

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:**
 - $2.7 \text{ K} < T < 10^{10} \text{ K}$
 - No limits to density (low density limit, LTE, STE)
 - Radiation field 10 m to 100 MeV

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Welcome to the Cloudy home page!

Cloudy is a spectral synthesis code designed to simulate conditions in interstellar matter under a broad range of conditions.

Please post question or problems on the Cloudy [discussion board](#). Updates to Cloudy will be announced on that board.

Summer school on Cloudy, and the physics and spectroscopy of the interstellar medium Summer 2012 in Lexington. More details on the [Summer School](#) page.

Getting started with Cloudy

[StepByStep](#) instructions for downloading and installing the release version.

[StellarAtmospheres](#) in Cloudy are now very flexible. They are described on this web site rather than in Hazy.

[KnownProblems](#) are described on this page.

[HotFixes](#) are small corrections to the source that fix problems discovered after the current stable version was released.

Frequently asked questions are on the [FaqPage](#)

More information about Cloudy

The [RevisionHistory](#) pages list changes and new features in past, current and the next versions.

Old versions of Cloudy are on the [CloudyOld](#) page

The [DownloadLinks](#) page gives links to download the code

The [RoadMap](#) page outlines planned future development

Acknowledgments for help with Cloudy are on the [AcknowledgmentsPage](#)

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Lots of information about Cloudy

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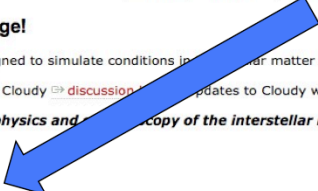
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How to download

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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 test suite. So the hot fixes should be applied after the test suite has been run and your system validated. A [KnownProblem](#) page lists 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, 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 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 that directory.
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 check your compiler. That directory also contains a group of programs that show how to call the code as a subroutine.

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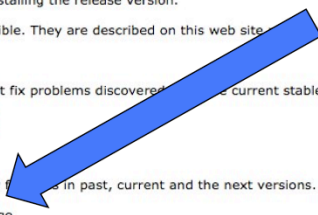
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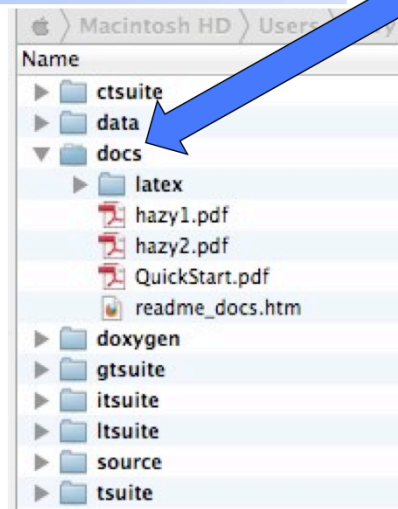
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Documentation

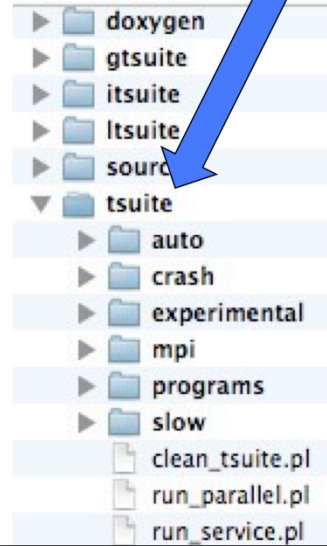
- ◆ Quick start guide
- ◆ Hazy 1, all commands
- ◆ Hazy 2, description of output, comparison with observations
- ◆ Hazy 3, not compiled, badly out of date, some physics on described there



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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**



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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”**

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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

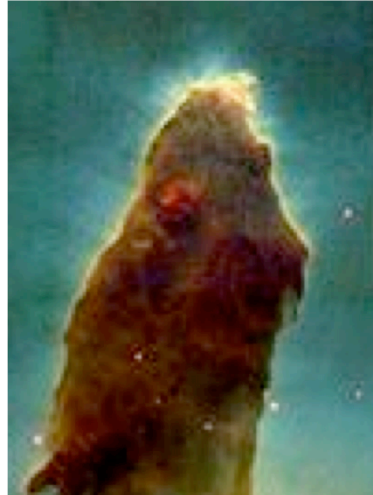
Parameters – the SED

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

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SED brightness – the intensity case

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



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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



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Cloud density

- ◆ **“hden” command**
- ◆ **Constant density by default**
- ◆ **Other equations of state possible**

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Composition

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

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