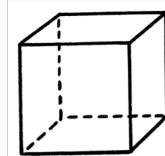


M16 command deck so far

- ◆ blackbody, T=4.87e4 K
- ◆ Q(H) 49.70
- ◆ radius 19
- ◆ hden 3
- ◆ abundances HII region
- ◆ cosmic ray background
- ◆ CMB
- ◆ iterate
- ◆ print last iteration
- ◆ save overview "M16.ovr" last
- ◆ save continuum "M16.con" units microns last
- ◆ save line emissivity "M16.ems" last
- ◆ H 1 4861.33A
- ◆ O 1 6300.30A
- ◆ Blnl 3727.00A
- ◆ O 3 5006.84A
- ◆ end of lines
- ◆ *****

A "unit cell"

- ◆ We will sometimes model a cubic cm of matter
 - A "unit cell", 1 cm³
- ◆ Lots faster & simpler
- ◆ These commands do a single "zone" that is $\log(dr)=0$ (or 1 cm) thick
 - stop zone 1
 - set dr 0



Command deck as unit cell

- ◆ **Stop zone 1**
- ◆ **Set dr 0**
- ◆ blackbody, T=4.87e4 K # the AGN3 Table 2.3 entry for O4 V
- ◆ Q(H) 49.70
- ◆ radius 19
- ◆ hden 3
- ◆ abundances HII region
- ◆ cosmic ray background
- ◆ CMB
- ◆ iterate
- ◆ print last iteration
- ◆ save overview "M16.ovr" last
- ◆ save continuum "M16.con" units microns last

Only save spectrum emitted by the cloud

- ◆ **stop zone 1**
- ◆ **set dr 0**
- ◆ blackbody, T=4.87e4 K # the AGN3 Table 2.3 entry for O4 V
- ◆ Q(H) 49.70
- ◆ radius 19
- ◆ hden 3
- ◆ abundances HII region
- ◆ cosmic ray background
- ◆ CMB
- ◆ iterate
- ◆ print last iteration
- ◆ save overview "M16.ovr" last
- ◆ **save emitted continuum** "M16.con" units microns last

Results for one zone

```
##### 1 Te:1.815E+04 Hden:1.000E+04 Ne:1.198E+04 R:1.000E+16 R-R0:5.000E-01
Hydrogen 5.78e-08 1.00e+00 H+o/Hden 1.00e+00 4.12e-18 H- H2 1.05e-22
Helium 5.75e-10 3.60e-03 0.96e-01 HeT 2e35 4.73e-11 Cmm H C 2.53e-10
```

Gas kinetic temperature

Results for one zone

```
##### 1 Te:1.815E+04 Hden:1.000E+04 Ne:1.198E+04 R:1.000E+16 R-R0:5.000E-01
Hydrogen 5.78e-08 1.00e+00 H+o/Hden 1.00e+00 4.12e-18 H- H2 1.05e-22
Helium 5.75e-10 3.60e-03 0.96e-01 HeT 2e35 4.73e-11 Cmm H C 2.53e-10
```

H⁰, H⁺ ionization fractions
n(x)/n(H, all forms)

Results for one zone

```
##### 1 Te:1.815E+04 Hden:1.000E+04 Ne:1.198E+04 R:1.000E+16 R-R0:5.000E-01
Hydrogen 5.78e-08 1.00e+00 H+o/Hden 1.00e+00 4.12e-18 H- H2 1.05e-22
Helium 5.75e-10 3.60e-03 0.06e-01 HeT 7e35 4.73e-11 Comp H C 2.53e-10
```

H₂ fraction
2n(H₂)/n(H, all forms)

Warnings, cautions, notes

- ◆ Cloudy is designed to be autonomous and self aware
- ◆ Generates notes, cautions, or warnings, if conditions are not appropriate.

```
Calculation stopped because NZONE reached. Iteration 1 of 1
The geometry is plane-parallel.
-Continuum zero at some energies.
-The H Lyman continuum is thin, and I assumed that it was thick. Use the ITERATE command to do more iterations.
-The He I continuum is thin and I assumed that it was thick. Use the ITERATE command to do more iterations.
-The He I continuum is thin and I assumed that it was thick. Use the ITERATE command to do more iterations.
Destruction of He 231s reached 32.0% of the total HeII dest rate at zone 1, 32.0% of that was photoionization.
Non-collisional excitation of [O III] 4363 reached 12.6% of the total.
AGE: Cloud age was not set. Longest timescale was 5.48e+08 s = 1.71e+01 years.
Local grain-gas photoelectric heating rate reached 63.5% of the total.
Grain photoelectric heating is VERY important.
The OMB was not included. This is added with the OMB command.
```

Check end of output

```
Cloudy ends: 1 zone, 1 iteration, 4 cautions. (single thread) ExecTime(s) 8.80
[Stop in cdMain at ../maincl.cpp:517, Cloudy exited OK]
```

Save prefix file names

- Save overview "HII.ovr" last no hash
- Save element hydrogen "HII.hyd" last no hash
- Save emitted continuum "HII.econ" units microns
- **Set save prefix "HII"**
- Save overview ".ovr" last no hash
- Save element hydrogen ".hyd" last no hash
- Save emitted continuum ".econ" units microns

We did 10¹⁹ cm, about 3 pc

- ◆ Now do 21, 23
- ◆ 17, 15, 13

The grid command – Hazy1 Chap 18

- ◆ Grid command computes a grid of models in parallel
- ◆ Include "vary" keyword on commands with variable parameters (Chapter 17.4)
- ◆ "grid" command specifies lower, upper bounds, and step size
 - Radius 13 vary
 - grid 13 23 2
 - Hazy 1 sec 18.5

The grid command – Hazy1 Chap 18

- ◆ “Save grid” command saves step parameters
 - Check for problems
- ◆ “no hash”, “last”, options on other save commands
- ◆ (See [this page](#) for description of –a runtime)