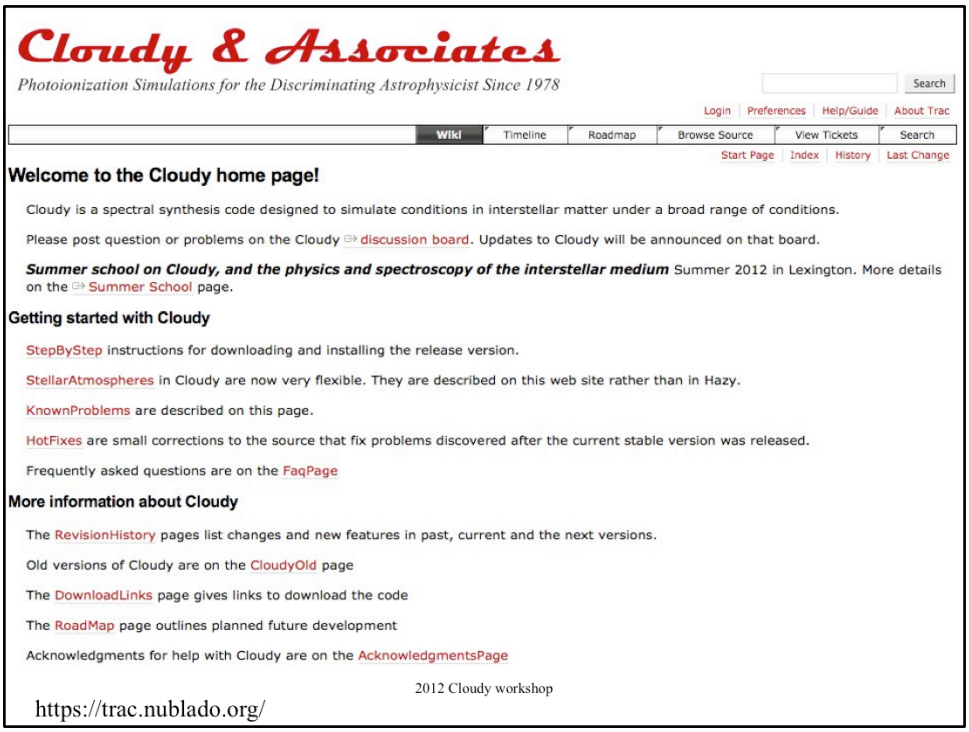
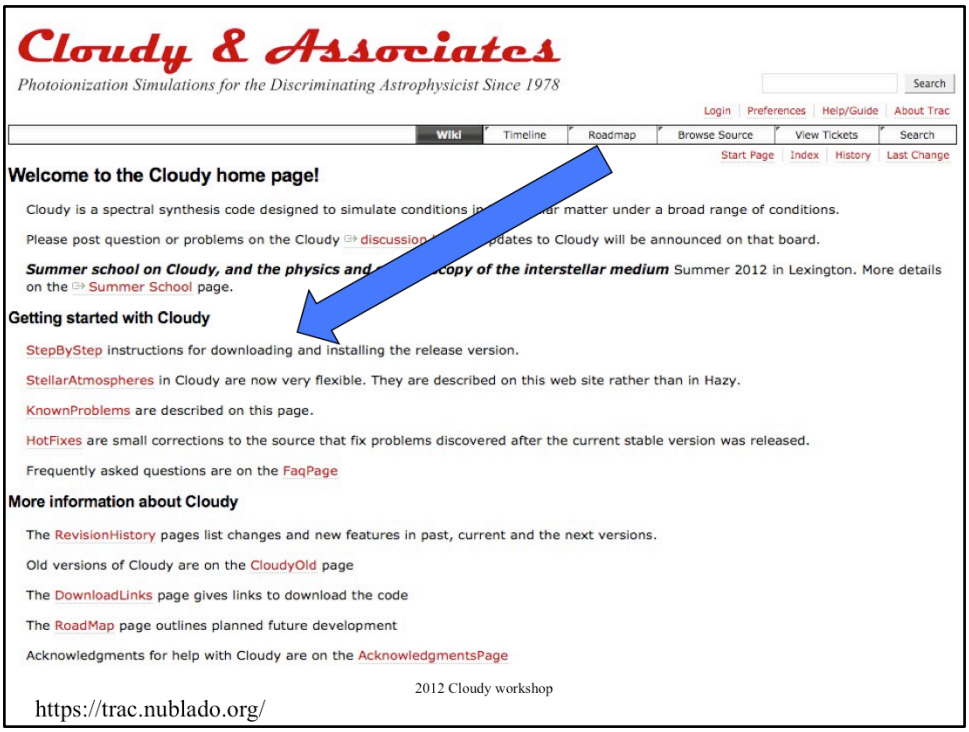
Cloudy

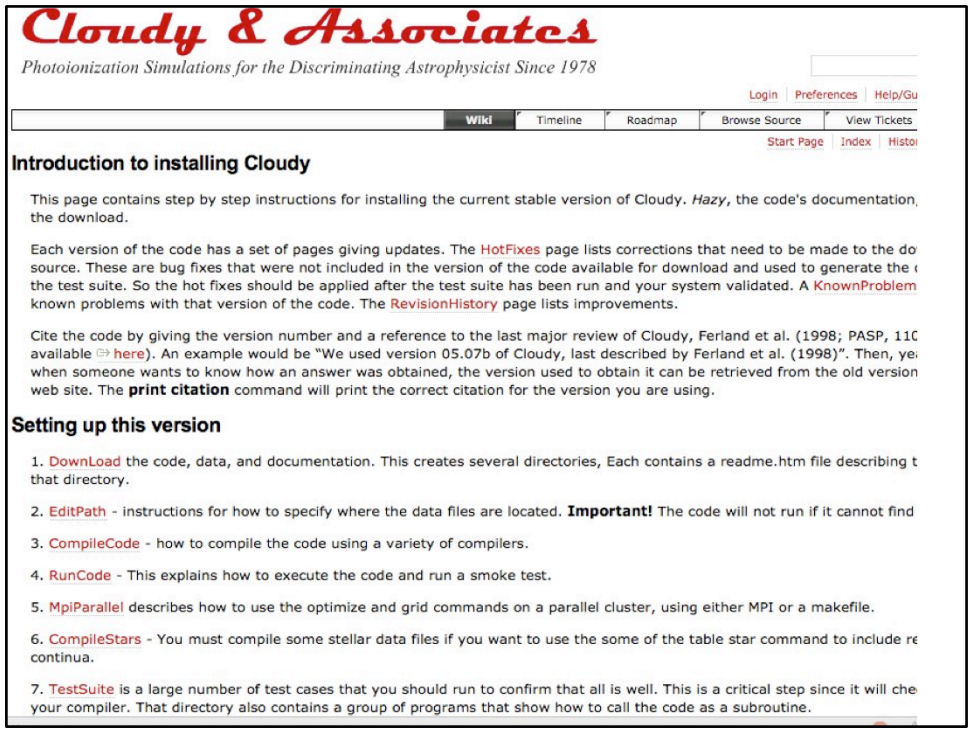
- **Accurate simulation of physical processes at the atomic & molecular level**
  - "universal fitting formulae" to atomic processes fail when used outside realm of validity, and are not used
- **Assumptions:**
  - energy is conserved
  - (usually) atomic processes have reached steady state
- **Limits:**
  - 2.7 K < T < 1010 K
  - No limits to density (low density limit, LTE, STE)
  - Radiation field 10 m to 100 MeV



Lots of information about Cloudy



How to download



Cloudy & Associates

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Introduction to installing Cloudy

This page contains step by step instructions for installing the current stable version of Cloudy. *Hazy*, the code's documentation, the download.

Each version of the code has a set of pages giving updates. The HotFixes page lists corrections that need to be made to the do source. These are bug fixes that were not included in the version of the code available for download and used to generate the the test suite. So the hot fixes should be applied after the test suite has been run and your system validated. A KnownProblem known problems with that version of the code. The RevisionHistory page lists improvements.

Cite the code by giving the version number and a reference to the last major review of Cloudy, Ferland et al. (1998; PASP, 11C available ⇨ here). An example would be "We used version 05.07b of Cloudy, last described by Ferland et al. (1998)". Then, ye when someone wants to know how an answer was obtained, the version used to obtain it can be retrieved from the old version web site. The **print citation** command will print the correct citation for the version you are using.

Setting up this version

1. DownLoad the code, data, and documentation. This creates several directories, Each contains a readme.htm file describing t that directory.

2. EditPath - instructions for how to specify where the data files are located. **Important!** The code will not run if it cannot find

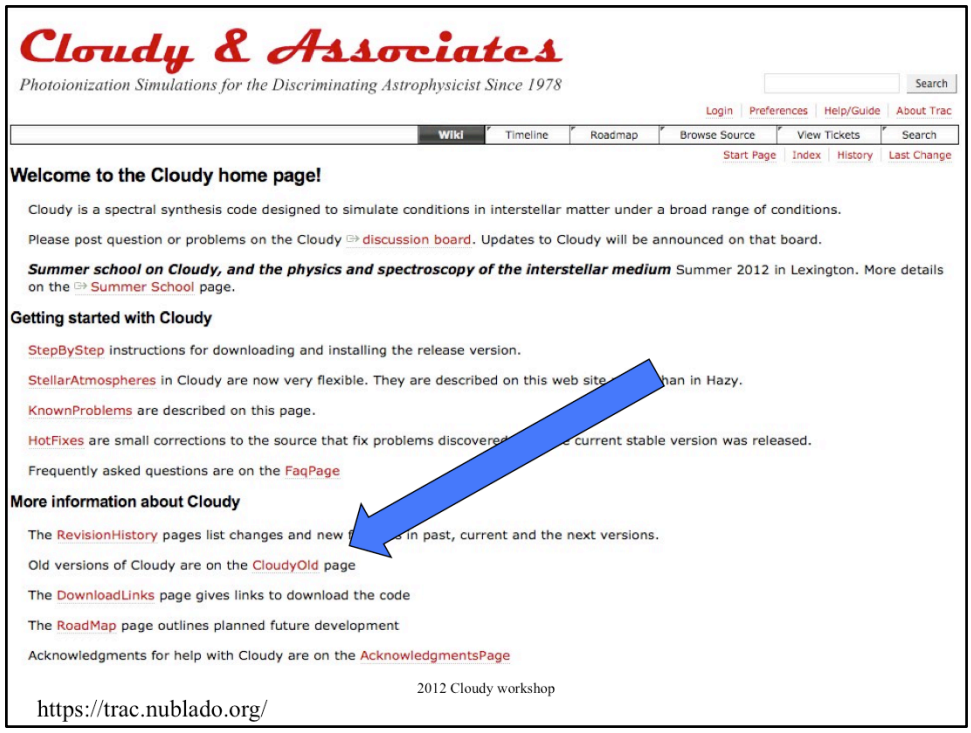
3. CompileCode - how to compile the code using a variety of compilers.

4. RunCode - This explains how to execute the code and run a smoke test.

5. MpiParallel describes how to use the optimize and grid commands on a parallel cluster, using either MPI or a makefile.

6. CompileStars - You must compile some stellar data files if you want to use the some of the table star command to include re continua.

7. TestSuite is a large number of test cases that you should run to confirm that all is well. This is a critical step since it will che your compiler. That directory also contains a group of programs that show how to call the code as a subroutine.

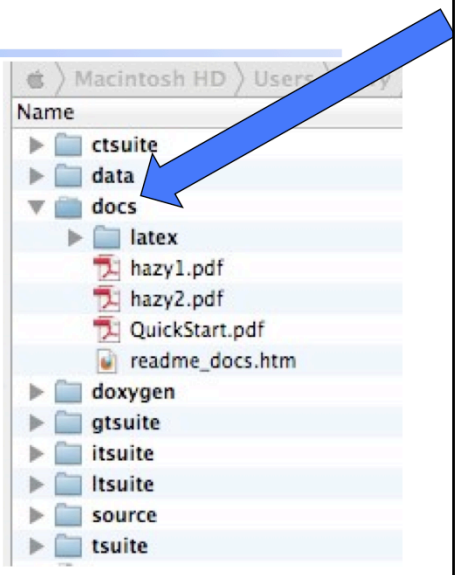


2012 Cloudy workshop

https://trac.nublado.org/

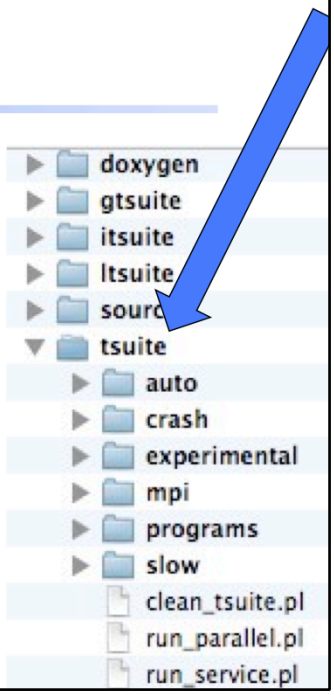
Documentation

- Quick start guide
- Hazy 1, all commands
- Hazy 2, description of output, comparison with observations
- Hazy 3, not compiled, badly out of date, some physics on described there



The test suite

- **Fully tests the code after any changes**
  - "Monitors" allow automatic comparison of current with previous results
- **Provides examples of how to use Cloudy**
  - But may include extraneous commands for testing
- **Useful examples of how to set up a simulation**



Running cloudy

- **“run” file contains**
  path-to-cloudy.exe < $1.in > $1.out 2>$1.err
- **File “model.in” contains input, then**
- **Run model &**
- **Produces output “model.out”**

Minimum to run Cloudy

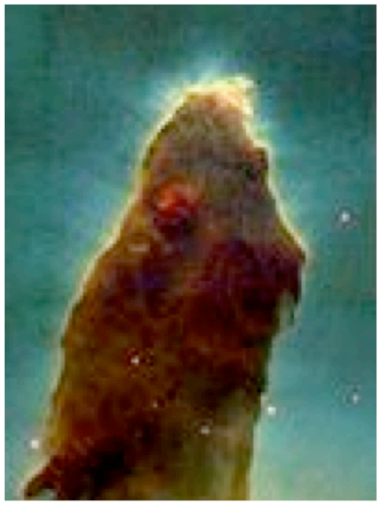
- **Must specify**
  - SED
  - Flux of photons per unit area
  - Gas density
- **May specify**
  - Gas composition, grains (solar by default)
  - Gas equation of state
  - Stopping criterion

Parameters – the SED

- Quick start guide Chapter 5
- Hazy 1, Chapters 4, 6

SED brightness – the intensity case

- **Specify ϕ(H) – photons per unit area**
  - The “intensity case”
  - predicts emission per unit area
  - Inner radius of cloud does not need to be specified



SED brightness – the luminosity case

- **Specify Q (H) – photon luminosity**
  - Inner radius of cloud must be specified, since $\phi(H) = Q(H) / 4\pi r^2$
  - predicts emission line luminosities

Cloud density

- "hden" command
- Constant density by default
- Other equations of state possible

Composition

- Solar, no grains, by default
- Other standard mixes possible