pyCloudy, a tool to manage Cloudy

Christophe Morisset
Instituto de Astronomia
UNAM, Mexico
chris_morisset@gmail.com

Christophe Morisset

- Working on HII regions, Planetary Nebulae, Wolf Rayet nebulae
- Interested in abundance determination, models of complex objects (3D, multi-phase, multi-components)
- Main developer of:
  - pyCloudy
  - PyNeb
  - 3MdB
- Interested in using Machine Learning techniques to interpolate in grids of models (Cloudy models for example)

The pyCloudy ecosystem

- Main page:

  https://sites.google.com/site/pycloudy
- Installing via `pip install pyCloudy`
- Github repository:

  https://github.com/Morisset/pyCloudy
- Forum:

  https://groups.google.com/forum/#!forum/pycloudy

PyCloudy (and PyNeb)

- Makes it easier to interact with Cloudy from any python script or notebook:
  - Write input file, run Cloudy, read output files from a single script
  - Easy to run grids of models (just a loop in python)
  - Make 3D models (actually pseudo-3D)
  - Allow to generate big grids of models (3MdB)
- PyNeb is another library that can be used to compute line emissivities, and determine electron temperature and densities from line ratios.

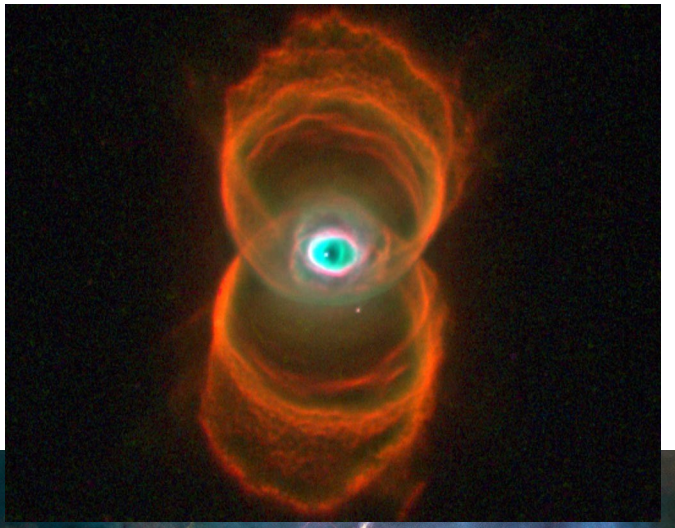
Why 3D ?

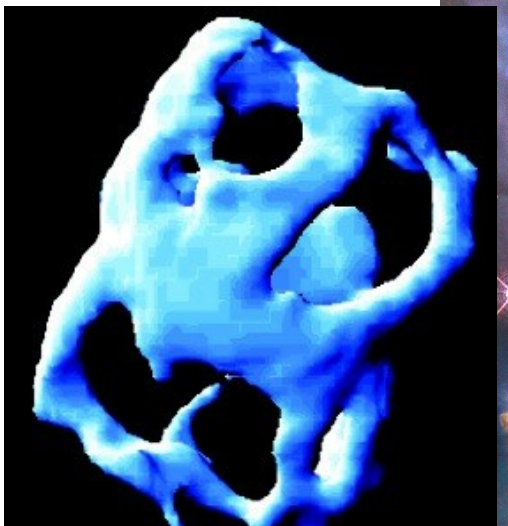
- As we all know, PN are spherical, and HII regions plan parallels :-)

Not O nor //

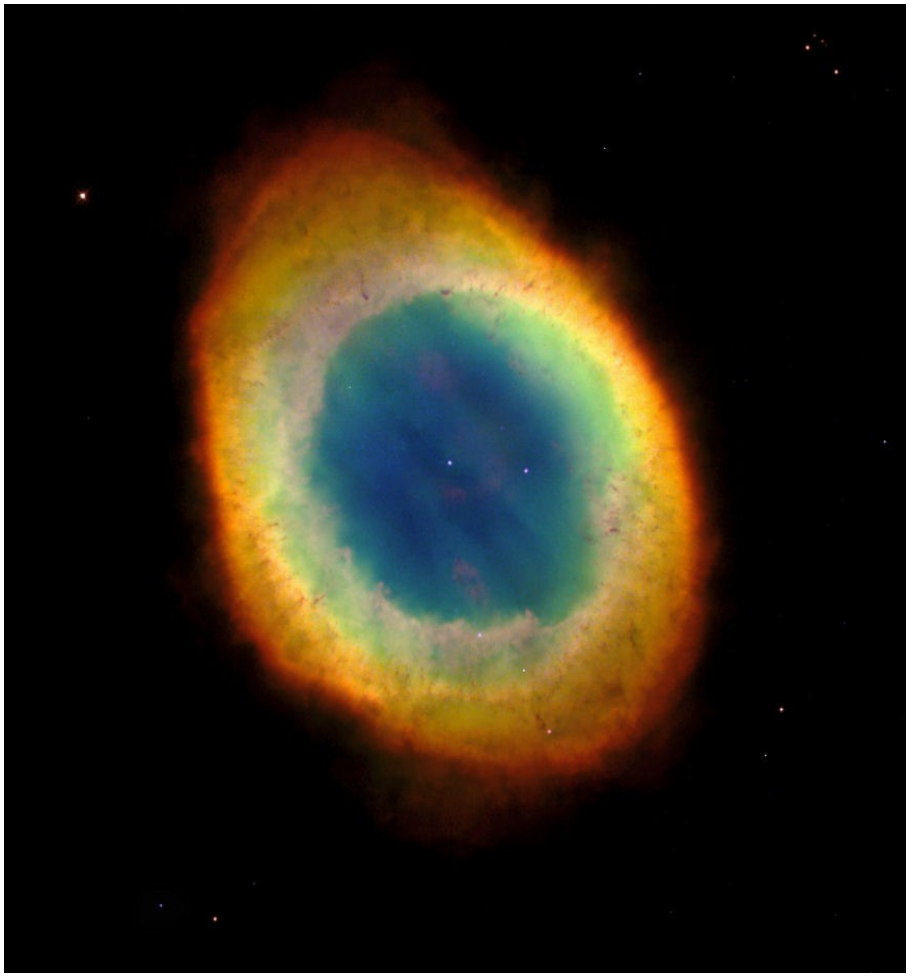

NGC 2346
Hubble Heritage
PRC99-37 • Space Telescope Science Institute • Hubble Heritage Team (AURA/STScI/NASA)


NGC 6543
HST • WFPC2
PR95-01a • ST ScI OPO • January 1995 • P. Harrington (U MD), NASA
12/13/94 zpl





Aperture effects



- Color = dominating emission line.
- Position : different line ratios.

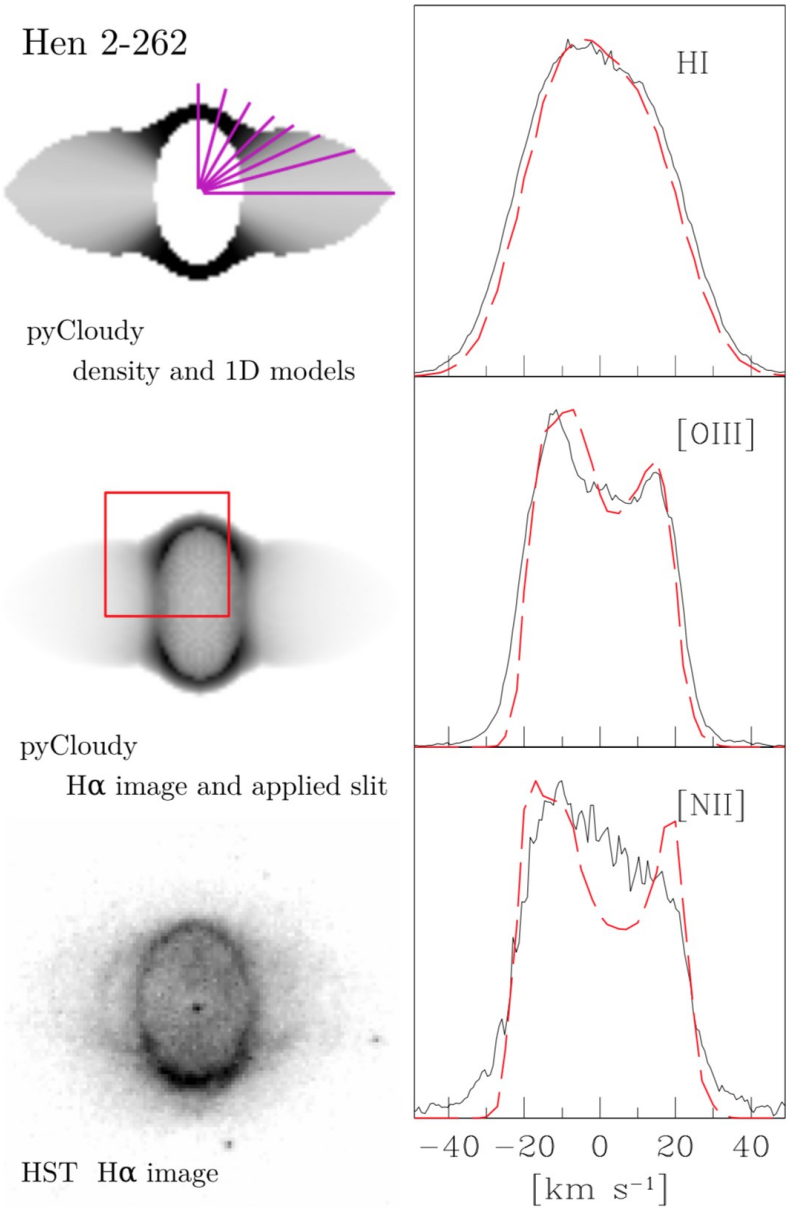
Velocity field

A&A 585, A69 (2016)
DOI: 10.1051/0004-6361/201526653

Astron & Astrop

3D pyCloudy modelling of bipolar planetary nebulae: Evidence for fast fading of the lobes⋆

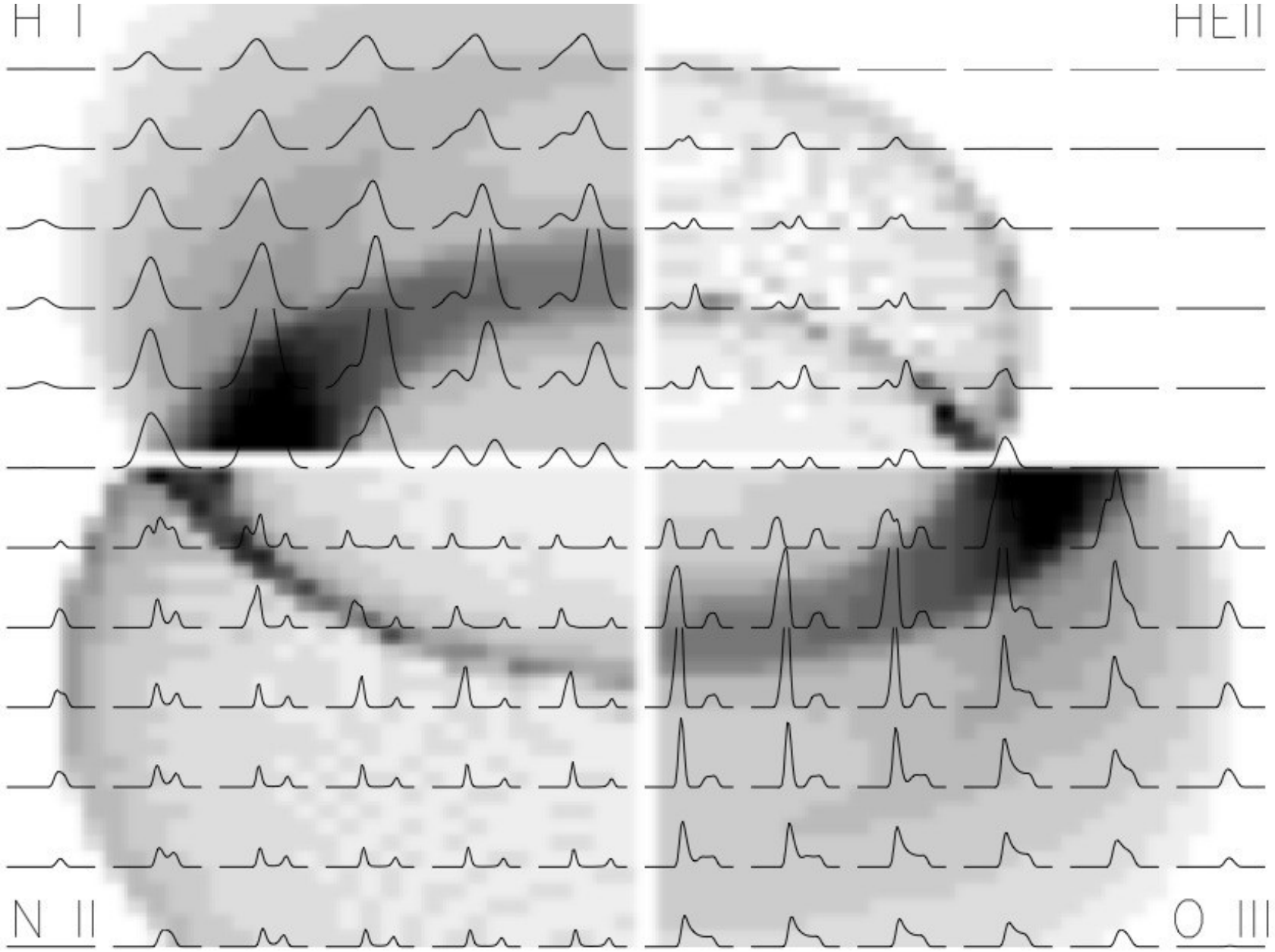
K. Gesicki[1], A. A. Zijlstra[2], and C. Morisset[3]



MODELLING OF ASYMMETRIC NEBULAE. II. LINE PROFILES

Revista Mexicana de Astronomía y Astrofísica, **42**, 153–166 (2006)

C. Morisset[1] and G. Stasińska[2]



Huge grids of models

- Sometimes one needs to compute huge grids of models (from a few 10^3 to 10^7 models...).
- In this case one cannot rely on reading all the output files, it would take toooooo much time and memory (RAM and ROM).
- The solution is to store the results of the models into a database.
- This is the main idea behind 3MdB (Mexican Million Models dataBase).

3MdB

- https://sites.google.com/site/mexicanmillionmodels/