New procedure of the fine analysis of spectra of F-G-K stars

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Outline

- Input data.
- Input physics.
- Paradigmas (suggestions, simplifications, theory)
- Computations and comparison with the observed spectra of template stars.
- Fit to observed spectra.

A few general remarks:

- Abundance determination is well developed business.
- We use solar physics as the background.
- A lot of experts. Everybody knows almost everything.
- It looks like comparatively simple procedure.
- All problems are known.
- A lot of software exists (WIDTH, CME, STARSP...)


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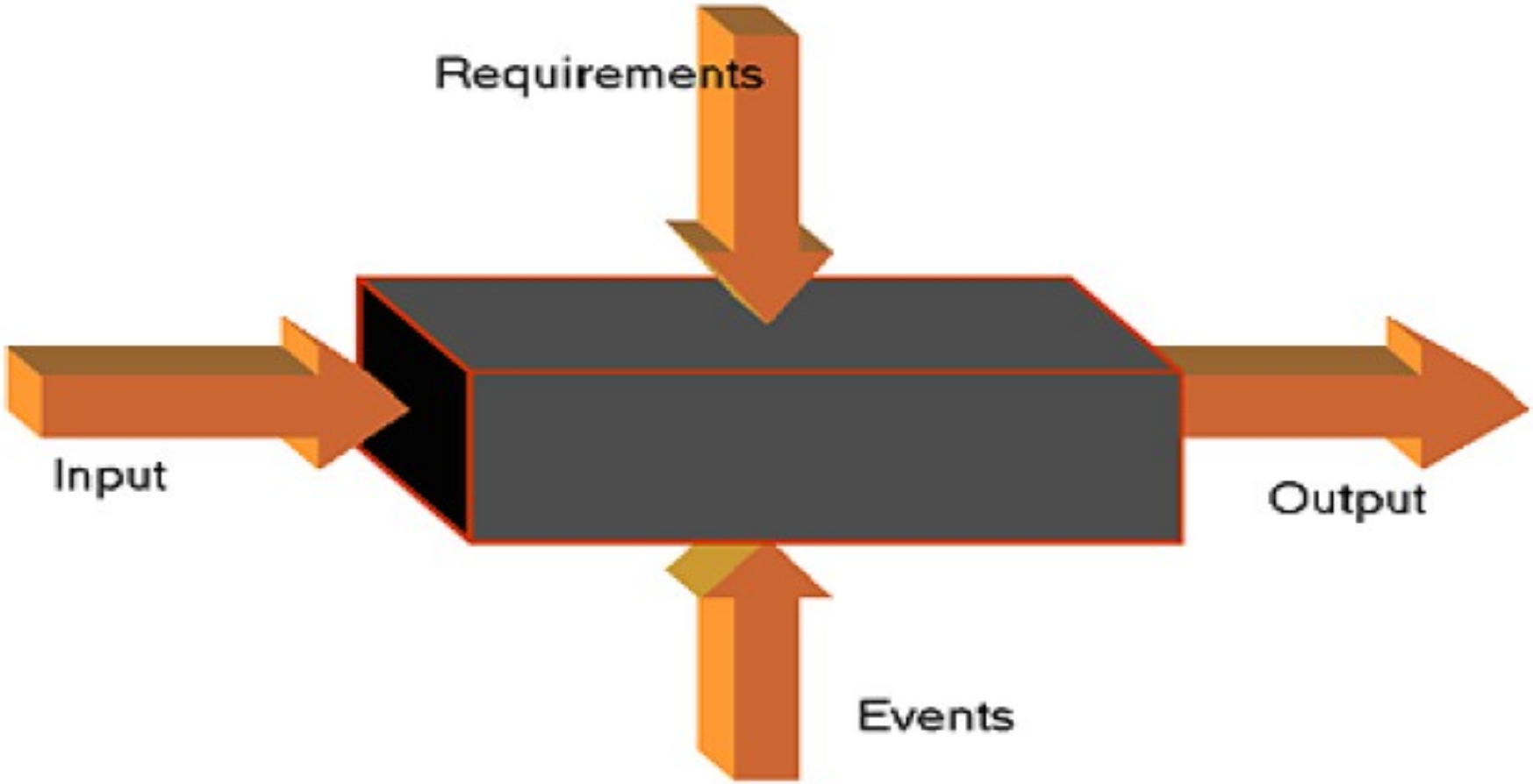
The "Gray body" concept




Welcome To
UNCERTAINTY
Est.2008

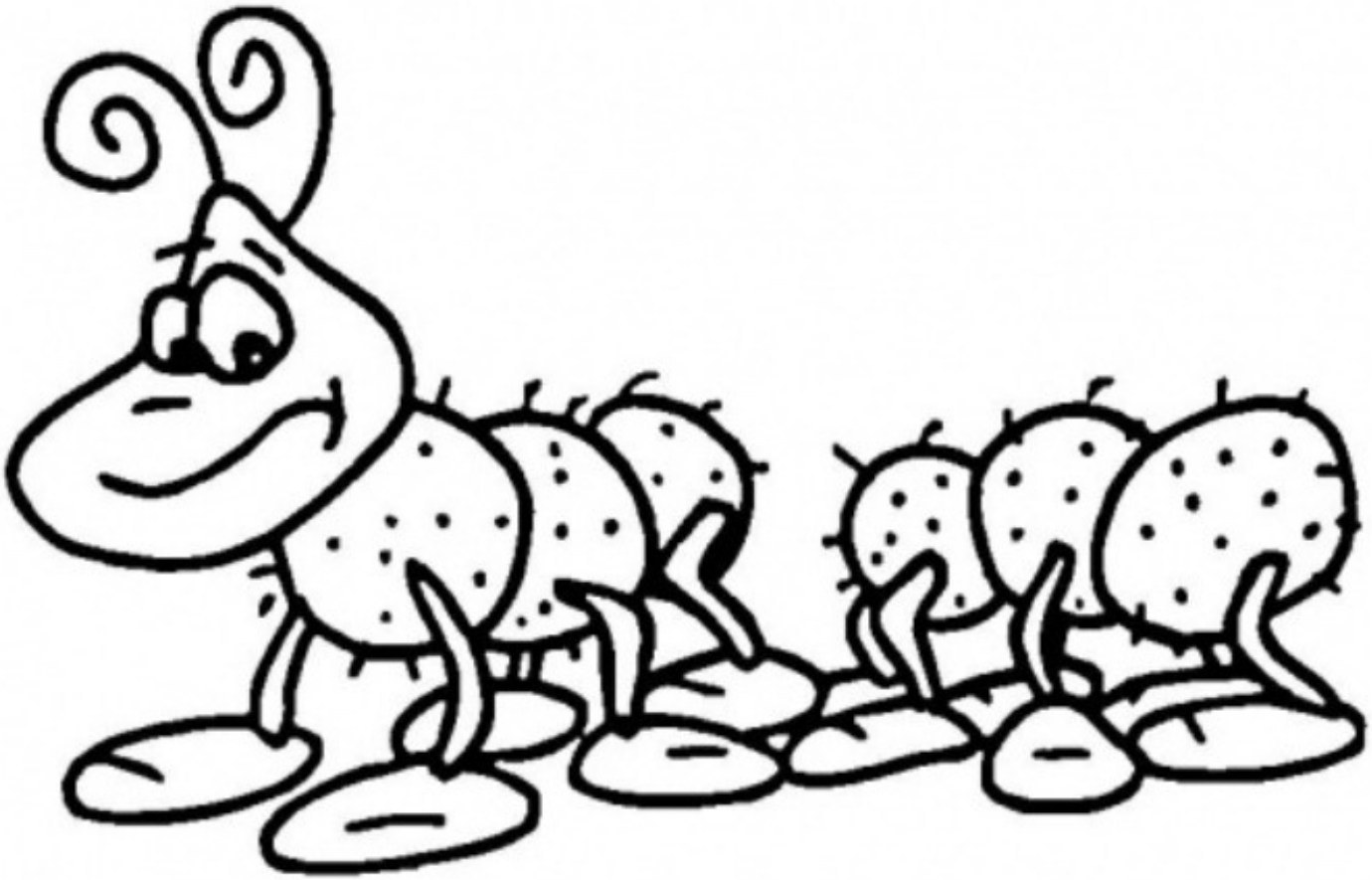
Problems forever

- NLTE
- Convection (1D, 2D, 3D, MHD...)
- Chemistry (dynamical processes in atmosphere)
- Spots
- Missing opacity
- Line formation theory
- Chromospheres, activity, waves
- Differential rotation

NLTE

- Cross sections (bb, bf, ff)
- Inelastic collisions with e-
- Inelastic collisions with H
- Opacities in bb, bf
- NLTE in lines of other elements
- Overionisation
- Loses of photons
- NLTE in ionisation equilibrium
- ...

When a centipede thinks about what will be the next leg, one cannot move anywhere at all.

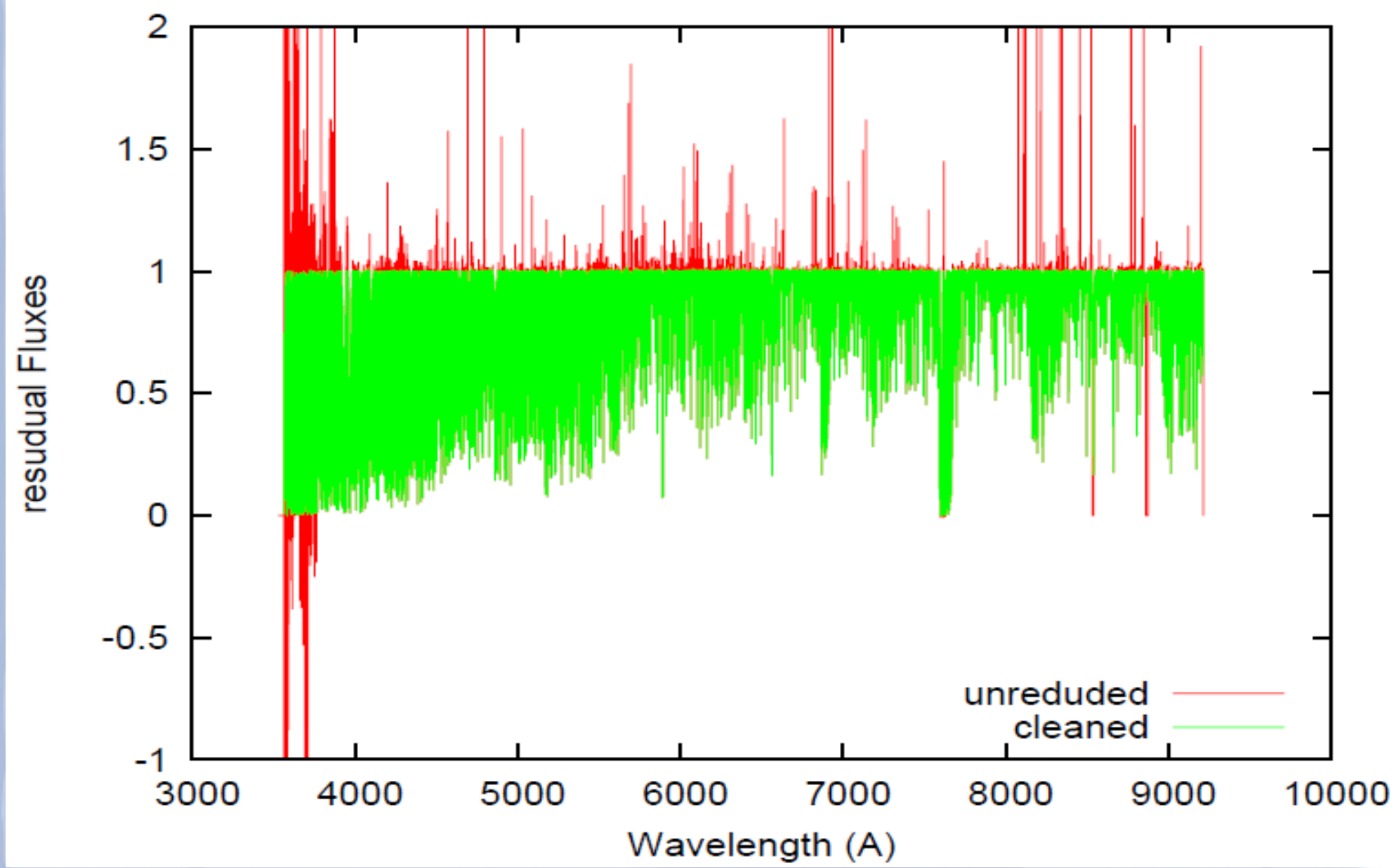



CLOSE
YOUREYES
CLEAR YOUR
HEART
LET ITGO

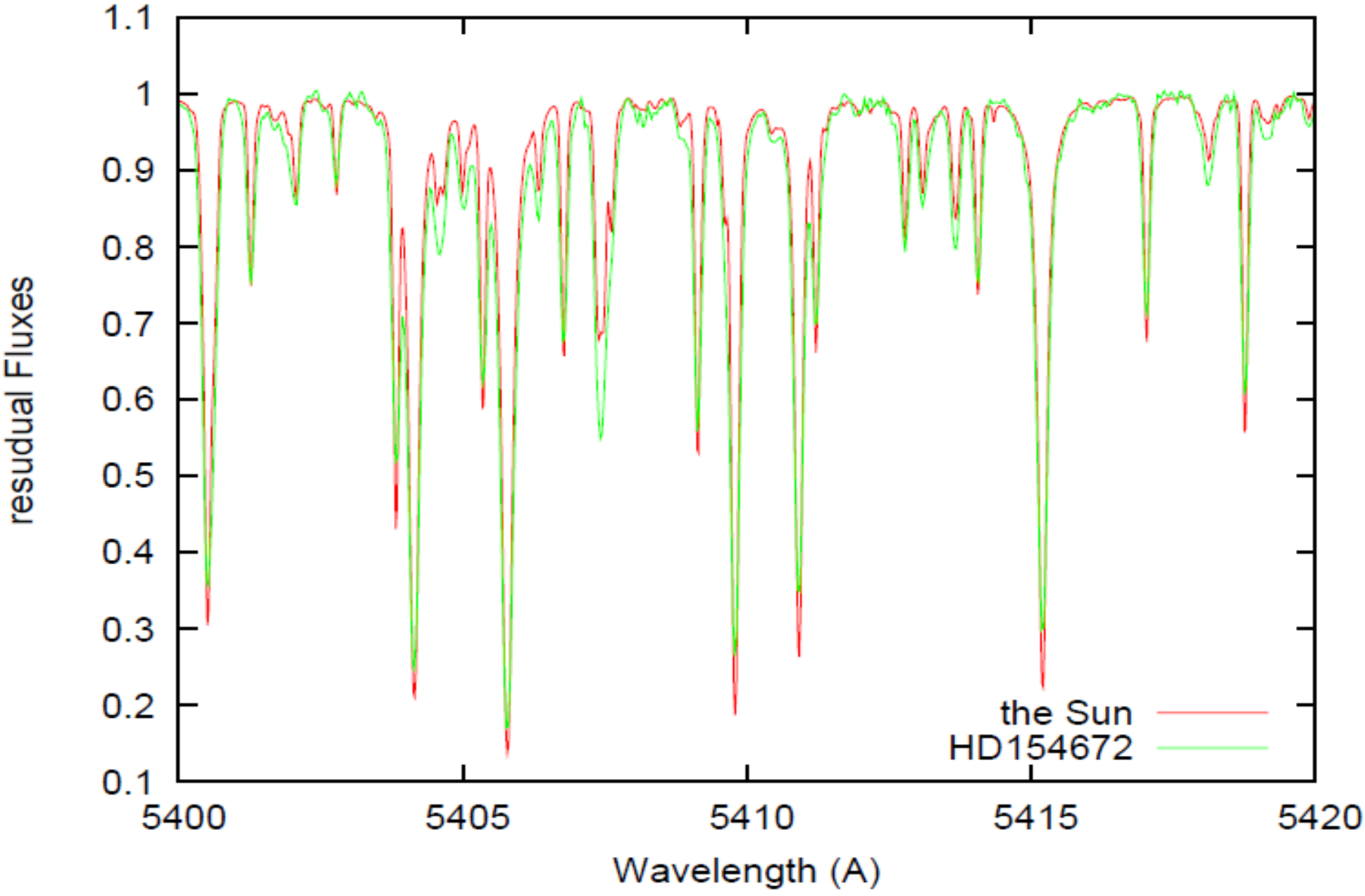
Let's go. Part 1.

- Reduce to the observed spectrum.
- Cleaning, make a "real" continuum.
- Compare the observed spectrum with the known templates (sic!!!).

Observed spectrum

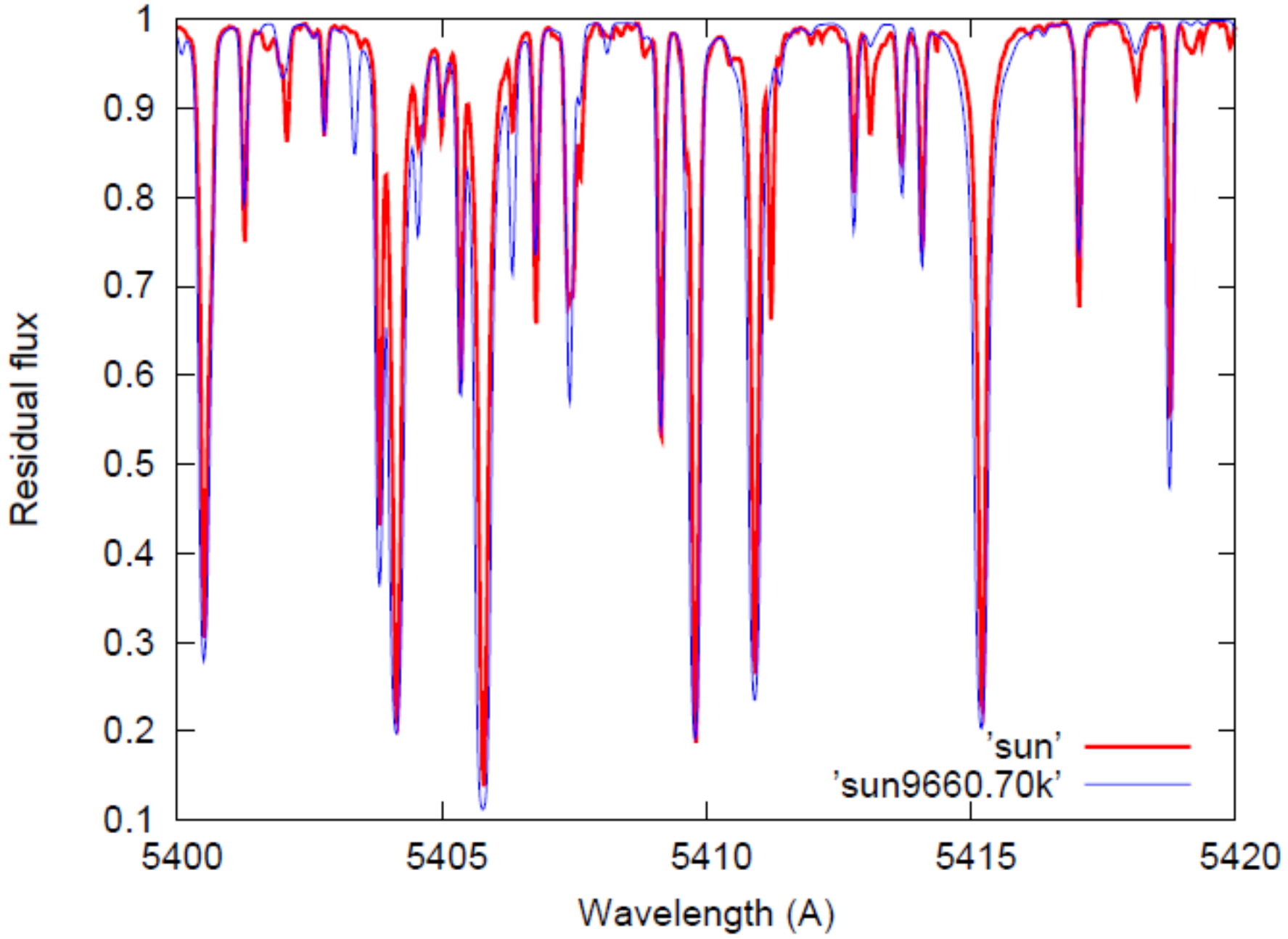


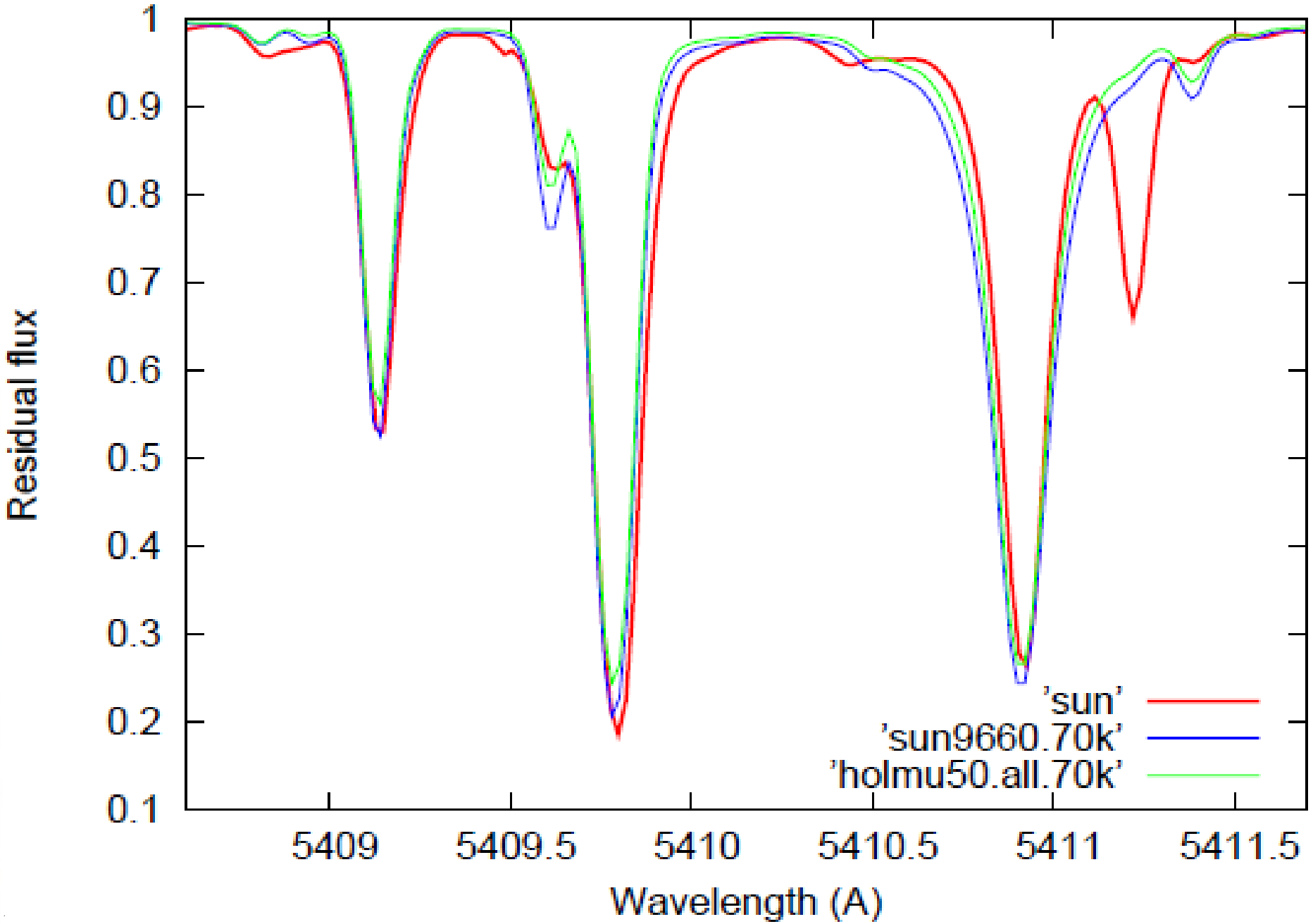
Comparison with the Sun



Theoretical and observed spectra.

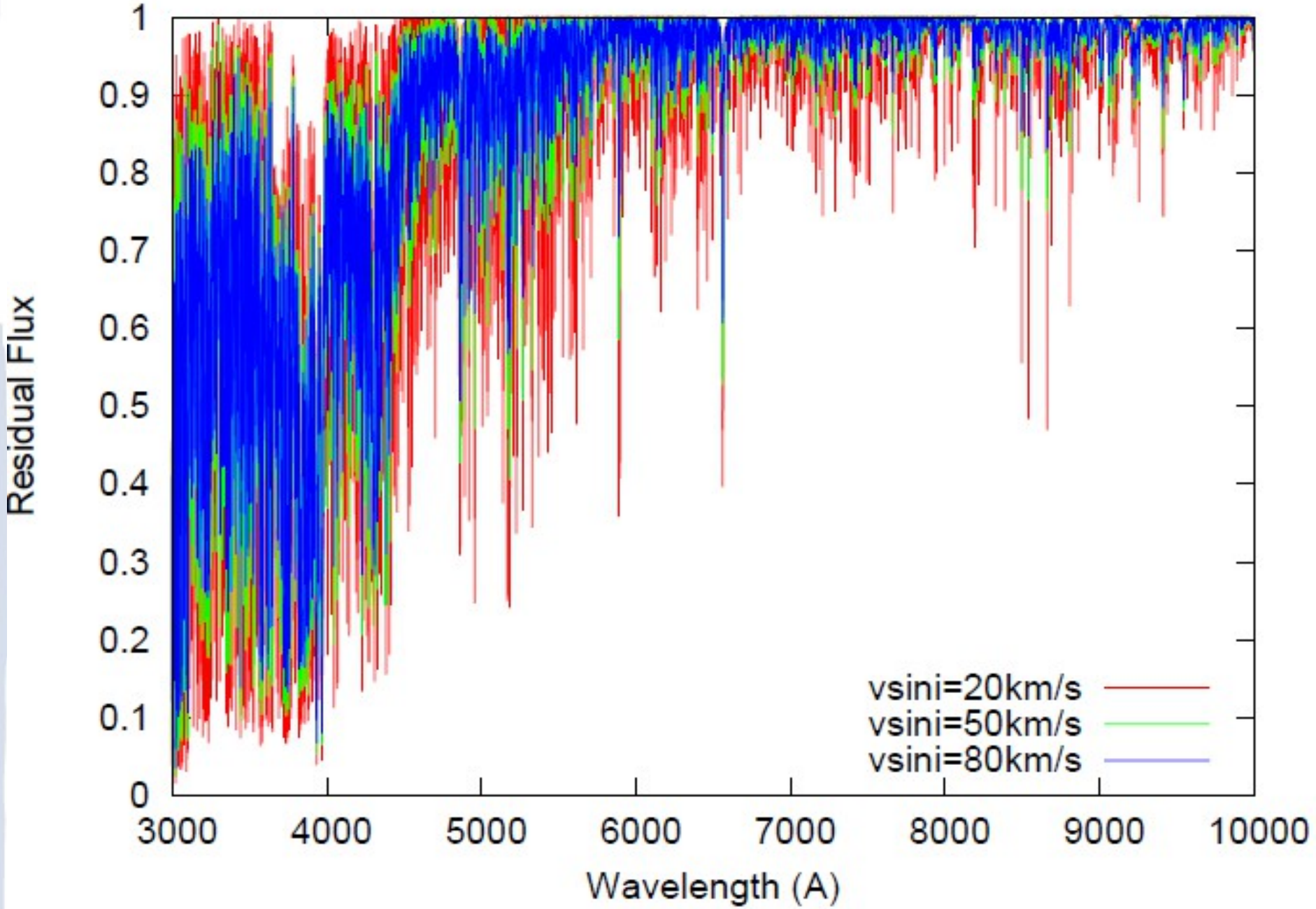
… theoretical model atmospheres...

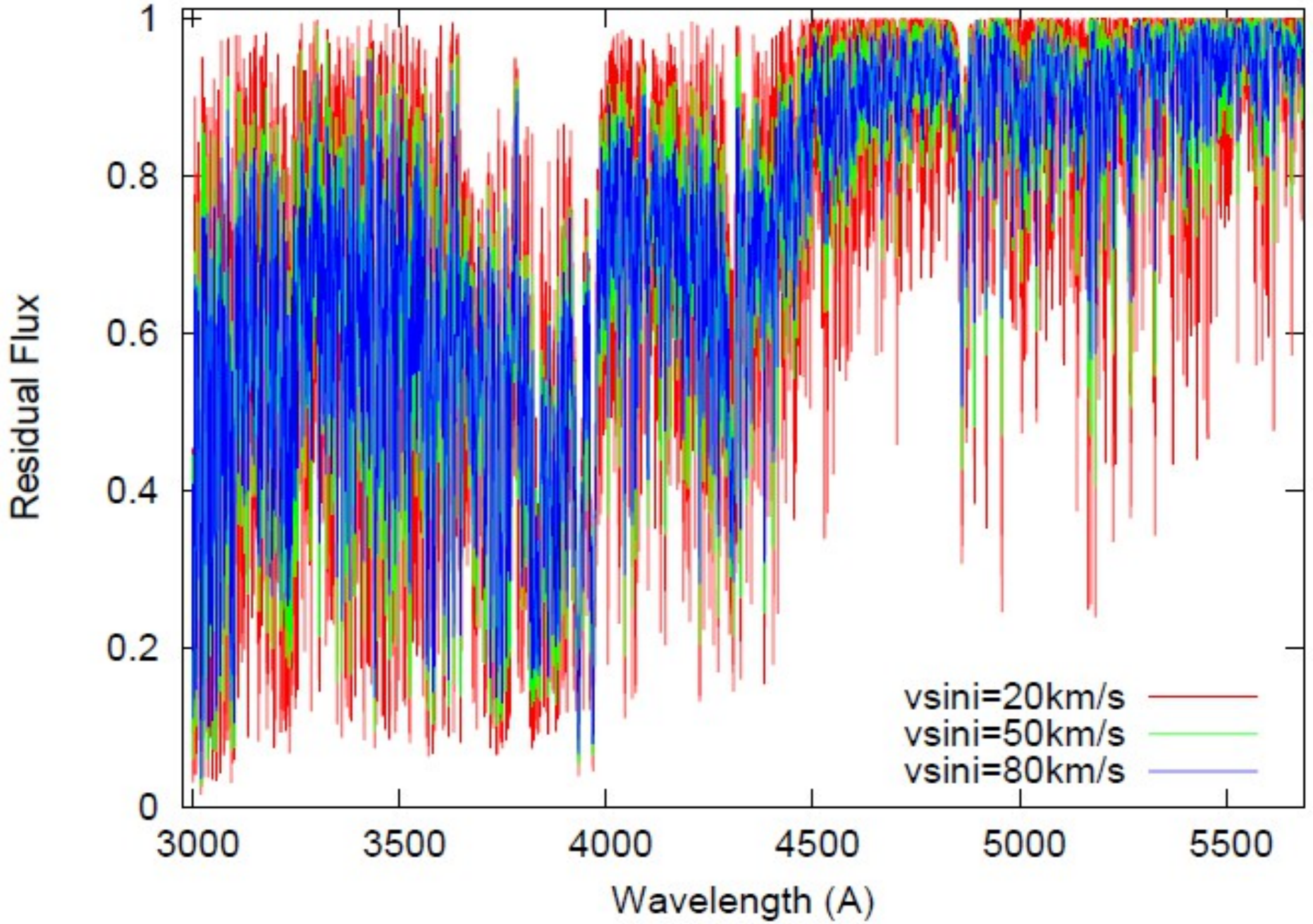

Residual flux
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
5400
5405
5410
5415
5420
Wavelength (A)
'sun'
'sun9660.70k'


Residual flux
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
5409
5409.5
5410
5410.5
5411
5411.5
Wavelength (A)
'sun'
'sun9660.70k'
'holmu50.all.70k'

Rotation and continuum.

… pseudocontinuum!!!


Residual Flux
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3000
4000
5000
6000
7000
8000
9000
10000
Wavelength (A)
vsini=20km/s
vsini=50km/s
vsini=80km/s


Residual Flux
1
0.8
0.6
0.4
0.2
0
3000
3500
4000
4500
5000
5500
Wavelength (A)
vsini=20km/s
vsini=50km/s
vsini=80km/s

Let's go. Part 2.

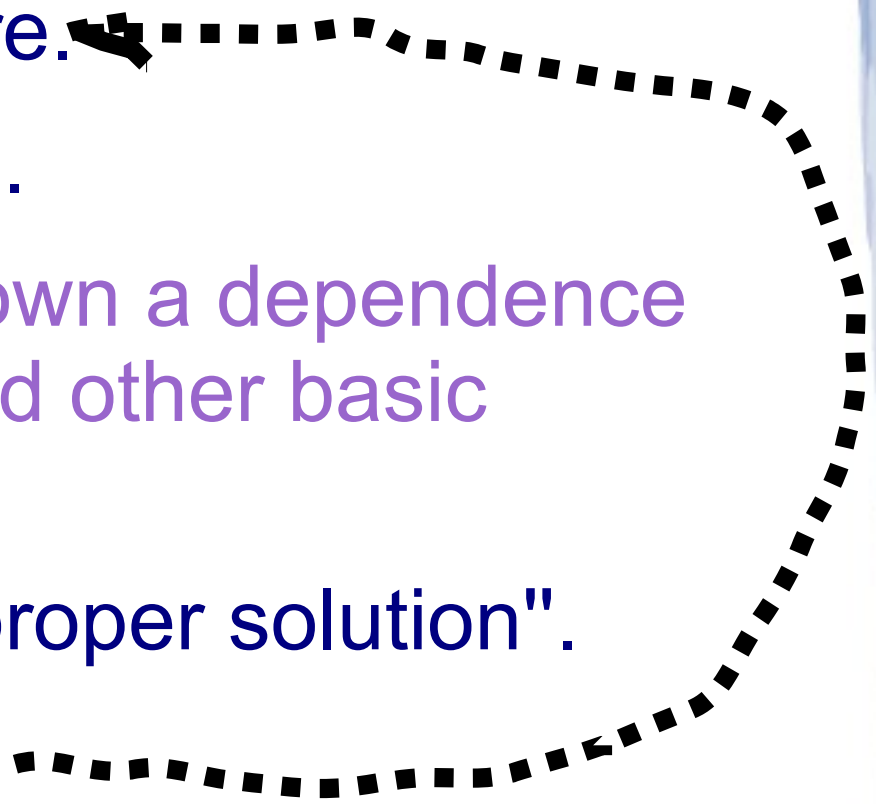
i. Compute model atmosphere.

ii. Compute synthetic spectra.

iii. Select proper features shown a dependence on the Fe abundance and other basic parameters.

iv. Perform a search of the "proper solution".

v. Find other abundances.



Repeat the process iteratively.

Our procedure (Pavlenko et al. 2012, MNRAS, 422, 542).

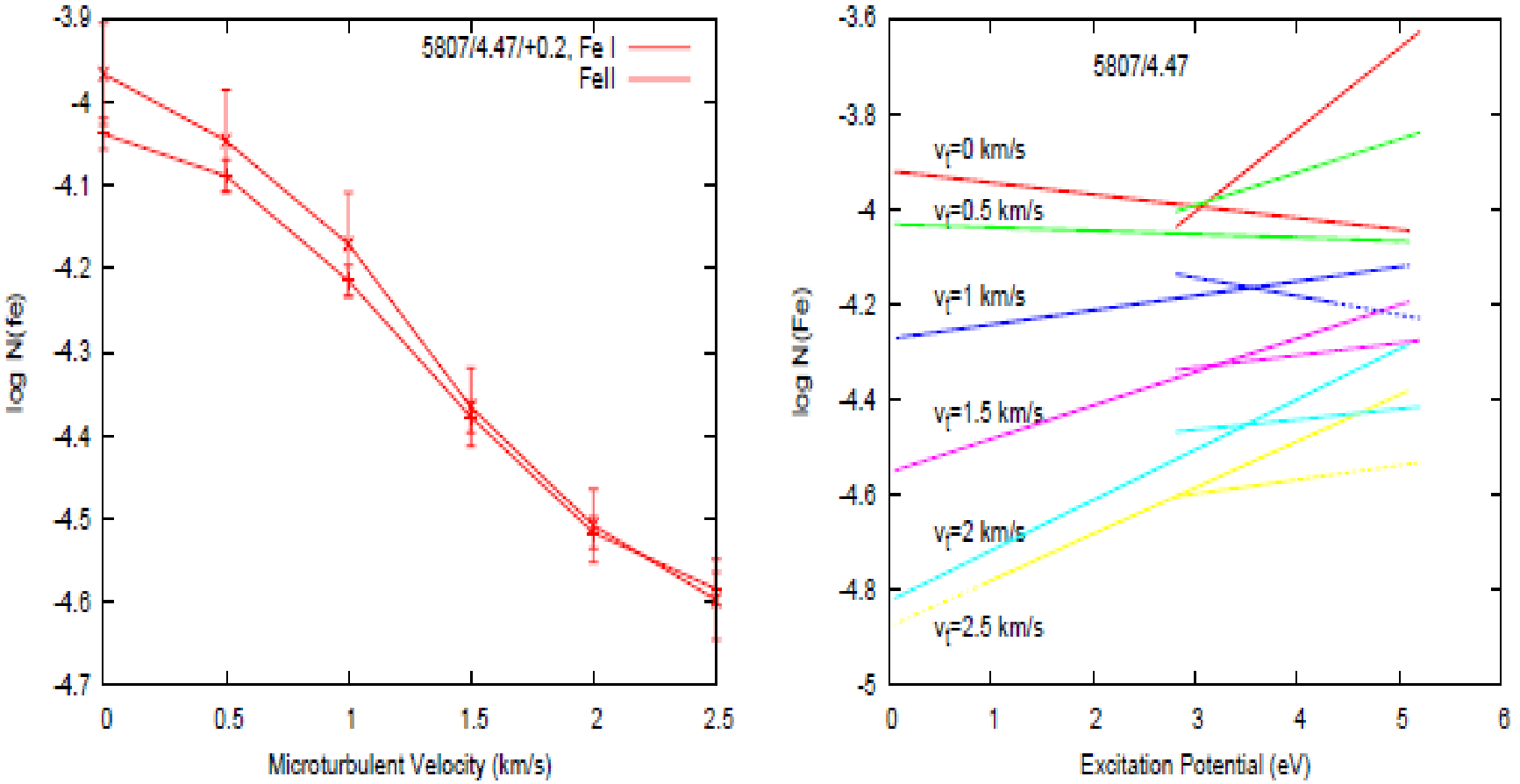


Figure 3. Left: abundances of iron determined from the fits on the synthetic stectra computed for the 5807/4.47/+0.2 model atmosphere to the observed Fe I and Fe II features in the observed spectrum of HD1835. Right: the dependence log N(Fe) vs. E'' of Fe I and Fe II lines shown by thin and thick lines, respectively.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V.Trimble & R.A, Bell:

"...Given the web of interconnected uncertainties and errors presented here, one is initially tempted to give up on stellar atmospheres completely and turn to something simple like cosmology."