

A photograph of a farm scene. In the foreground, several horses of various colors (brown, grey, and white) are grazing in a green field. A white fence runs across the middle ground. Behind the fence is a calm pond that reflects the surrounding trees and sky. In the background, there are more trees, a small building, and a larger white fence. The sky is clear and blue.

*The Hot Inner Region of the
Obscuring Torus in AGN*

Gary J. Ferland

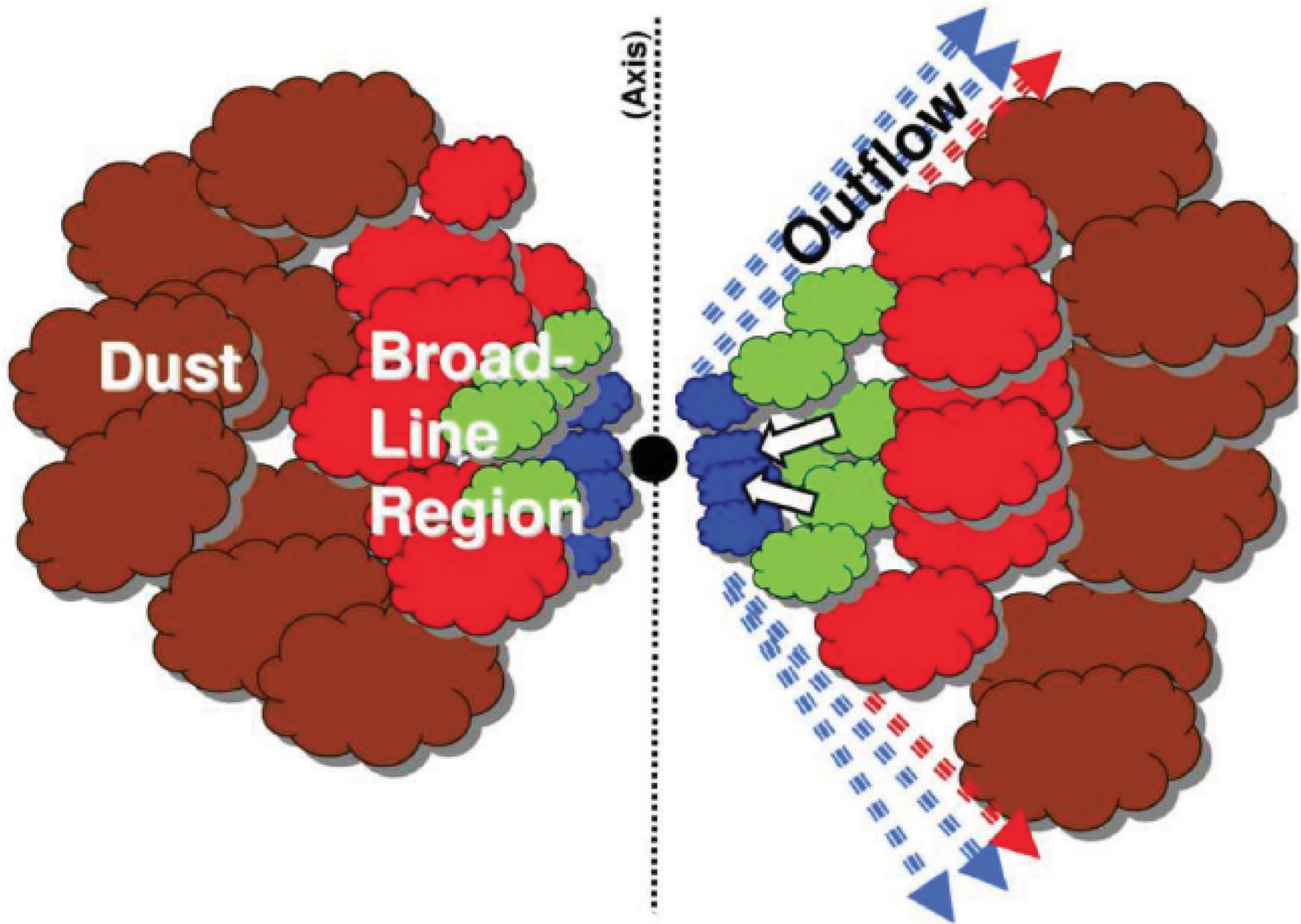
Physics, University of Kentucky

The Hot Inner Region of the Obscuring Torus in AGN

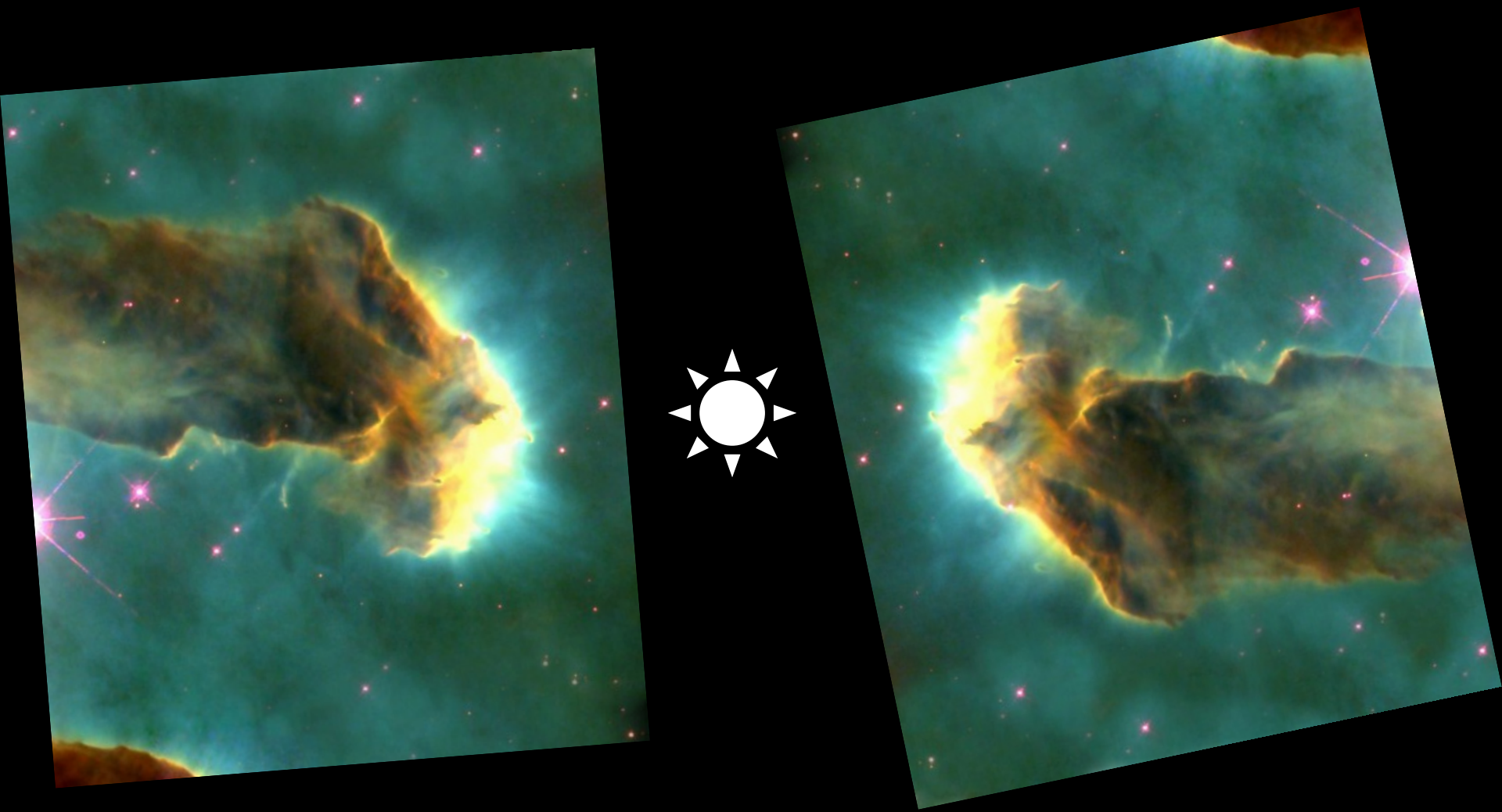
Gary J. Ferland

Queen's University Belfast









After Kriss ~2000

Model nearly fully defined

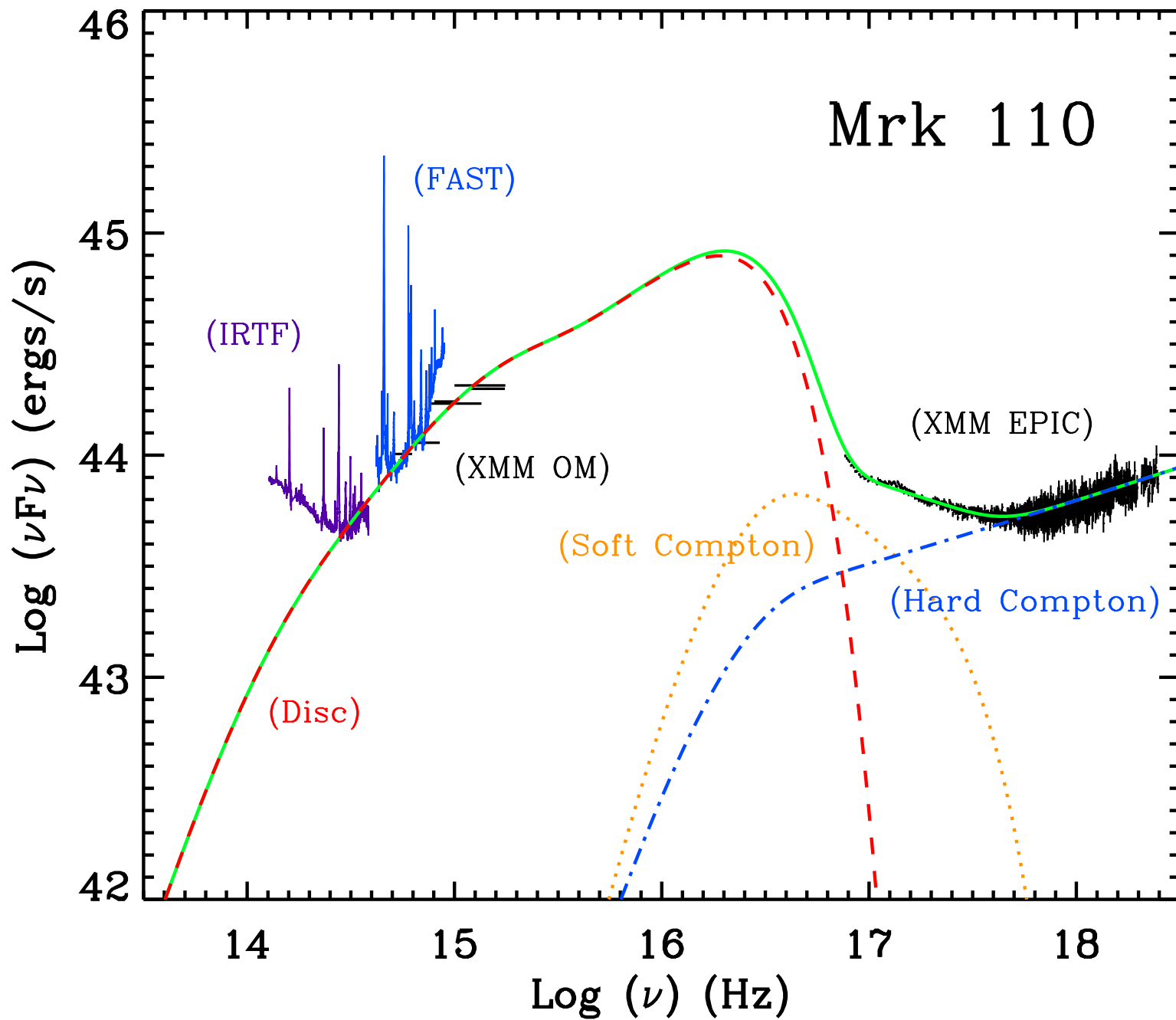
- ◆ **Observed SED**
- ◆ **Hot dust component of IR SED sets position of inner edge of torus**
- ◆ **Abundances, ISM with enhanced metals (inner region of large galaxy)**
- ◆ **Gas density is only free parameter, take $n_{\text{H}} = 10^6 \text{ cm}^{-3}$**
 - Appropriate for galactic

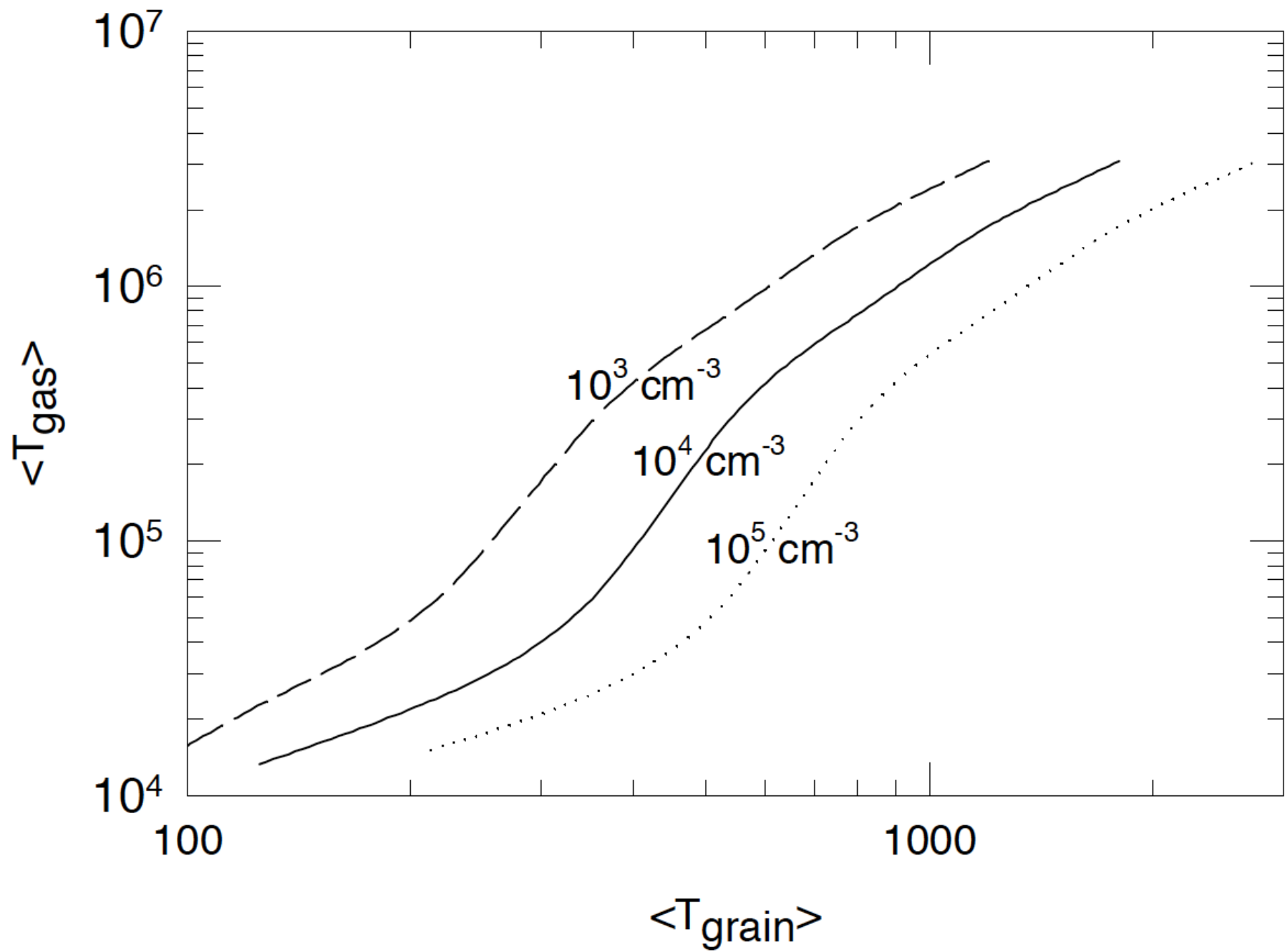
Grain physics in Cloudy

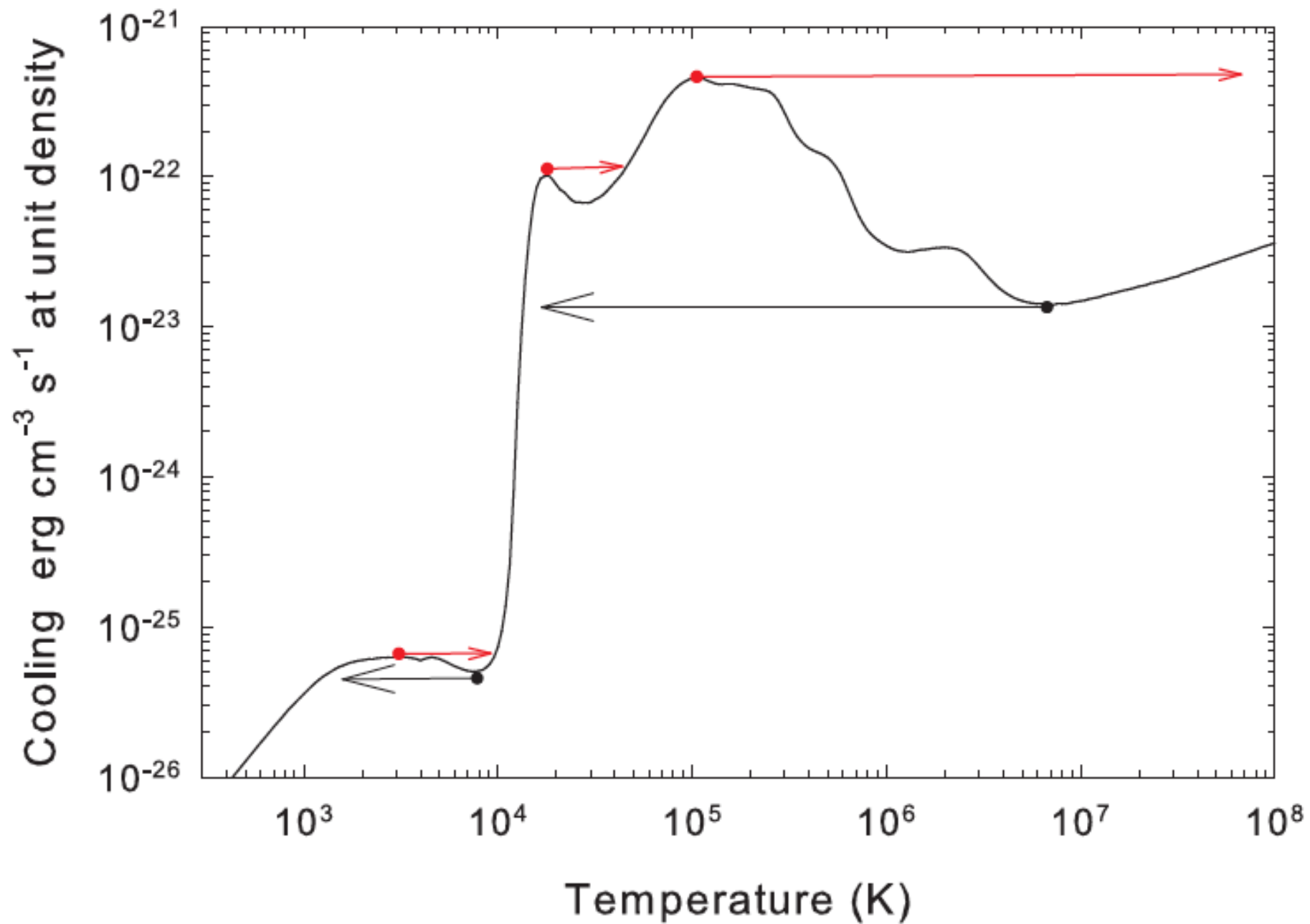
- ◆ **State of the art, summarized in van Hoof+01, 04**
- ◆ **Any number of materials and sizes**
 - Silicate, graphite, PAH
 - 10 size bins per material
- ◆ **Gas-grain coupling**
 - Collide with one another
 - Light emitted and absorbed
 - Electron emission from grains

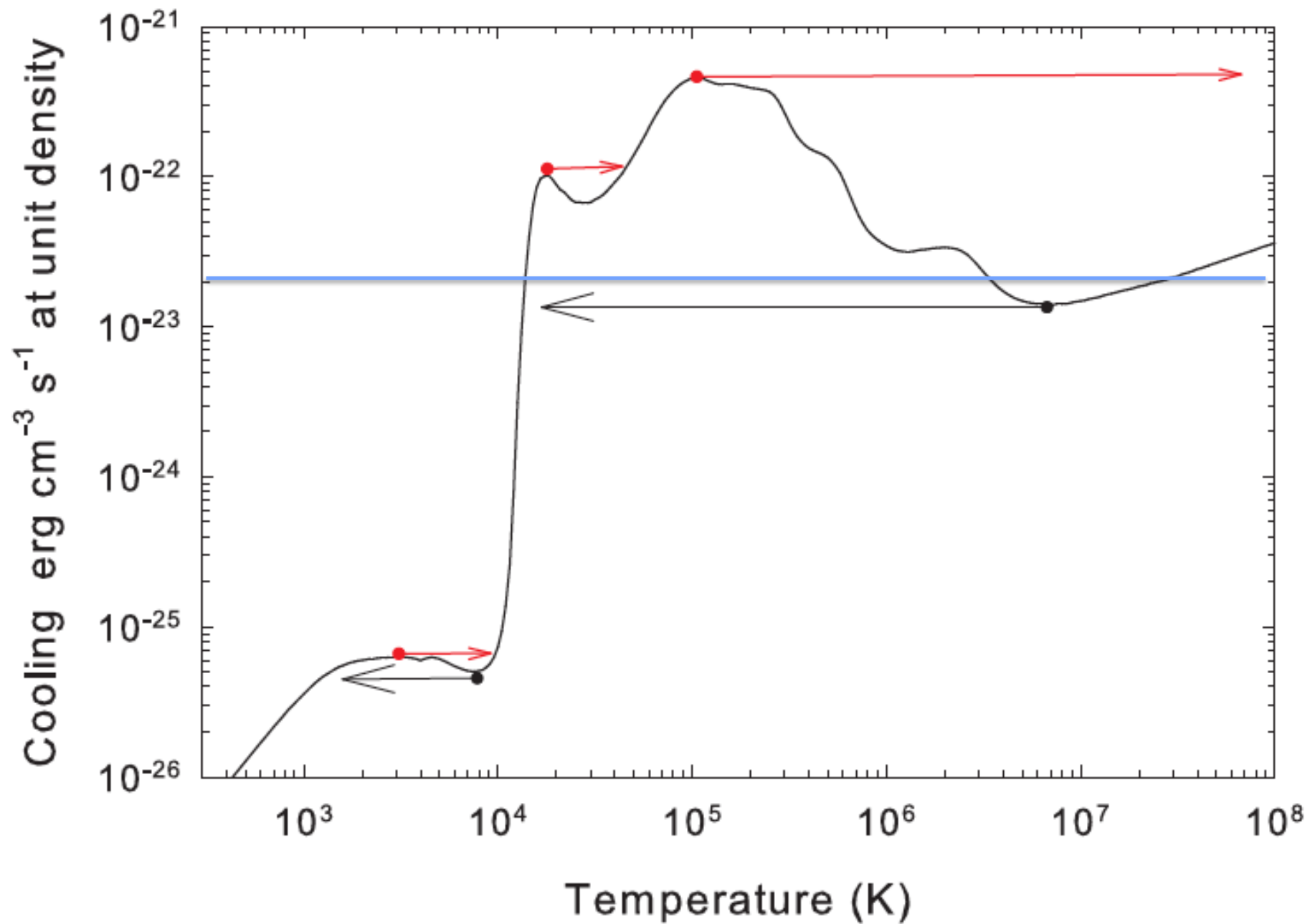
Chemistry in Cloudy

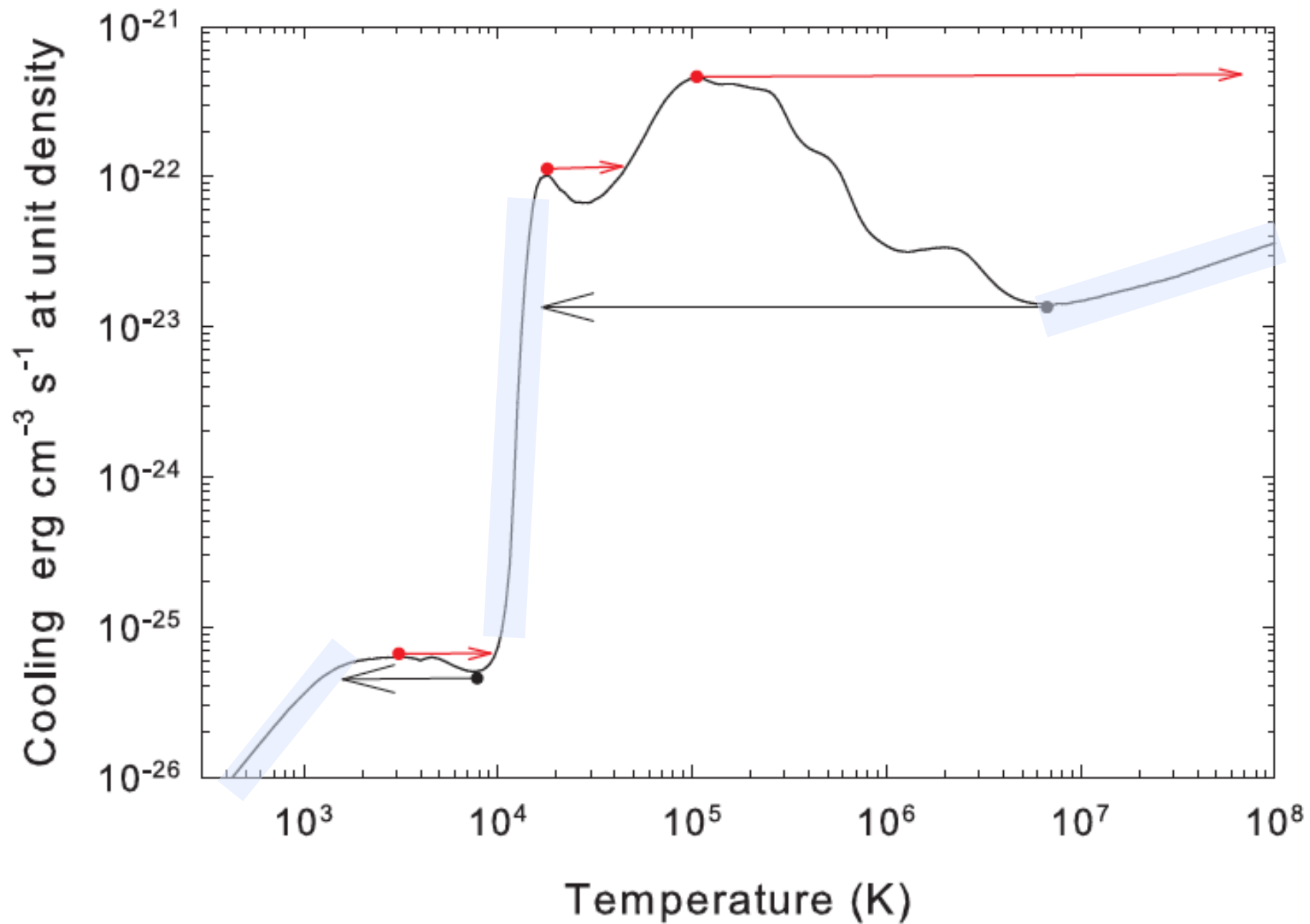
- ◆ **State of the art of gas phase time steady chemistry**
- ◆ **100+ molecules**
- ◆ **Internal structure and line spectra for 35 molecules**
- ◆ **Full treatment of molecular hydrogen**
- ◆ **Good agreement with special-purpose PDR/ molecular cloud codes**









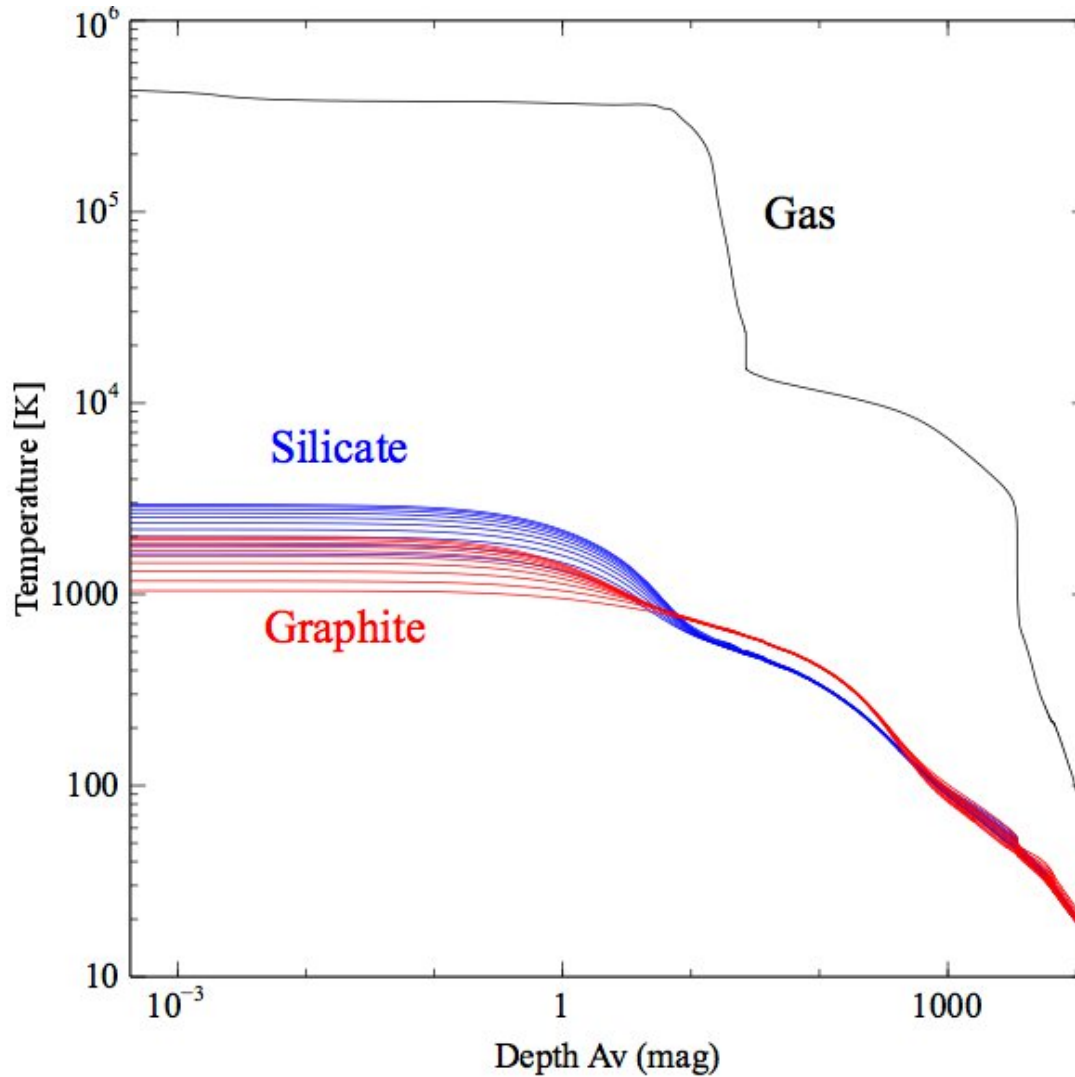


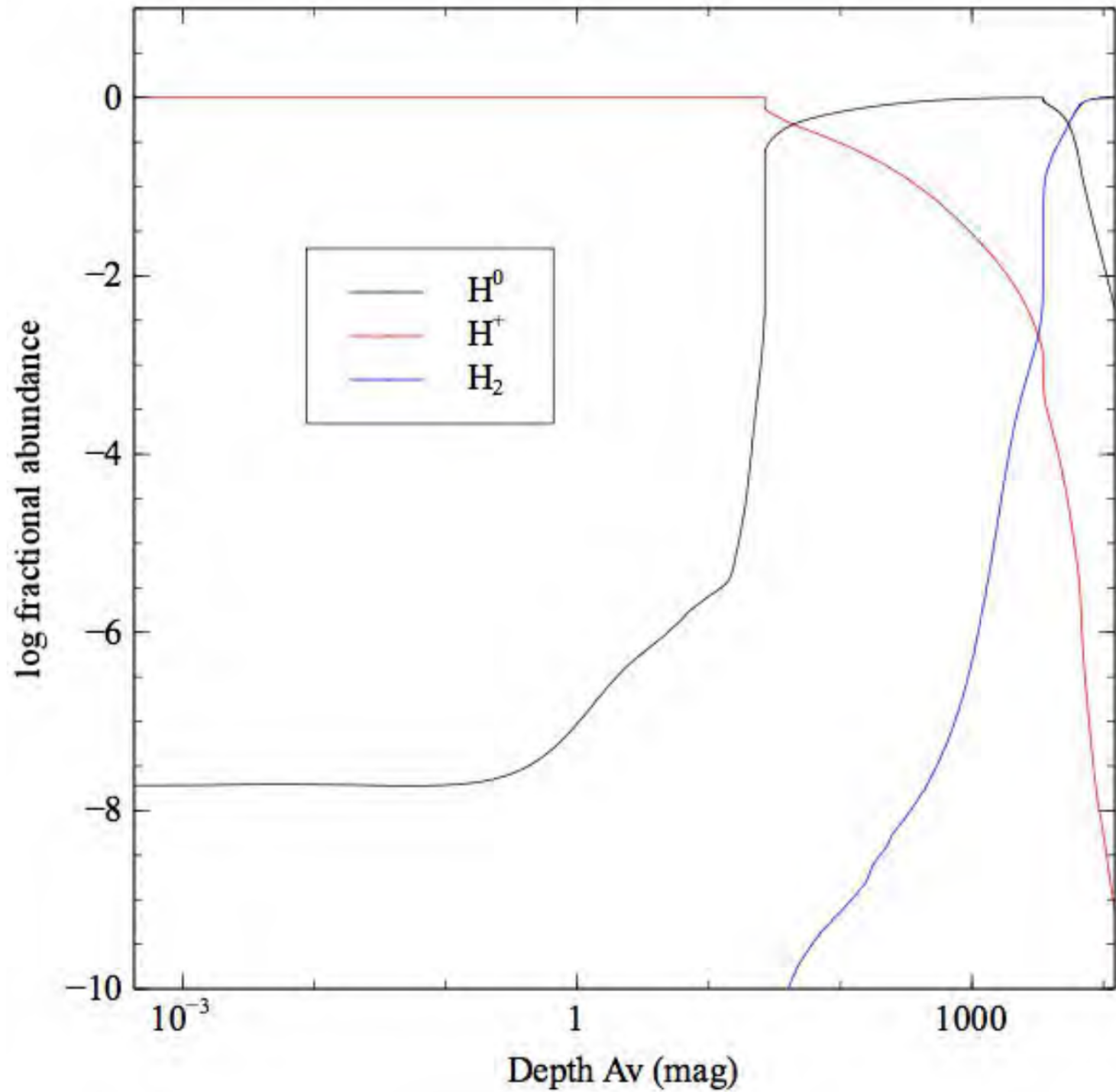
Illuminated face of torus

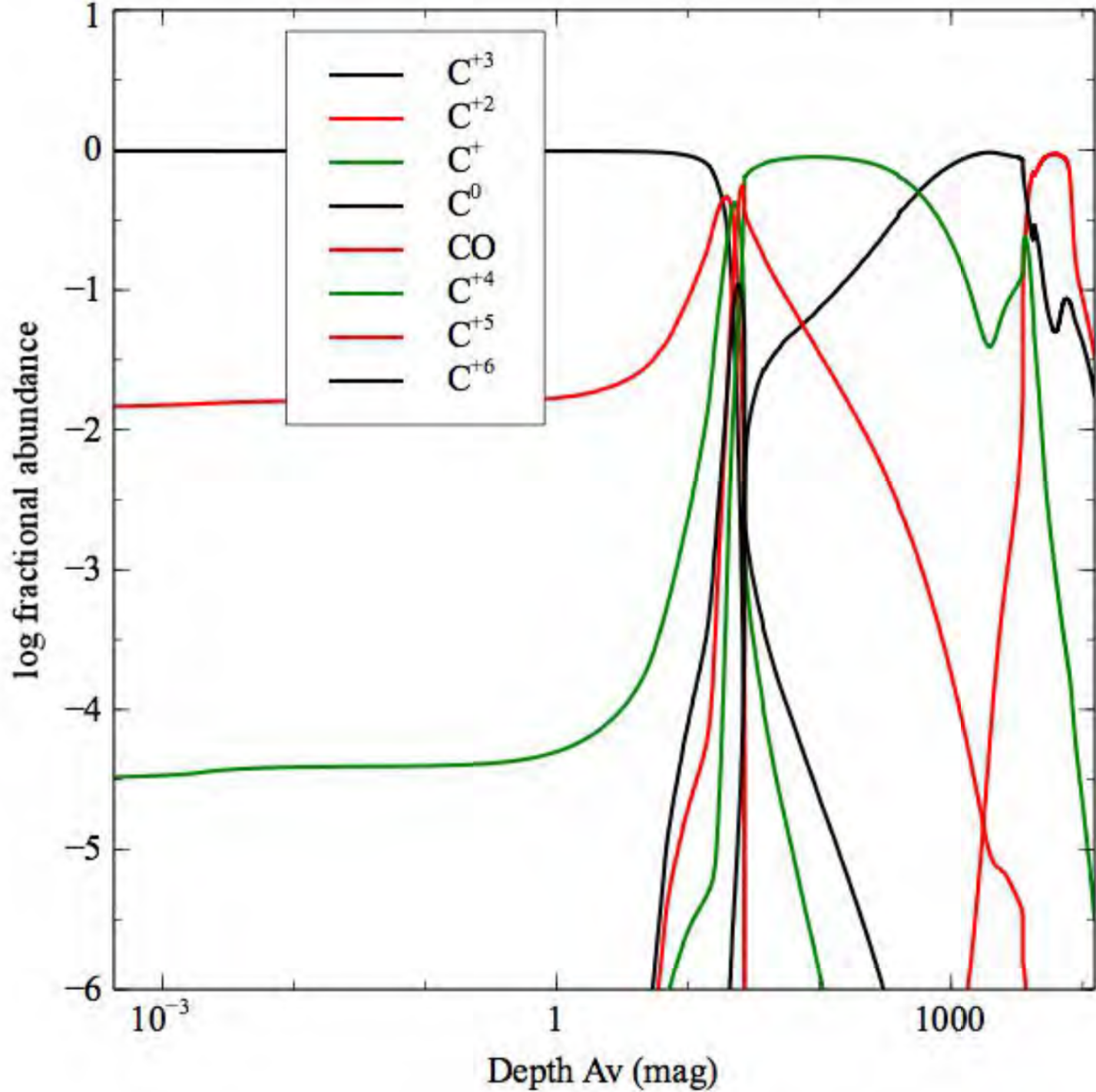
- ◆ **Hot**
- ◆ **Highly ionized, Fe VII, Fe X, Fe XI, Fe XIV**
- ◆ **With several stable gas phases**
- ◆ **And several unstable ones**



T_{gas} vs $A_V(\text{depth})$







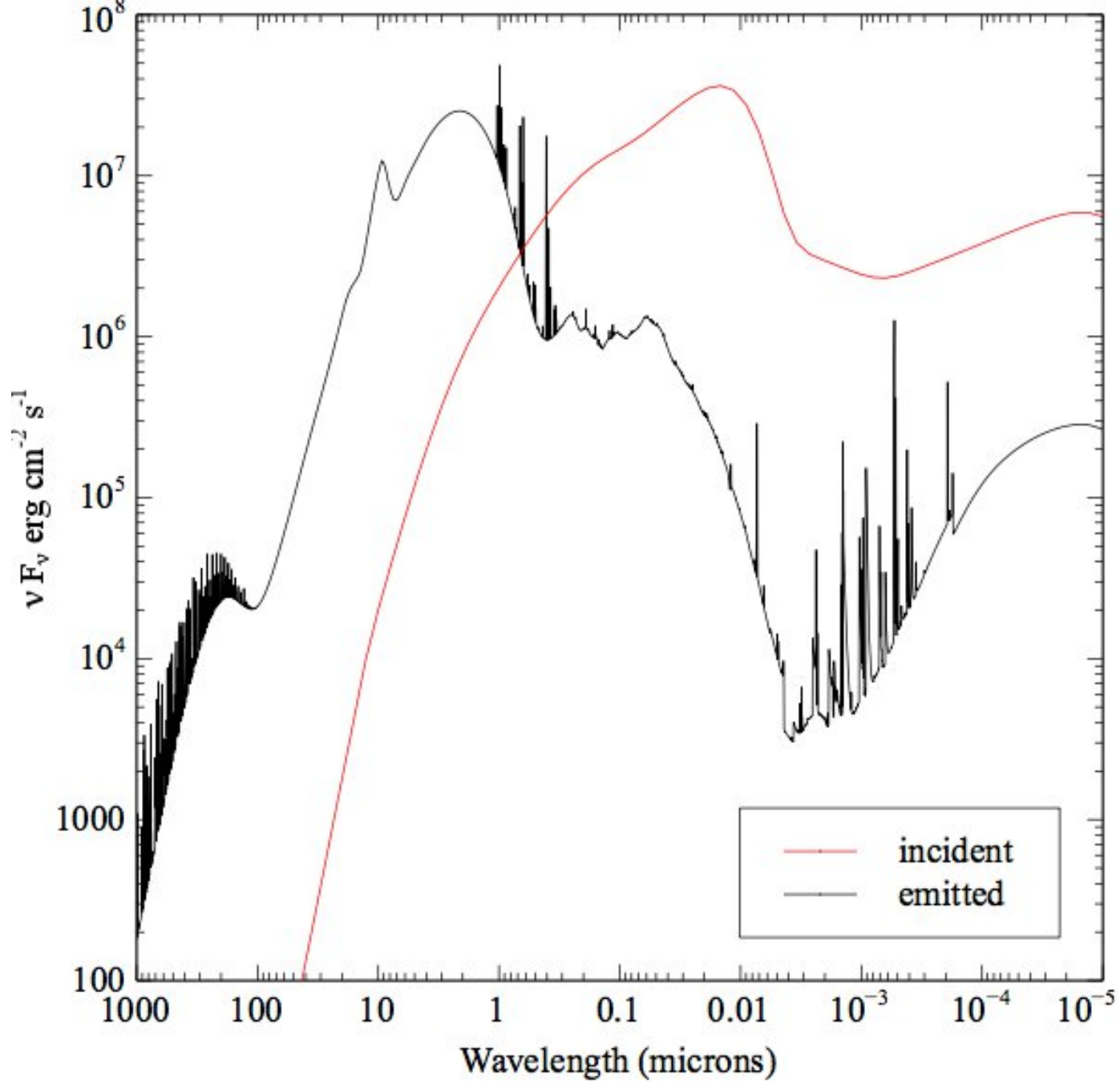
Three distinct phases

- ◆ **Hot phase, half million K, where hot dust emission originates**
 - HIT – Hot Inner Torus
- ◆ **Warm, 10,000K region, atomic**
 - Optical forbidden lines
- ◆ **Cool, 100K, atomic / molecular region**
 - H₂, CO, IR Fe II

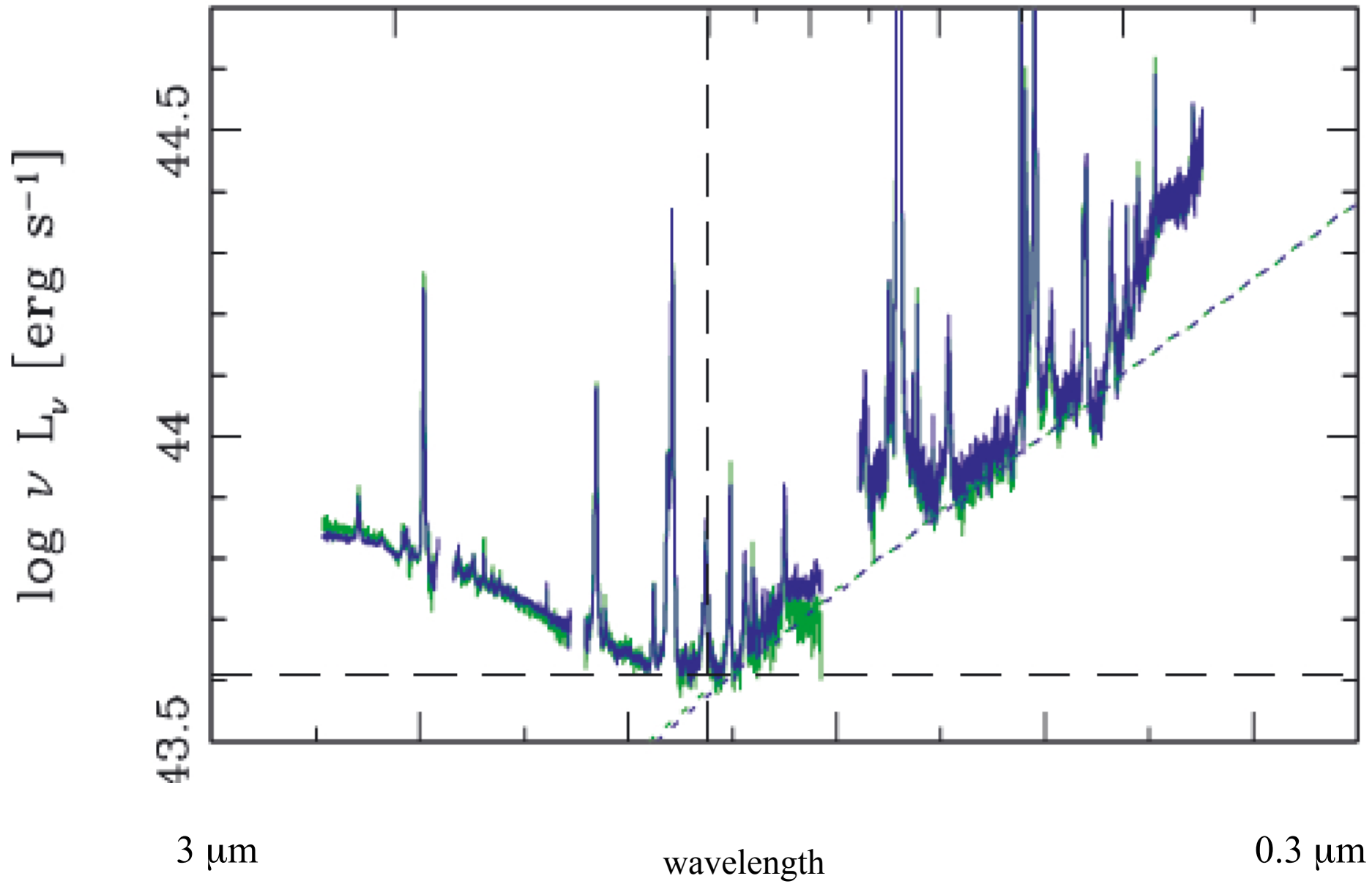
Structure vs depth

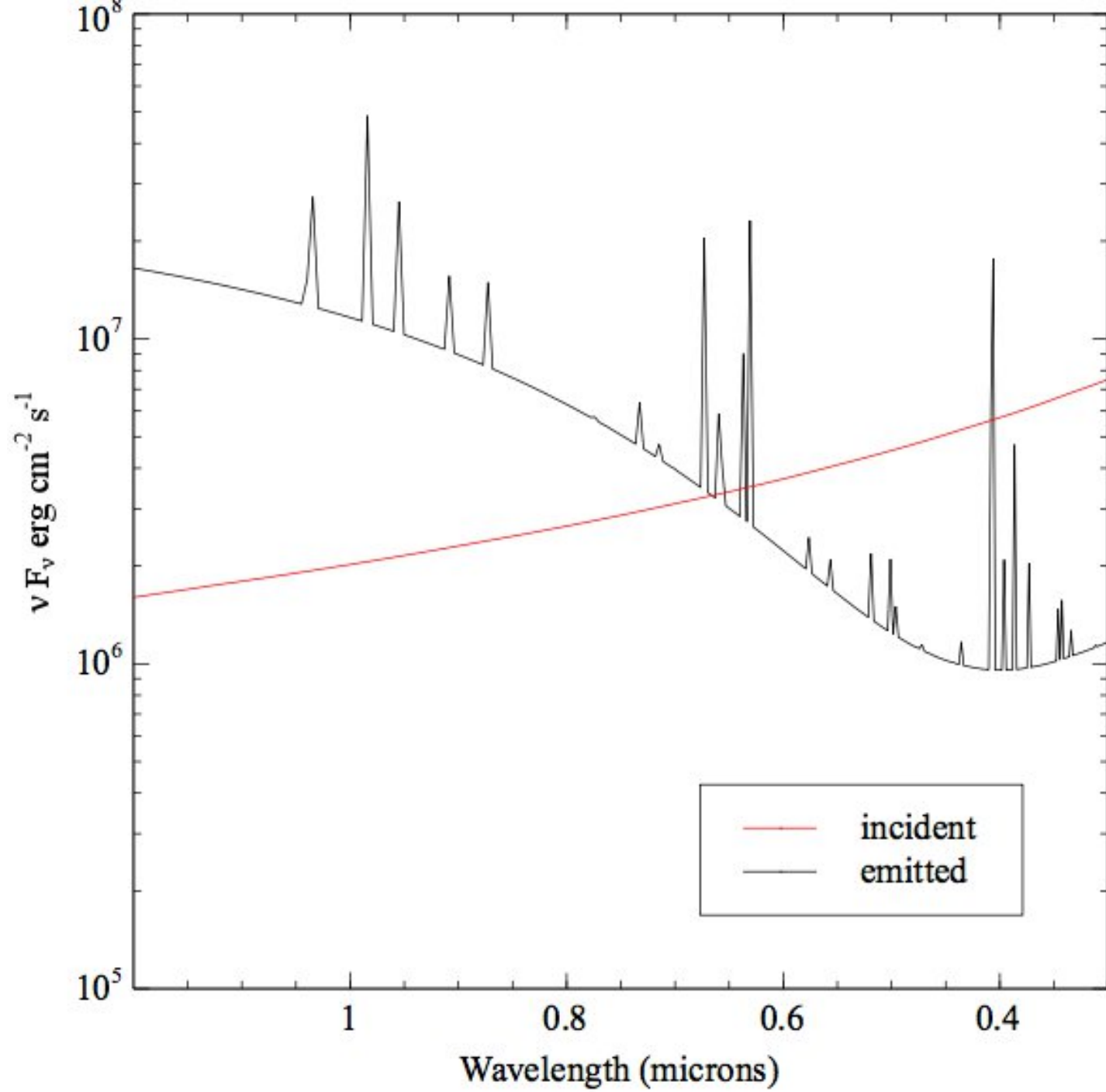
- ◆ **Strong coronal lines**
- ◆ **Optical nebular lines are produced**

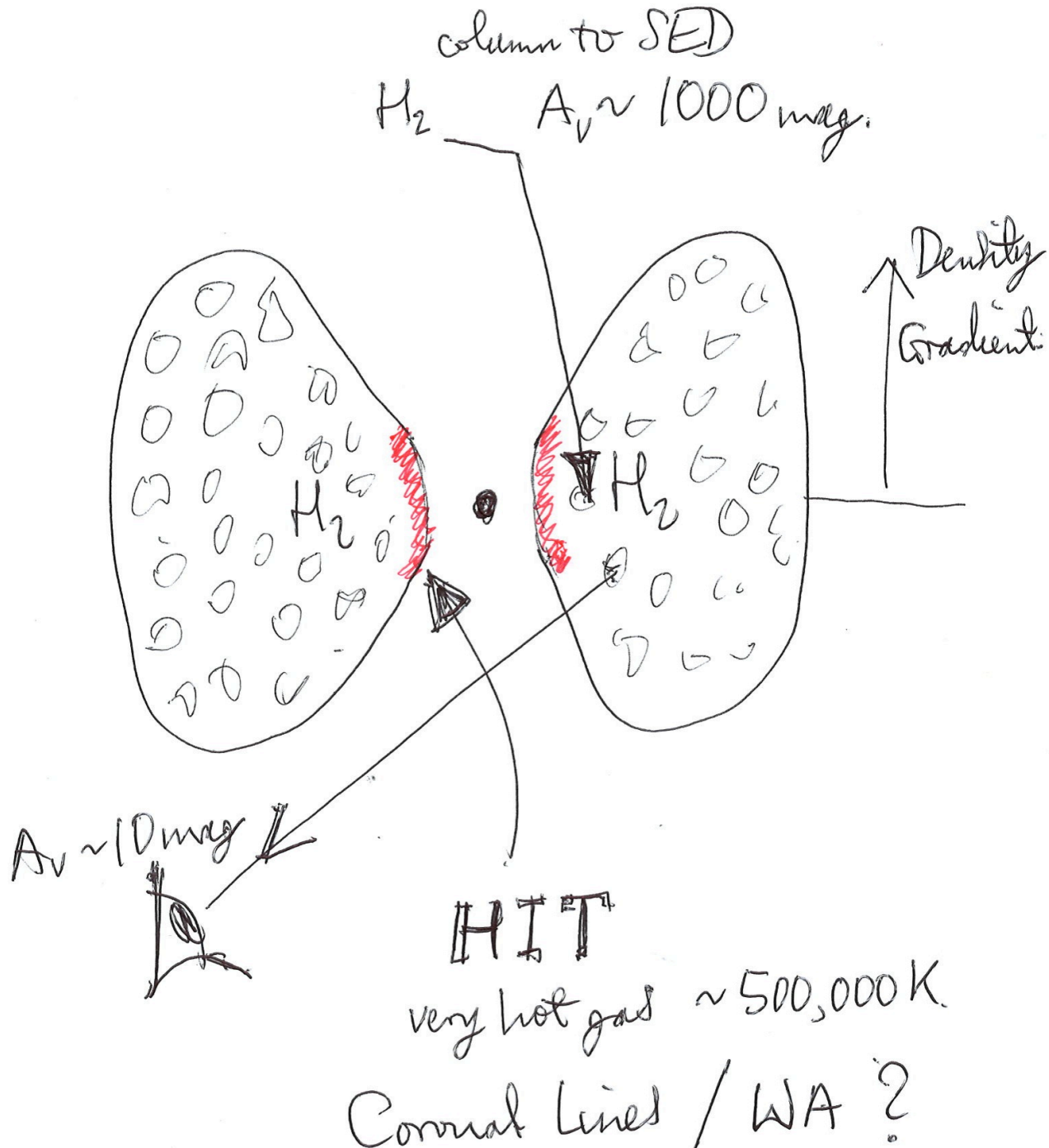
- ◆ **H₂, IR Fe II, and CO, but $A_V \sim 10^3$ needed to achieve sufficient shielding for molecules to exist**
- ◆ **So disk-like geometry required**



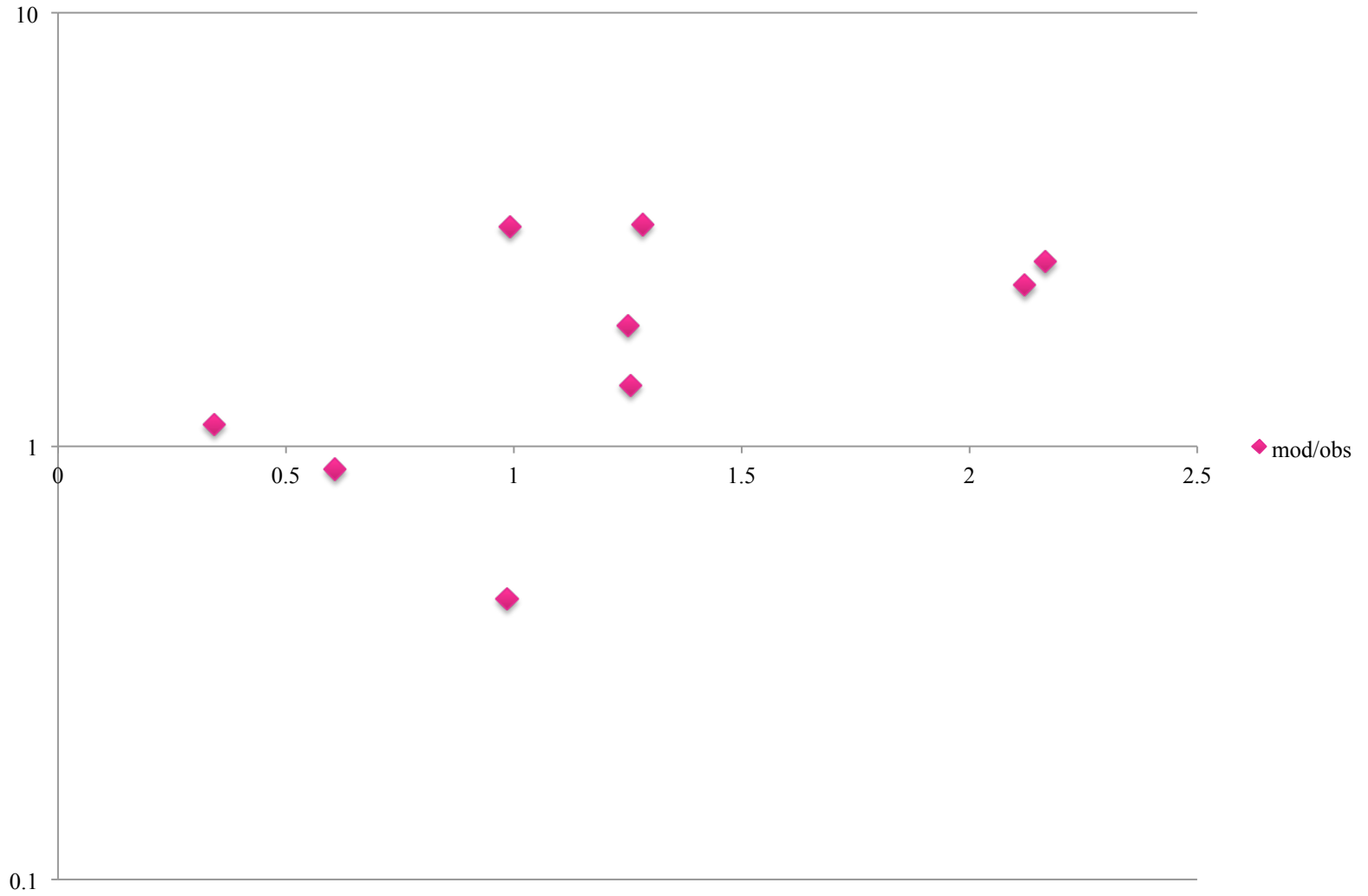
Landt+11







mod/obs



$L(\text{model})/L(\text{observed})$ vs Wavelength (microns)