

py-tools for modeling gaseous nebulae

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summary

- python: no way, you need to know it ;-)
- PyNeb: determine physico-chemical parameters of the nebula
- pyCloudy:
 - easy managing Cloudy from python
 - grids
 - pseudo-3D models
- 3MdB: a database of Cloudy models

python

- need to learn it: mostly use language in astronomy and in the world
- python 2.7 vs. 3.6: now it's time to switch to 3.
- a lot of tutorials (e.g. <https://github.com/Morisset/Python-lectures-Notebooks>)
- stackoverflow site: answers almost all the questions.

Installing python

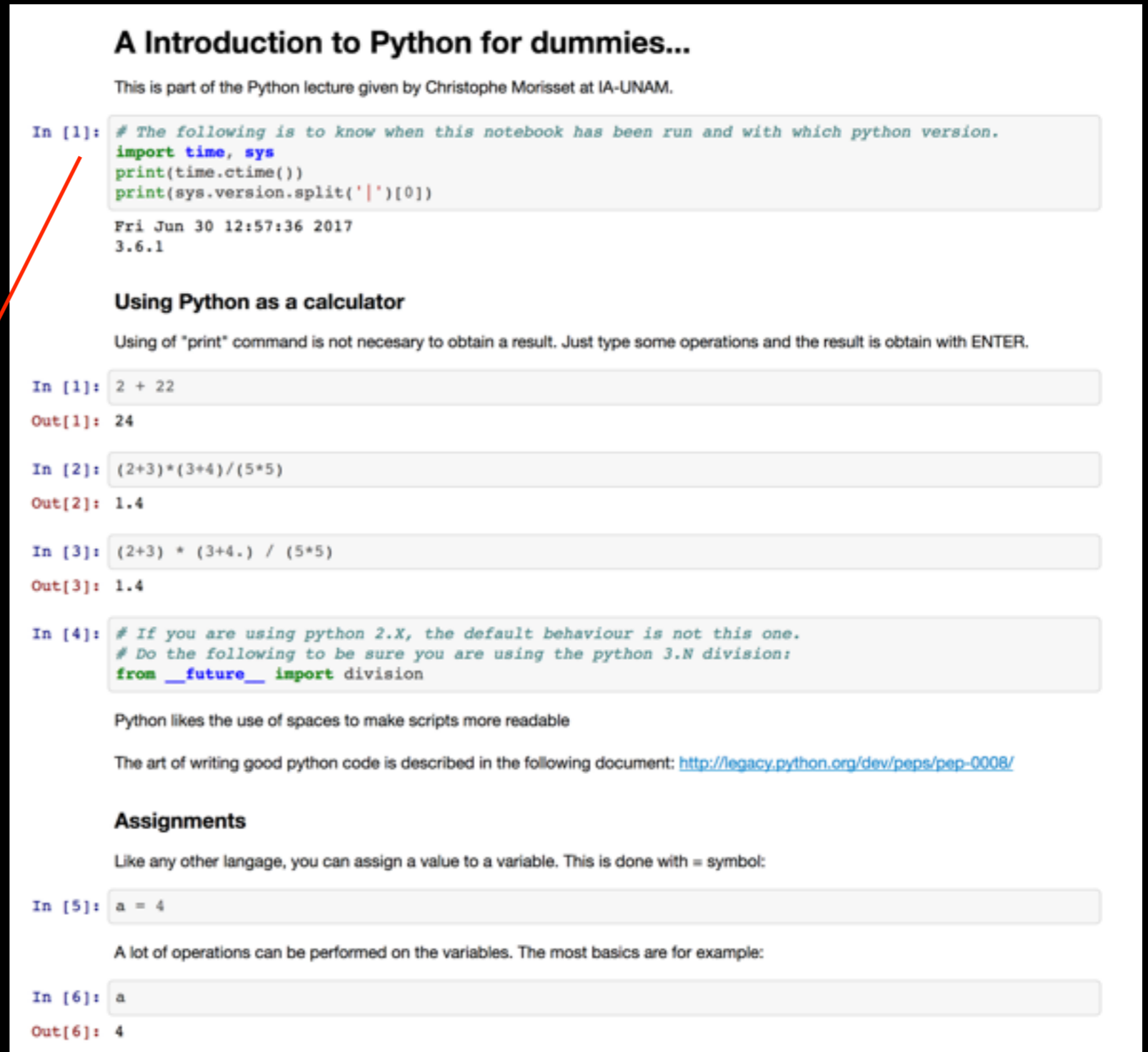
- Better use a package manager.
- For example: Anaconda <https://anaconda.org/>
- Comes with almost all the useful libraries
- `conda install` or `pip install`
- easy way to have python 2.7 and 3.6 on the same computer
- The best is using ipython (interactive mode)

Notebooks

This is the easy way to build manuals.

jupyter notebook

execute cell with SHIFT+ENTER



A Introduction to Python for dummies...

This is part of the Python lecture given by Christophe Morisset at IA-UNAM.

```
In [1]: # The following is to know when this notebook has been run and with which python version.
import time, sys
print(time.ctime())
print(sys.version.split('|')[0])
```

Fri Jun 30 12:57:36 2017
3.6.1

Using Python as a calculator

Using of "print" command is not necessary to obtain a result. Just type some operations and the result is obtain with ENTER.

```
In [1]: 2 + 22
```

Out[1]: 24

```
In [2]: (2+3)*(3+4)/(5*5)
```

Out[2]: 1.4

```
In [3]: (2+3) * (3+4.) / (5*5)
```

Out[3]: 1.4

```
In [4]: # If you are using python 2.X, the default behaviour is not this one.
# Do the following to be sure you are using the python 3.N division:
from __future__ import division
```

Python likes the use of spaces to make scripts more readable

The art of writing good python code is described in the following document: <http://legacy.python.org/dev/peps/pep-0008/>

Assignments

Like any other langage, you can assign a value to a variable. This is done with = symbol:

```
In [5]: a = 4
```

A lot of operations can be performed on the variables. The most basics are for example:

```
In [6]: a
```

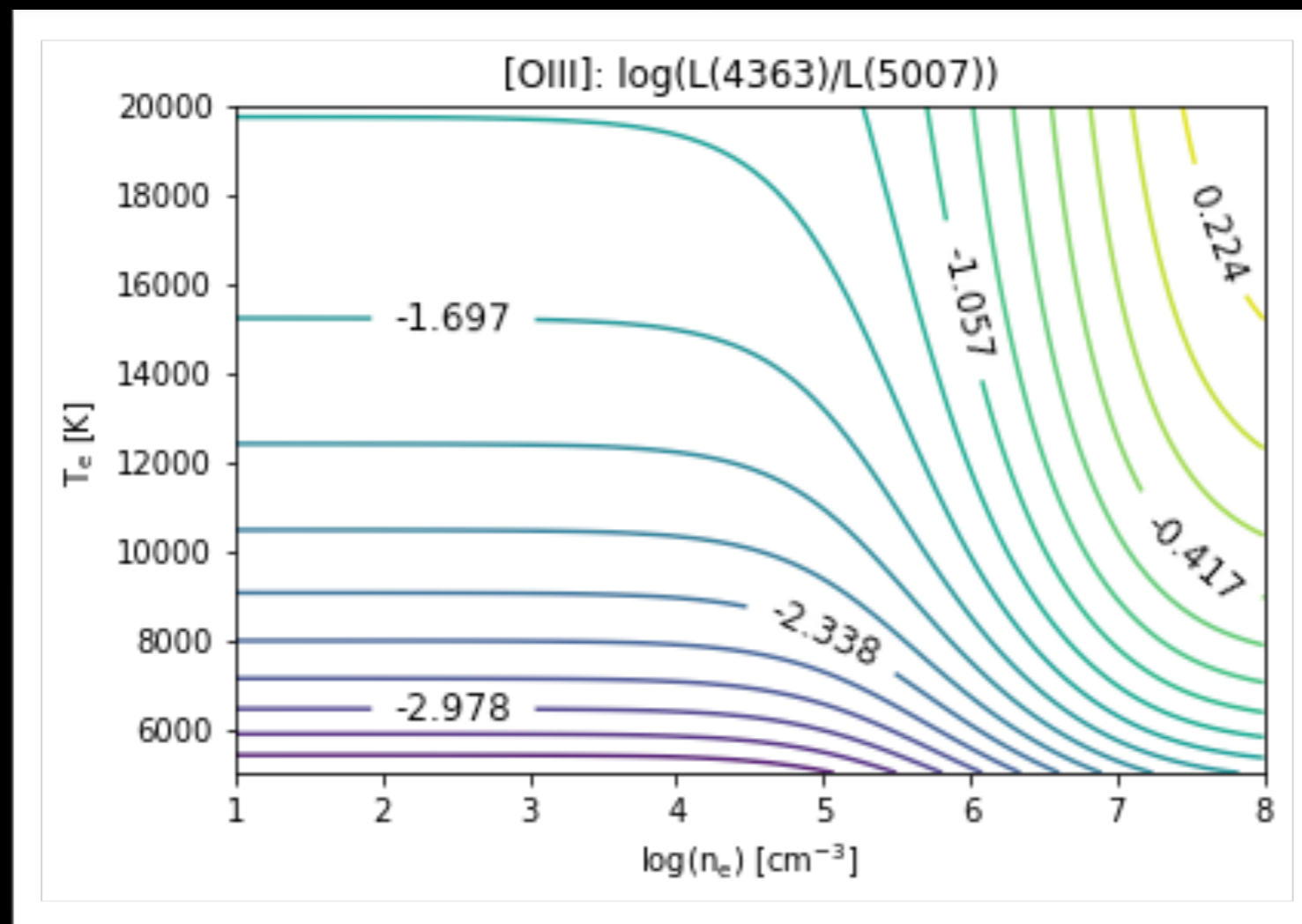
Out[6]: 4

PyNeb

- python library to:
 - determine and apply reddening corrections
 - determine electron temperature and density from line ratios; also crossing Te-Ne using 2 diagnostics
 - determine ionic abundances from line intensities and Te-Ne.
 - determine elemental abundances using ICFs
- It helps to define starting points for the model.

PyNeb diagnostic diagrams

- Each diagnostic has its validity domain.



PyNeb

- web page: <https://pypi.python.org/pypi/PyNeb>
- Manual: https://github.com/Morisset/PyNeb_devel/tree/master/docs
- Reference Manual: https://morisset.github.io/PyNeb_Manual/html/index.html
- group: <https://groups.google.com/forum/#!forum/pyneb>

pyCloudy

- Library to manage Cloudy from python
- web page with examples: <https://sites.google.com/site/pycloudy/>
- development web page: <https://github.com/Morisset/pyCloudy>
- group: <https://groups.google.com/forum/#!forum/pycloudy>

3MdB

- A database of already run Cloudy models for PNe, HII regions and DIG.
- Acces via mySQL.
- Very easy using pymysql and pandas libraries.
- Visit <https://sites.google.com/site/mexicanmillionmodels/>

pyCloudy for Cloudy summer school

https://github.com/Morisset/Cloudy_Summer_School/