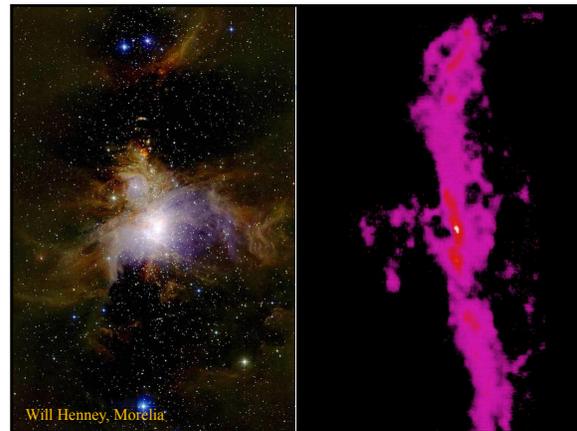
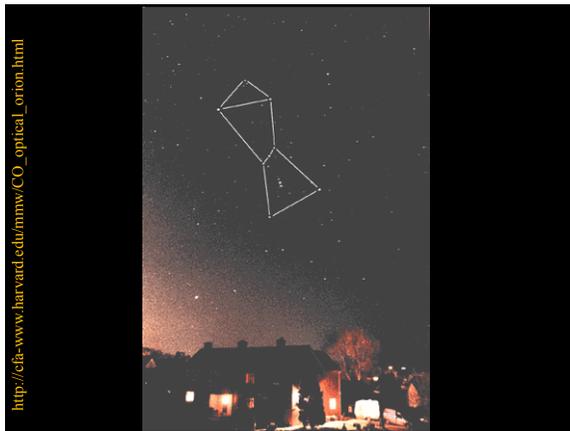


## Intrinsic emission line spectrum

- ◆ **Line formation includes**
  - Continuum photo excitation (fluorescence)
  - Collisional excitation / deexcitation
  - Line trapping due to line optical depths
  - Line destruction due to “background opacity”
  - Background opacity includes continuum absorption / scattering such as
    - » Electron scattering
    - » Photoelectric absorption
    - » Grains
- ◆ **The intrinsic spectrum includes all this physics**

## What about dusty regions?

- ◆ **The dust extinction across the  $H^+$  region must be small**
  - The  $H^+$  -  $H^0$  ionization front occurs at optical depth unity at 912A
  - That optical depth is usually dominated by hydrogen photoelectric opacity
  - The dust optical depth at 912A is almost certainly  $\ll 1$
  - The dust optical depth in the optical is  $\sim 10\times$  smaller than that
- ◆ **Very high ionization parameters are an exception, discussed [here](#)**



## Intrinsic, emitted spectra

- ◆ **Hazy 2, Section 2.10**



Figure 2.1: The geometry assumed in an open dusty geometry. The panel on the left is part of the HST image of M16, an  $H^+$  layer on the surface of a molecular cloud viewed nearly edge-on. The idealized geometry is shown on the right. The lightly shaded area is the  $H^+$  region, while the darker region to its right is the optically thick molecular cloud. Light produced by an atom in the  $H^+$  region can directly escape from the illuminated face of the cloud. If the atom emits isotropically then roughly half the emission will escape this way. The remaining fraction of the light is emitted towards the molecular cloud where a small part, determined by the albedo, can be reflected back towards the illuminated face.



## Speed ups

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- ◆ Hazy 1, Sec 19.17

## Open source

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- ◆ Contributions welcome!
- ◆ Cloudy user group on [Yahoo](#)
- ◆ Code must be compatible with our license
  
- ◆ Also, use the [Yahoo](#) user group to ask any questions, or to report bugs