

Exercise 1:

LTE vs NLTE line synthesis



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Installing the STiC code

You can pull the code from the GITHUB repository:

<https://github.com/jaimedelacruz/stic>

Follow the instructions to install it:

```
git clone https://github.com/jaimedelacruz/stic.git
```

```
# Define your CPU
```

```
export OS=Linux
```

```
export CPU=x86_64
```

```
# Select the makefile
```

```
cd stic/src
```

```
cd makefiles/
```

```
rm makefile.x86_64.Linux
```

```
ln -s makefile.x86_64.Linux.gcc makefile.x86_64.Linux
```

```
cd ..
```

```
# Compile RH
```

```
cd rh/rh_1d/
```

```
make -j4
```

```
cd ../../
```

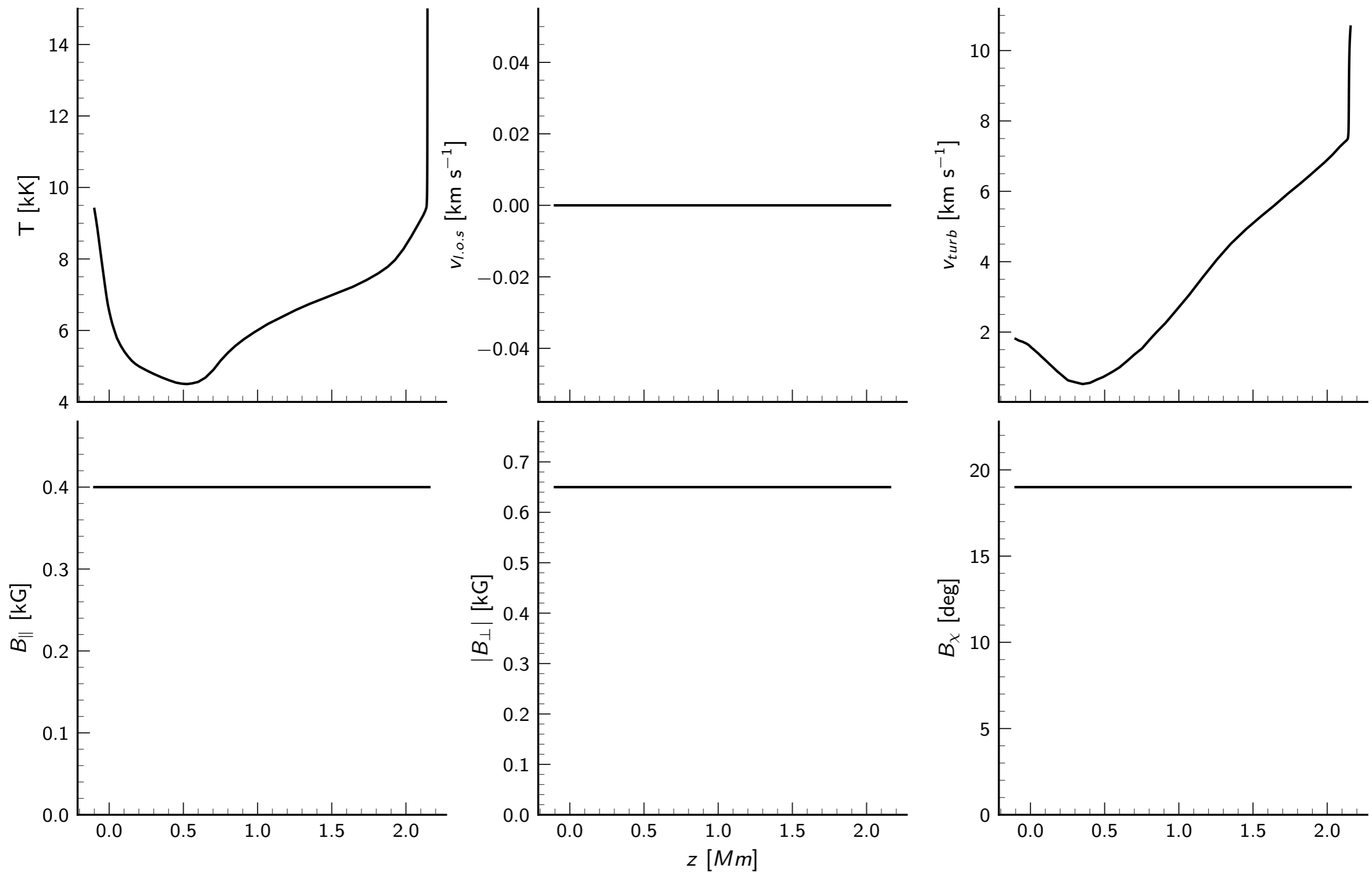
```
# Compile EOS and inversion engine
```

```
make -j4
```

```
./STiC.x # just to test that the binary executes
```

Exercise 1

FAL-C model atmosphere + constant **B**



Exercise 1

Now, enter the exercise_1 folder: `input.cfg`, `atoms.input`, `keyword.input`

We will now synthesize spectra in LTE first.

Then we will compute the same spectra in NLTE assuming statistical equilibrium.

LTE synthesis: There are some limitations in RH on how to do this. The easy way: set relevant atoms as `ACTIVE` and the initial solution to `LTE_POPULATIONS` in `atoms.input`. But then we set the number of iterations to zero so the populations are not iterated.

In `keyword.input`:

```
N_MAX_ITER = 0
```

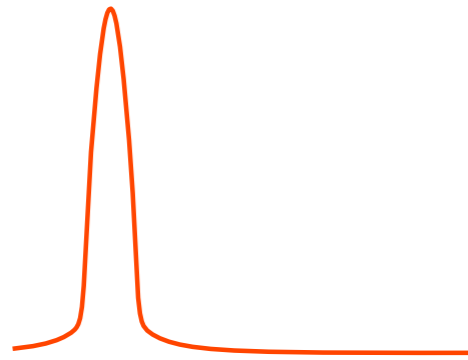
NLTE synthesis: Now change the name of the output profiles file and set the number of maximum iterations to a large number (e.g., 200):

In `keyword.input`:

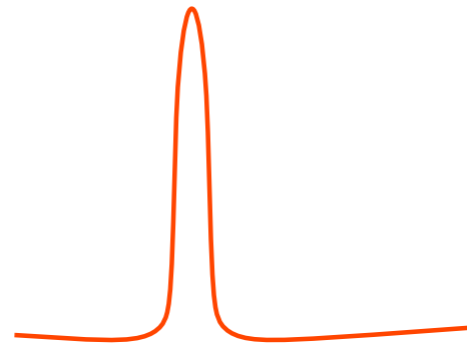
```
N_MAX_ITER = 200
```

Exercise 1

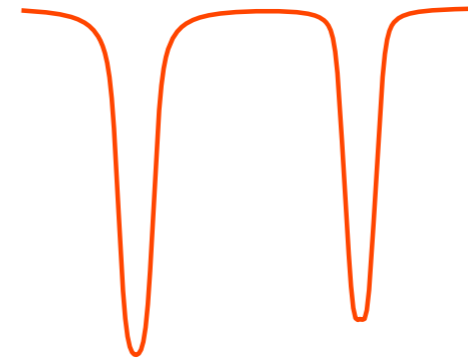
Mg II k



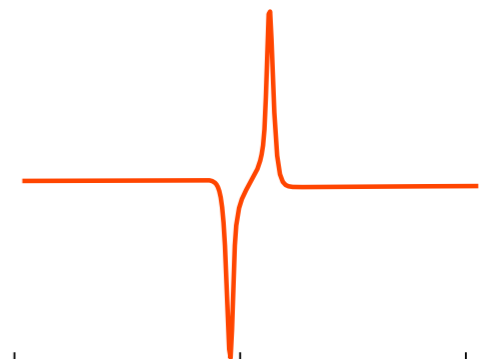
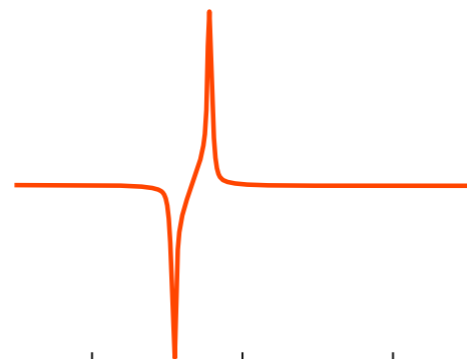
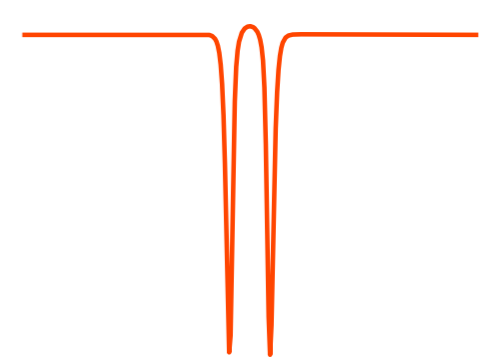
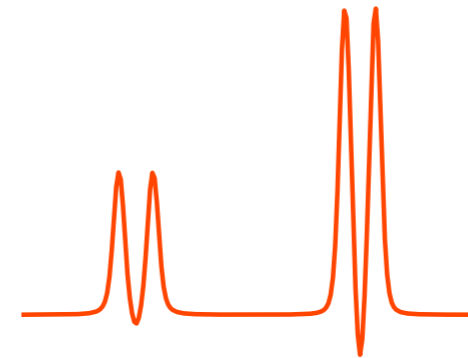
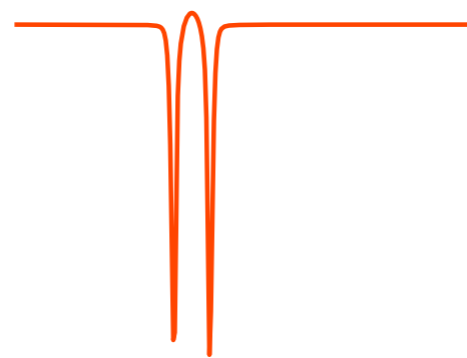
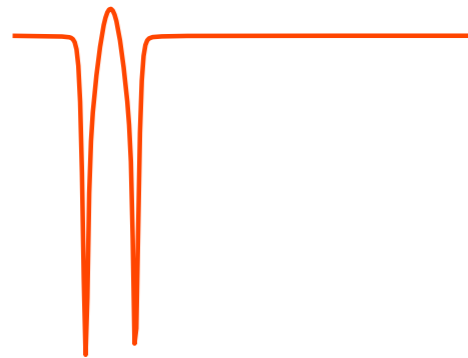
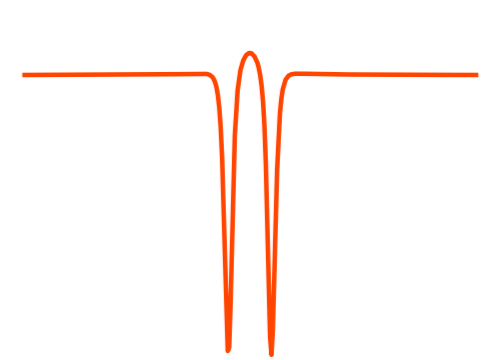
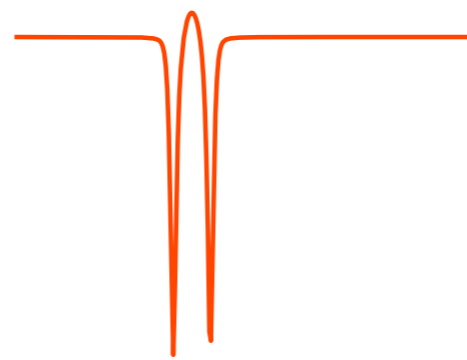
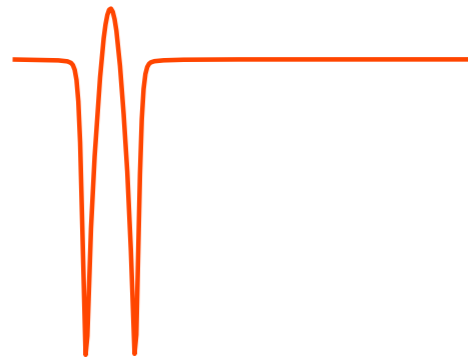
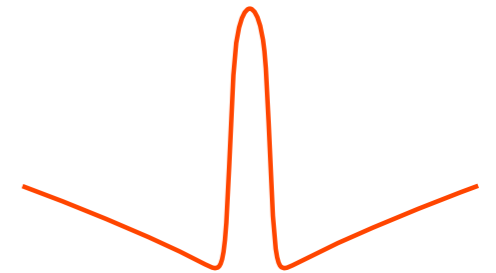
Ca II k



Fe I 6301 & 6302



Ca II 8542



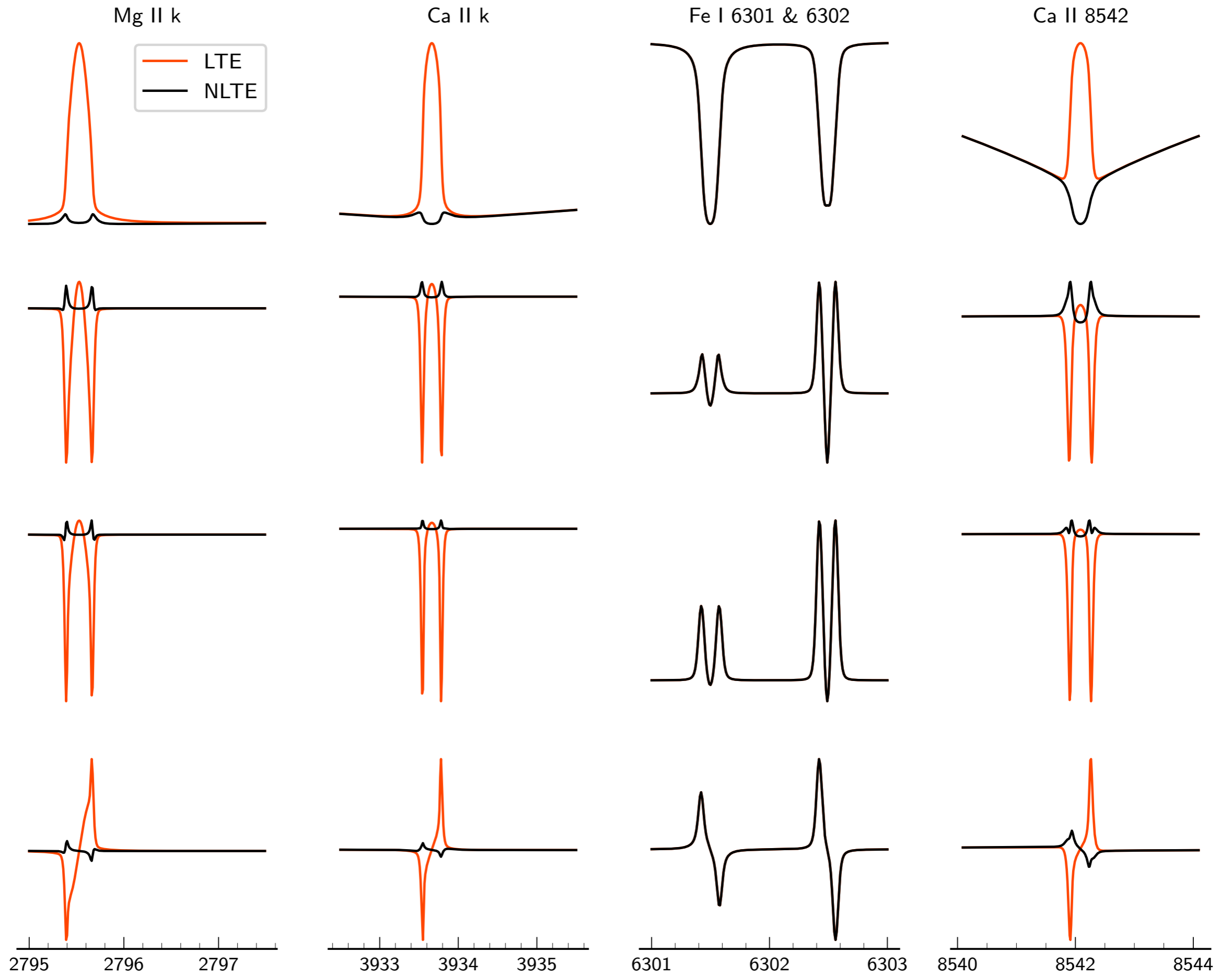
2795 2796 2797

3933 3934 3935

6301 6302 6303

8540 8542 8544

Exercise 1



Summary

The damping wings of chromospheric lines are photospheric and in most cases LTE

The Gaussian core is chromospheric and deviates from LTE