

Chemical Abundance Analysis of Extragalactic Red Giants

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in collaboration with
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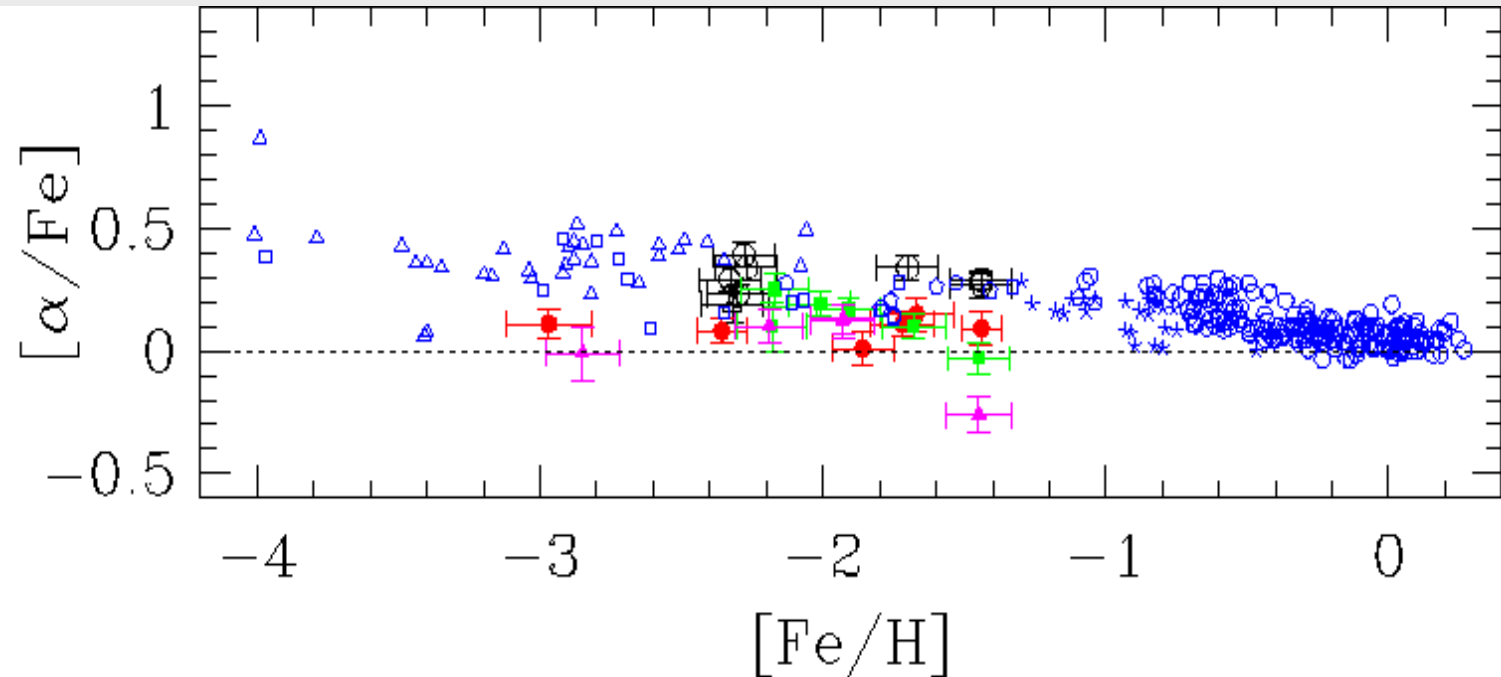
Why extragalactic red giants?

- Giants are bright
- Chemical abundance → star formation history
- The build-up of the Milky Way and M31 haloes
 - MW: Leo I dSph
 - M31: NGC 147, 185, 205 (dEs), And I, II, III, X, XIV (dSphs)

Chemistry is History

- Obtain $[\text{Fe}/\text{H}]$ and $[\alpha/\text{H}]$
 - $\alpha = \{\text{Ca}, \text{Ti}, \text{Mg}\}$
- SNe II (fast) $\rightarrow \alpha, r$ -process
- SNe Ia (slow) \rightarrow Fe-peak
- $[\alpha/\text{Fe}] \rightarrow$ burstiness of progenitor population
- Why don't the dSphs have the same $[\alpha/\text{Fe}]$ as the halo? (Shetrone, Côté, and Sargent 2001)

Chemistry is History

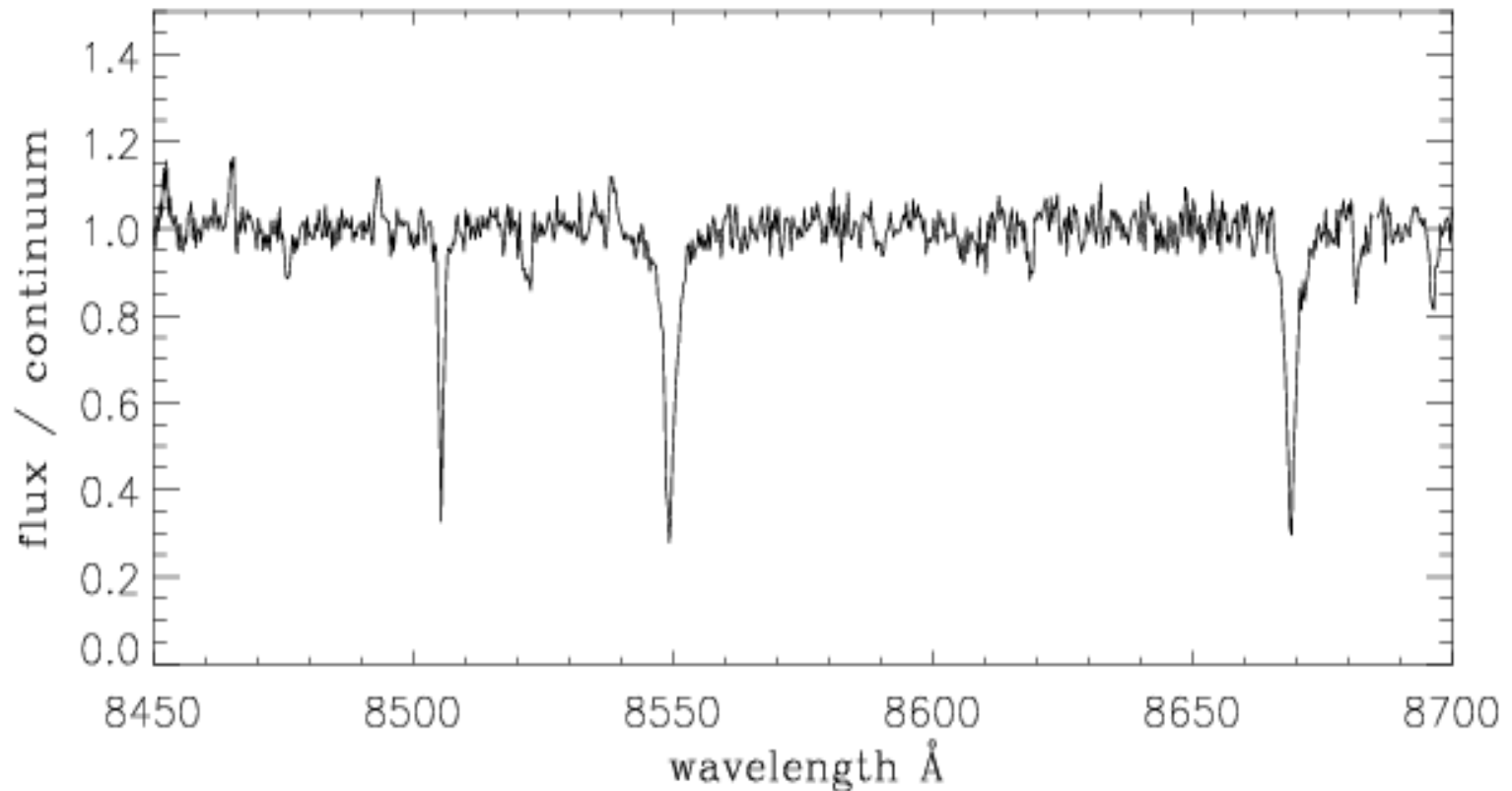


- M92&M3 □ GS (halo)
- △ N2419 ○ E93 (disk)
- Draco ★ V98 (QSO)
- UMin ★ P00 (QSO)
- ▲ Sex
- △ M95 (halo)
- ★ NS (halo/disk)
- S99 (halo)

Shetrone, Côté,
and Sargent
2001

Moderate-Resolution Spectra

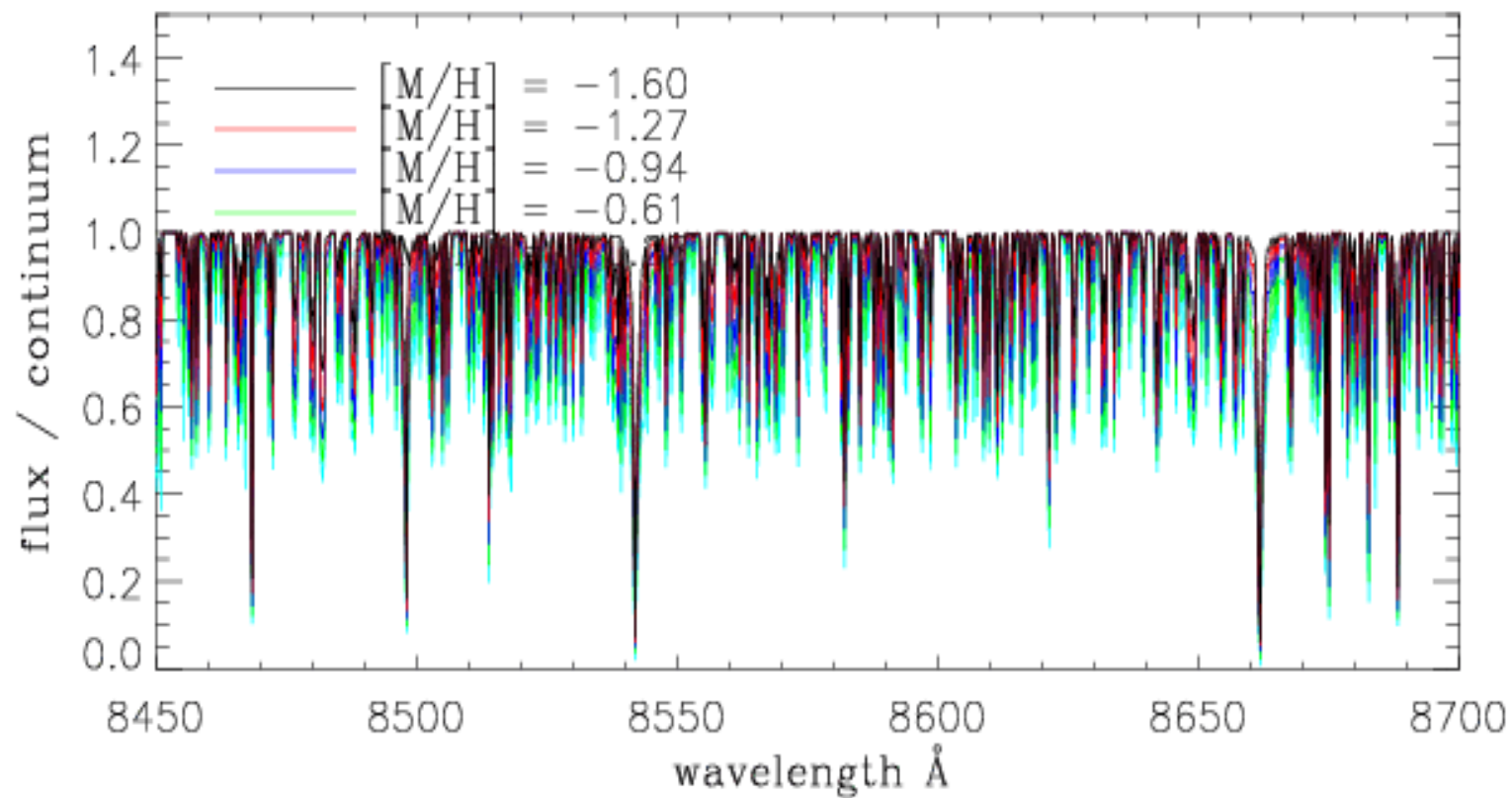
- DEIMOS: $\sim 1.0 \text{ \AA}$ FWHM, 6000-9200 \AA



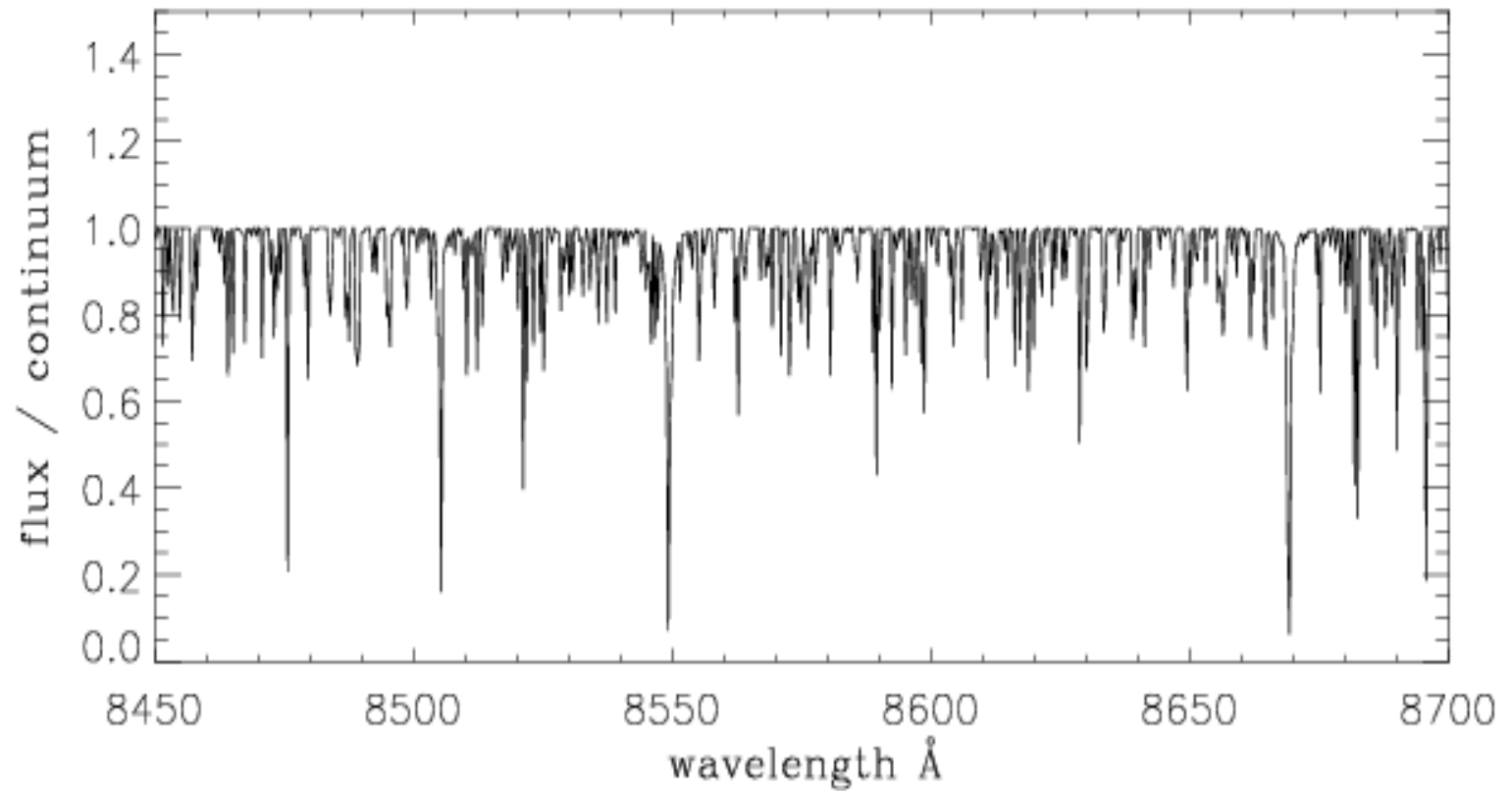
Synthetic Spectra

- model atmosphere: T_{eff} , $\log g$, $[\text{Fe}/\text{H}]$
 - Victoria-Regina isochrones (VandenBerg, Bergbusch, and Dowler 2006)
 - color temperatures (Ramírez and Meléndez 2005)
 - Kurucz model atmospheres
- line lists: λ , $\log(gf)$, excitation potential
 - Kurucz line list

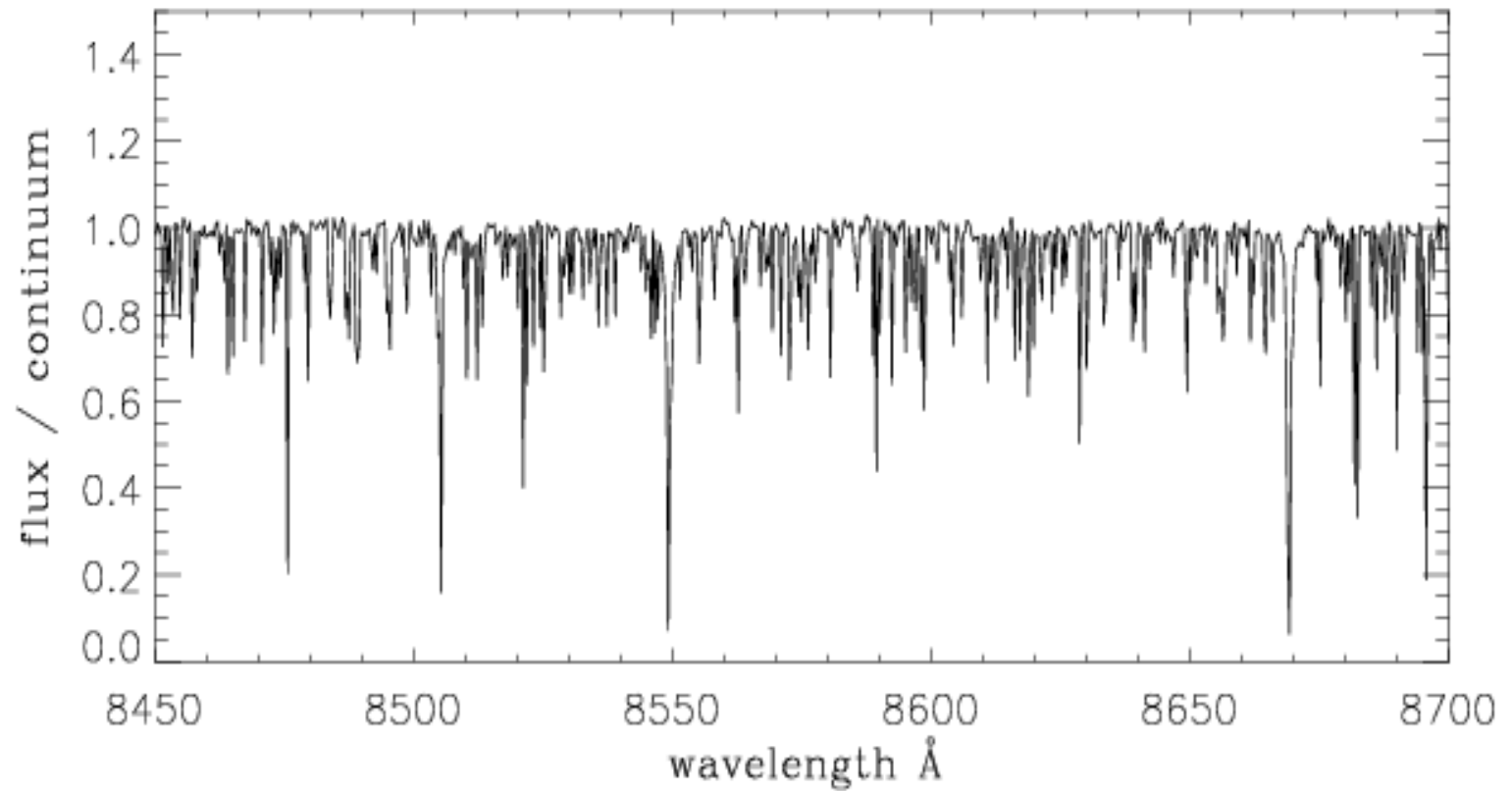
Synthetic Spectra



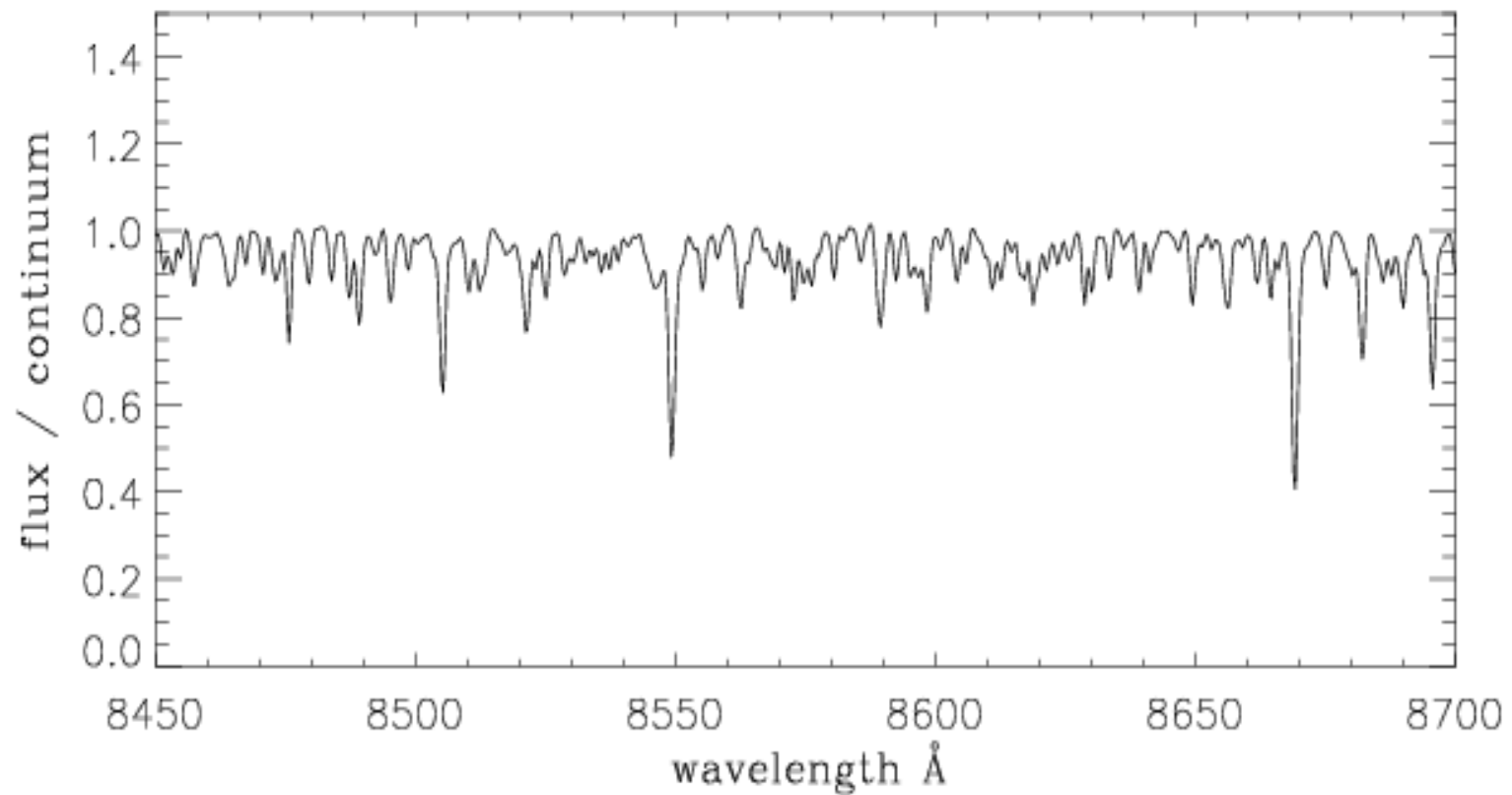
Synthetic Spectra



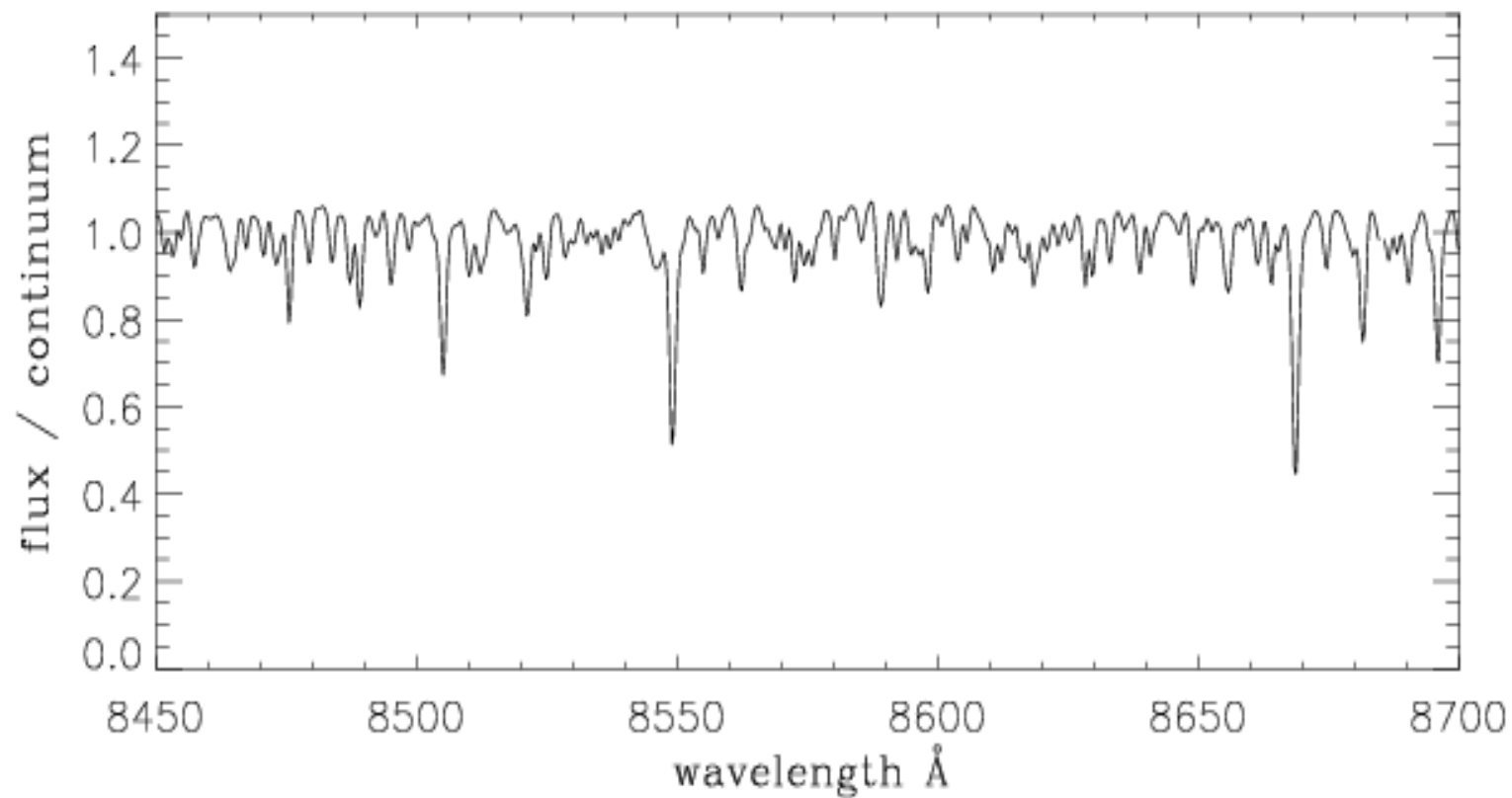
Synthetic Spectra



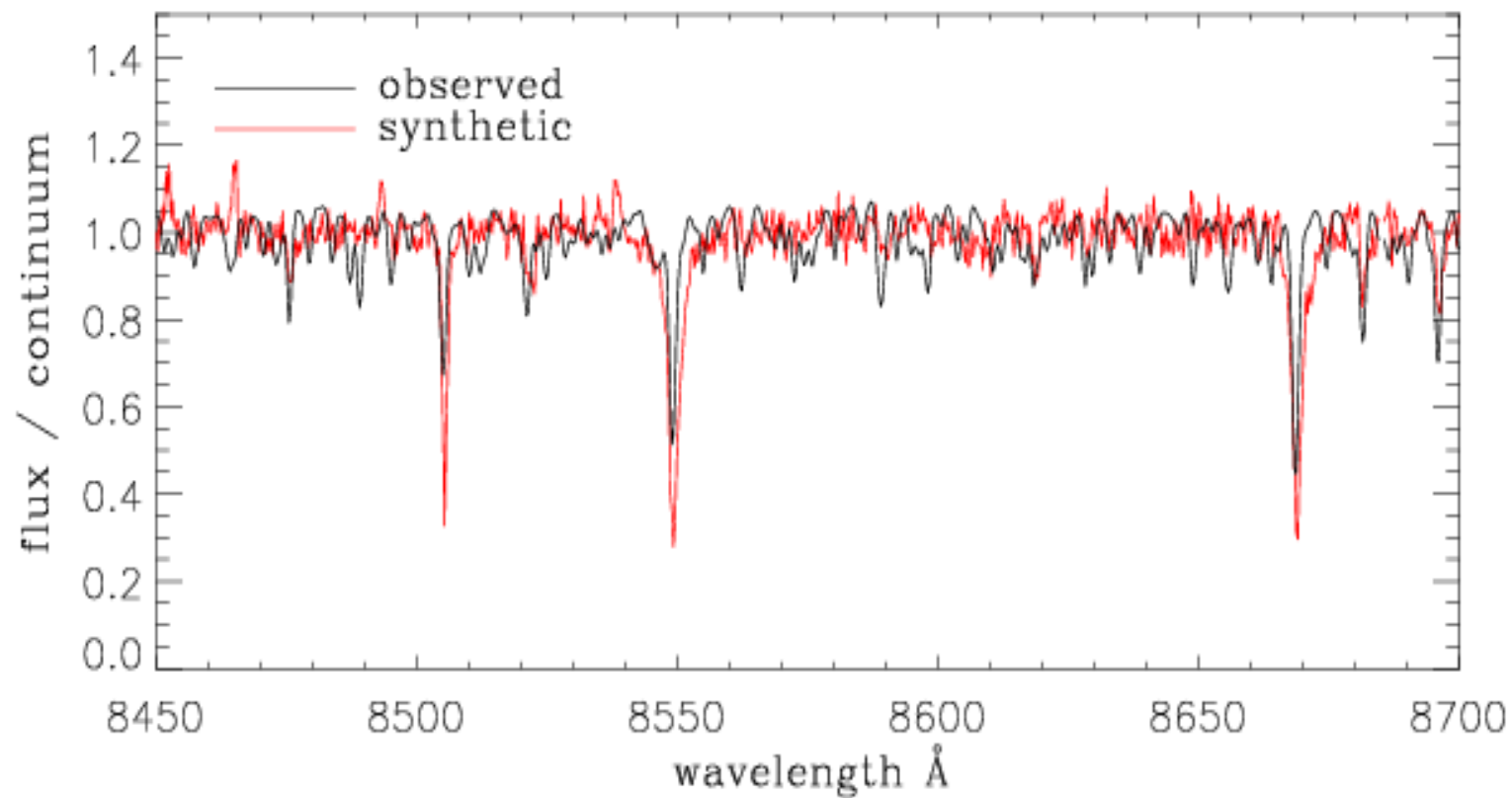
Synthetic Spectra



Synthetic Spectra



Synthetic Spectra



Chemical Parameter Space

- adjust [M/H] and [α /H] to minimize χ_r^2
- resynthesize with new atmosphere
- iterate

- Please look for results this summer!