Practical Introduction to Model Fitting

5 examples of model fitting, all on real data : to be made **successively**

1. fitting of a **simple** model on **one** file
2. fitting with **parameters sharing** on several files
3. fitting with **degeneracies**
4. application to a set of AMBER data :
   exercise yourself!
5. Fitting another set of data for fun

In red, questions or advices

Exercise 1- simple fit 1.1

- Launch LITpro

- Load the data file **arcturus.1.79mu.oifits** from the local repository */home/linux/data/Model_Fitting/tutorial/LITpro/*

(note that the data used for the practice are also available from *http://apps.jmmc.fr/oidata/*)

- Proceed with these steps:
  - Select File > New settings
  - Click "Load oifiles"

    What kind of data did you load ?
  - explore the data :

    In File Panel, with "Plot VIS2DATA…", UV coverage,…

    What clue do you get from the OI_T3 data ?
  - Add a target (click "Targets")
  - Add model (for ex. disk)
  - Initialize the parameters
  - Run fit
  - Visualize the result of the fit: tables, plots

- Try a fit after removing the setting "Normalize total flux":

  Explain the value of parameters and of Chi2

- Save the settings (click File > Save settings)

Exercise 1- simple fit 1.2

- Same operations with the file **arcturus.1.52mu.oifits**
- Fit from various initial "Values" for the diameter

  What is the problem ?
- Analyze with "Plot Chi2" tools

  Why the final Chi2 is not so good?
- Try to improve the final Chi2

  Check with a "nice teacher"

Exercise 2 - Fit with sharing of parameter

- Aim : on **2** data sets, one by wavelength, fit a model of **center-to-limb darkening** (e.g. power law) considering that:
  - the diameter of the photosphere (therefore common to both groups) is achromatic
  - the center-to-limb darkening coefficient is chromatic

- Files to load: **arcturus.1.52mu.oifits** and **arcturus.1.79mu.oifits**

- Select for ex. limb_power model for each of one and share the diameter between both

  (**use contextual menu** – mouse right click)

To do: plot **all the data and fitted models** on the **same** graph

Check with a "nice teacher"

Exercise 3 - Fit with degeneracies
3 -1

- Aim : estimate the separation of the binary Theta1 Ori C
  - from the file **Theta1Ori2007Dec03_2.fits**
  - build the model: combine **2 puncts**
  - select **only VIS2**
  - and run fit

What happens ?

Check with a “nice teacher”

Exercise 3 - 2

- Use the tools ***Plot Chi2 2D with (x2, y2), (fx_w1, fx_w2)…***

How looks the chi2 map?

How are x2, y2 ? (see also the correlation matrix)

Why ?

How to overcome the difficulty ?

Check with a “nice teacher”

Exercise 3-3

- After the degeneracy has been analyzed:

– load the file **Theta1Ori2007Dec05_2.fits**
– set the suitable values for flux_weight1, flux_weight2, [x2, y2]
– and fit both files

Are there different solutions?

You can convert the results to polar coordinates (**use contextual menu** – mouse right click on punct2.x2 or punct2.y2 -)

… If yes, **why** ?

Exercise 3-4

- Add T3phi
- Do again the fit (with same initial conditions than the previous one)
- Compare the result with the published one - Ask a “nice teacher”-

- Plot an image of your model

How the fit can be improved?

Check your solution with a “nice teacher”

Exercise 4: exercise yourself!

- Load from the local repository */home/linux/data/Model_Fitting/tutorial/LITpro/* the files:

  PRODUCT_HD87643_1.94-2.31micron_2008-03-01T02_01_57.1002.fits

  PRODUCT_HD87643_1.94-2.41micron_2008-03-05T03_05_13.1075.fits

  PRODUCT_HD87643_1.94-2.54micron_2008-03-12T00_24_20.3943.fits

  PRODUCT_HD87643_1.96-2.55micron_2008-03-11T00_17_20.5606.fits

- Observe the data… VIS2 and T3phi, remembering exercise 3

- Build a first model and conduct the fit yourself

Exercise 5: another binary

- Load the data file **2004-BSC1948I.fits** from the local repository */home/linux/data/Model_Fitting/tutorial/LITpro/*

- Conduct the fit like for Exercise 3

  Beware of the symmetries

Check your solution with a “nice teacher”