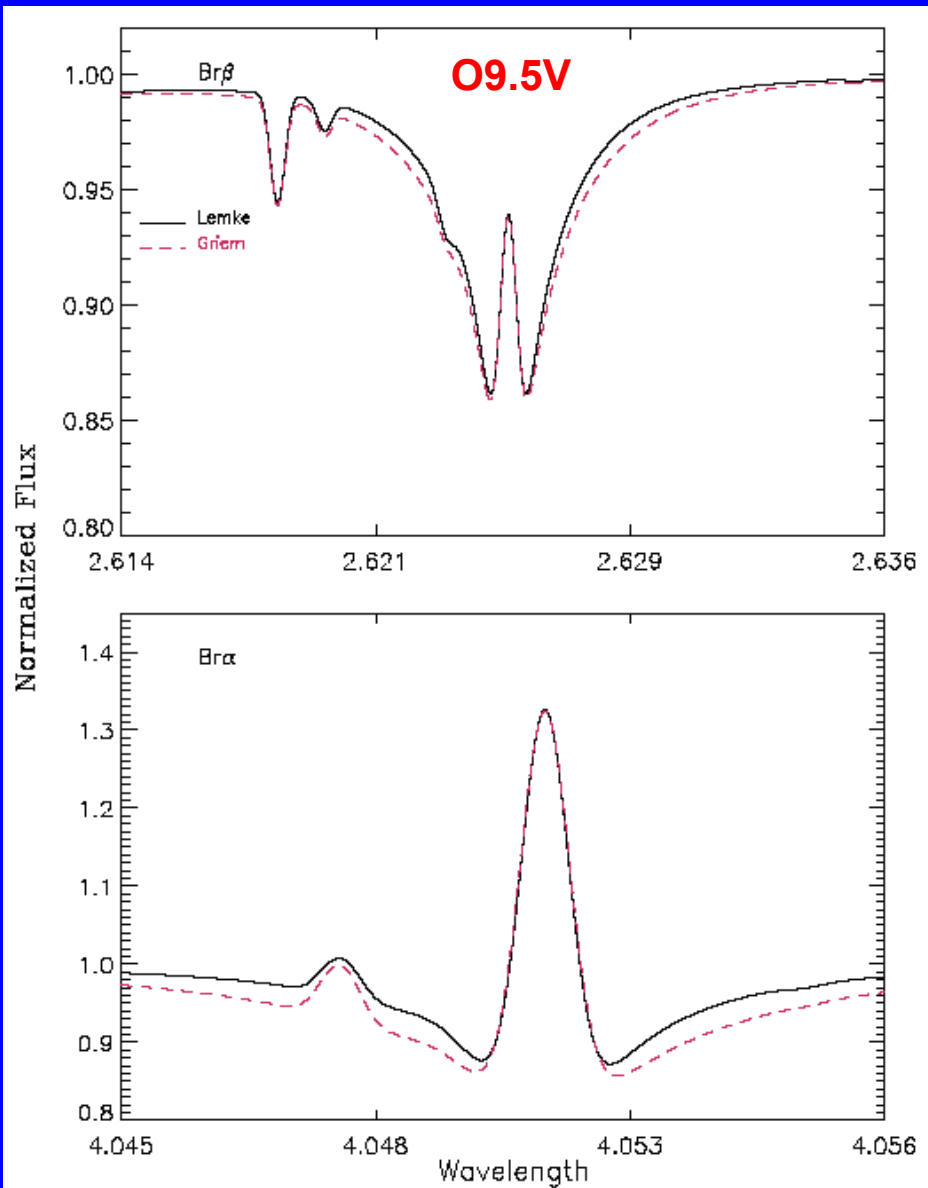
OIII 8-7 packing & number of levels



HI collisions

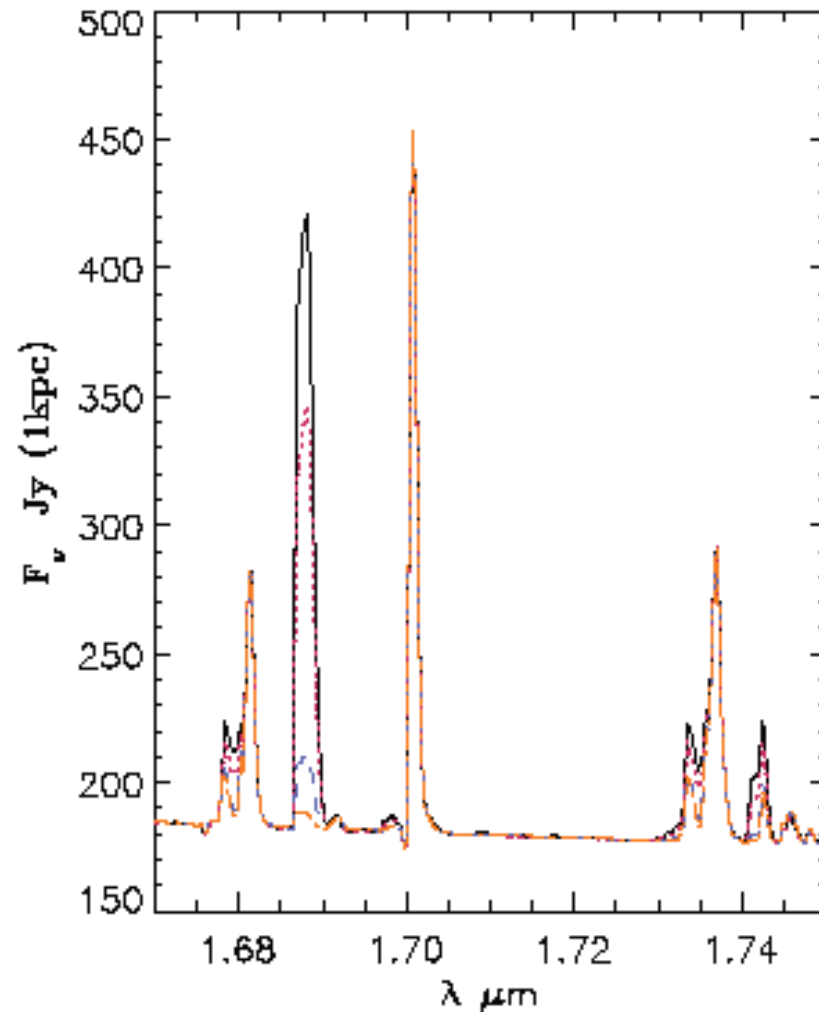
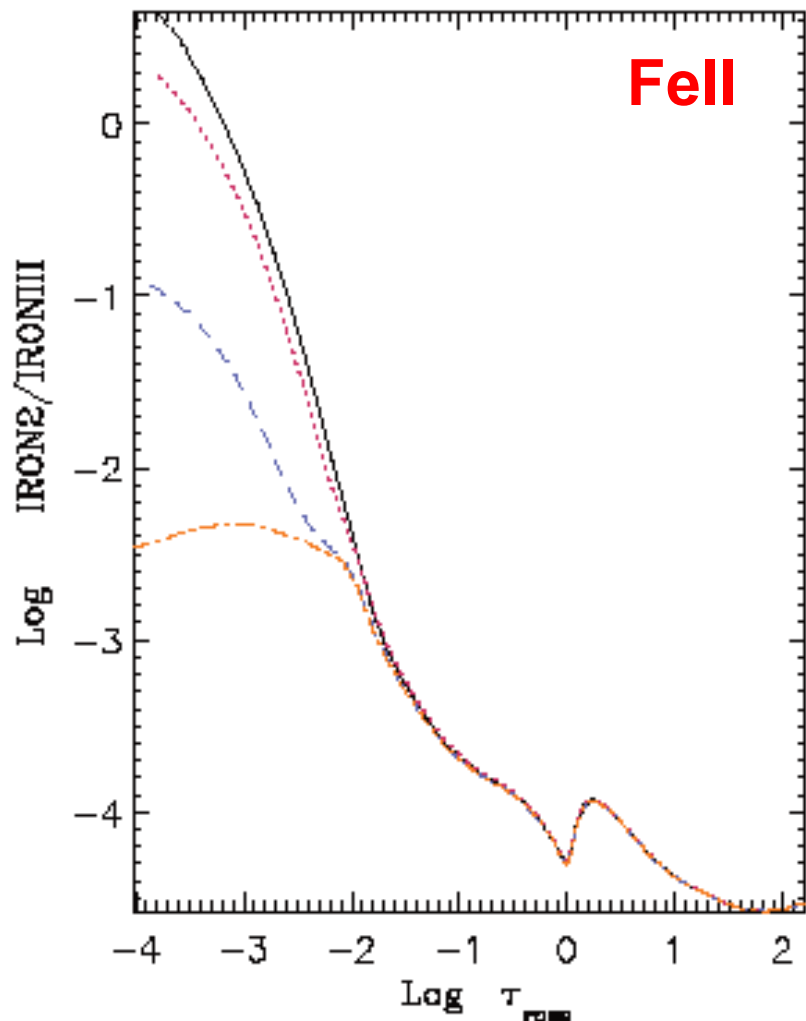


HI Broadening



Charge Exchange in LBVs

$\text{FeII} + \text{HI} \rightarrow \text{FeI} + \text{HII}$



Charge Exchange in LBVs

