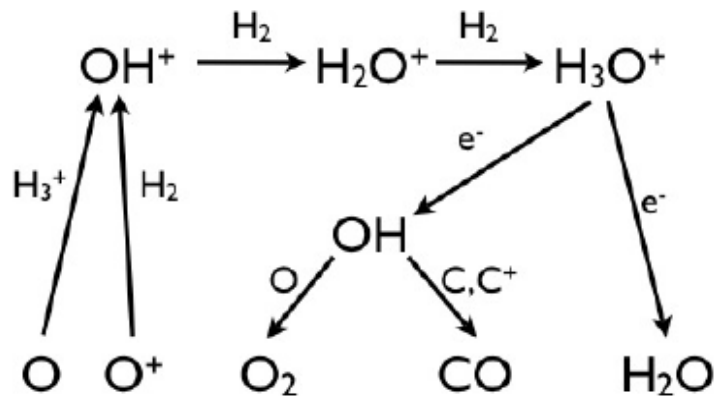
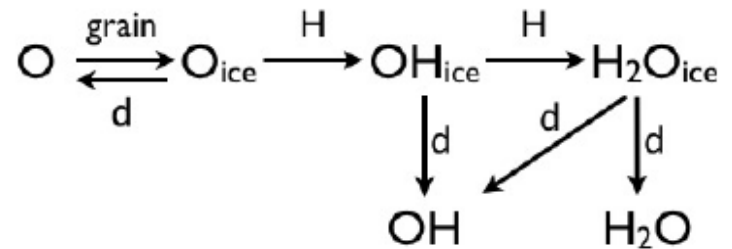


# Science question: What is the origin of interstellar water?

models of gas vs. grain chemistry in interstellar clouds



gas



grains

# Modeling of photodissociated surfaces of clouds



Using the line of sight toward Cyg OB2#12 as an example. A total column corresponding to  $A_v=10$  magnitudes of extinction is seen toward this association.

First, let's look at CO J=5-4 as seen by HORUS.

10

CO J=5-4, 576 GHz, 1 hour

$N=2.5 \times 10^{17} \text{ cm}^{-2}$ ,  $n=2 \times 10^3 \text{ cm}^{-3}$ ,  $\tau_0 = 5$

these 2 clouds  
get only gas  
chemistry

this cloud gets  
gas+grain  
chemistry

5

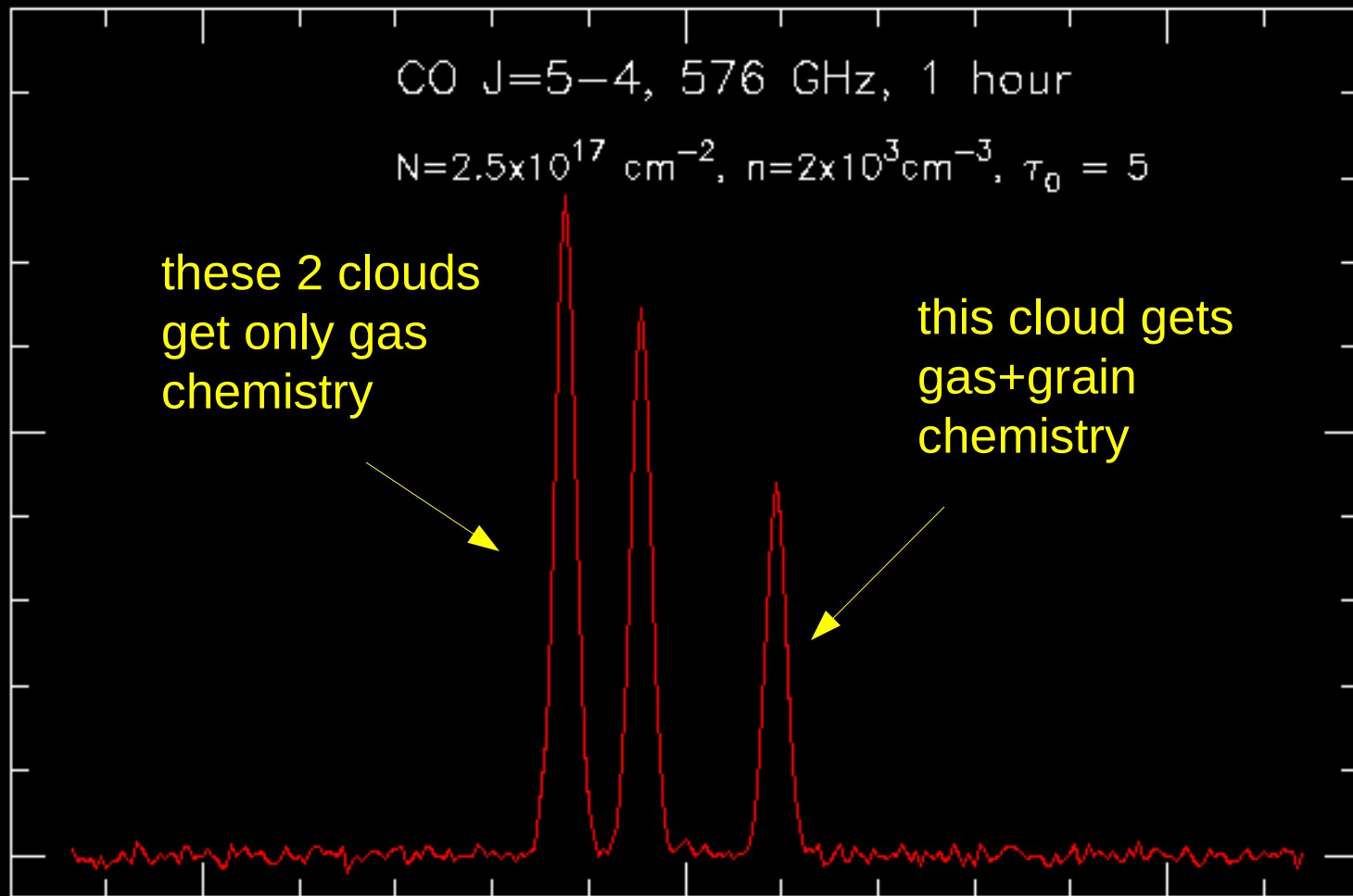
0

100

0

-100

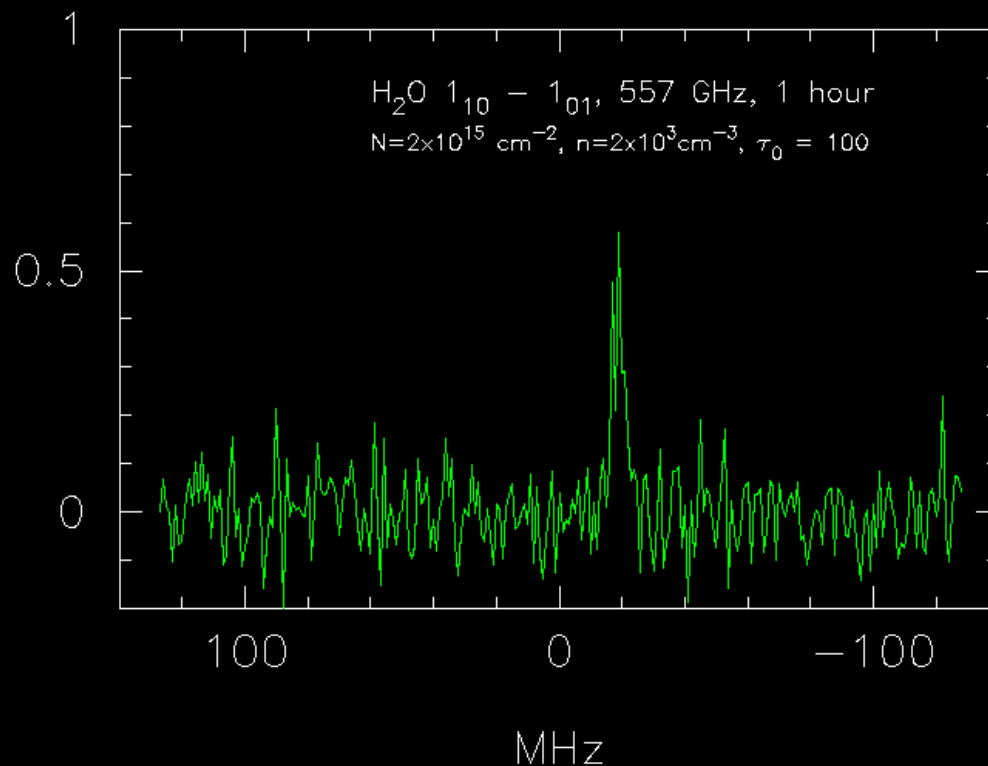
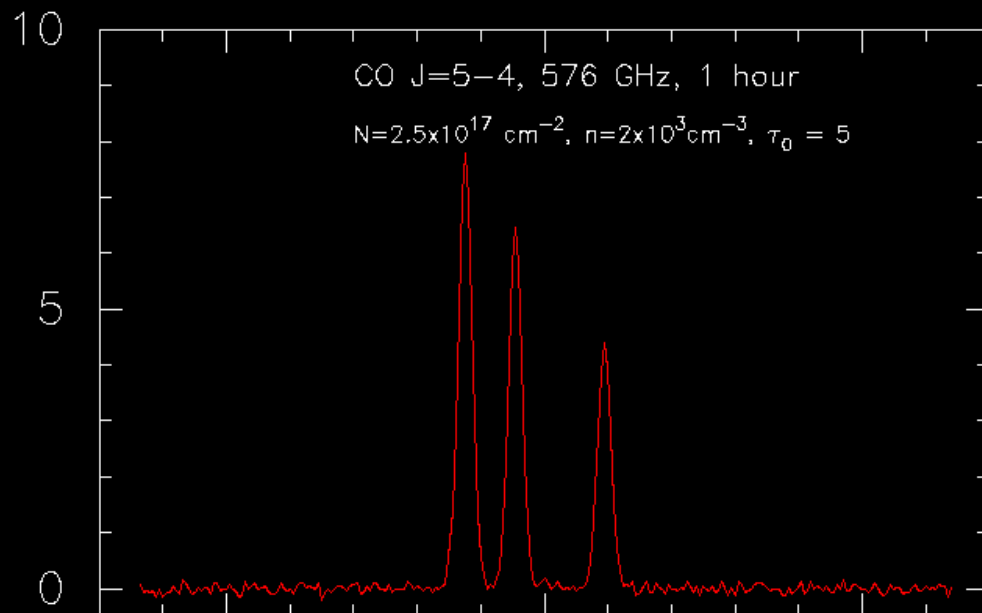
MHz

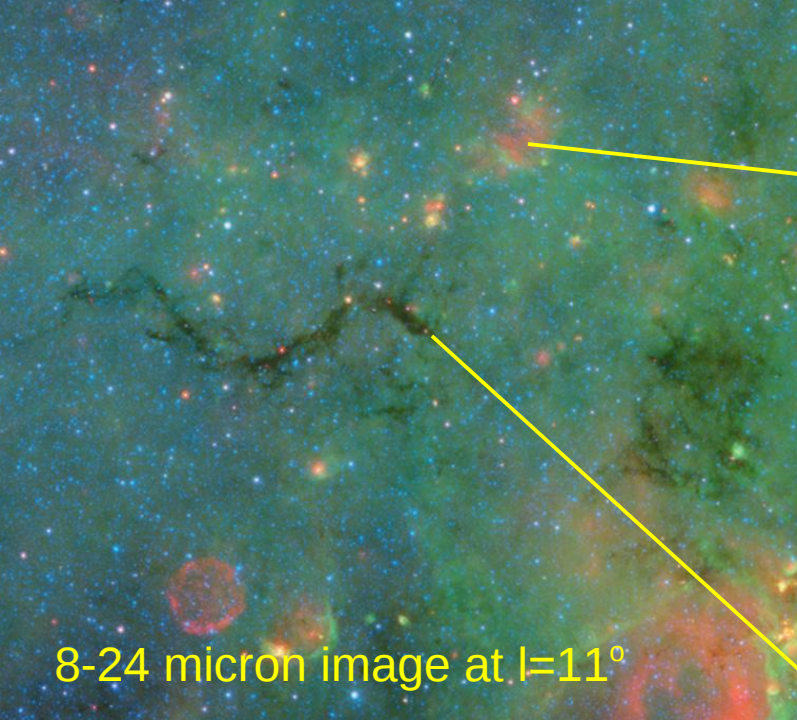




HORUS' water spectrum is only observed in the line of sight where surface formation of  $\text{H}_2\text{O}$  on grains is included.

What about dense clouds?

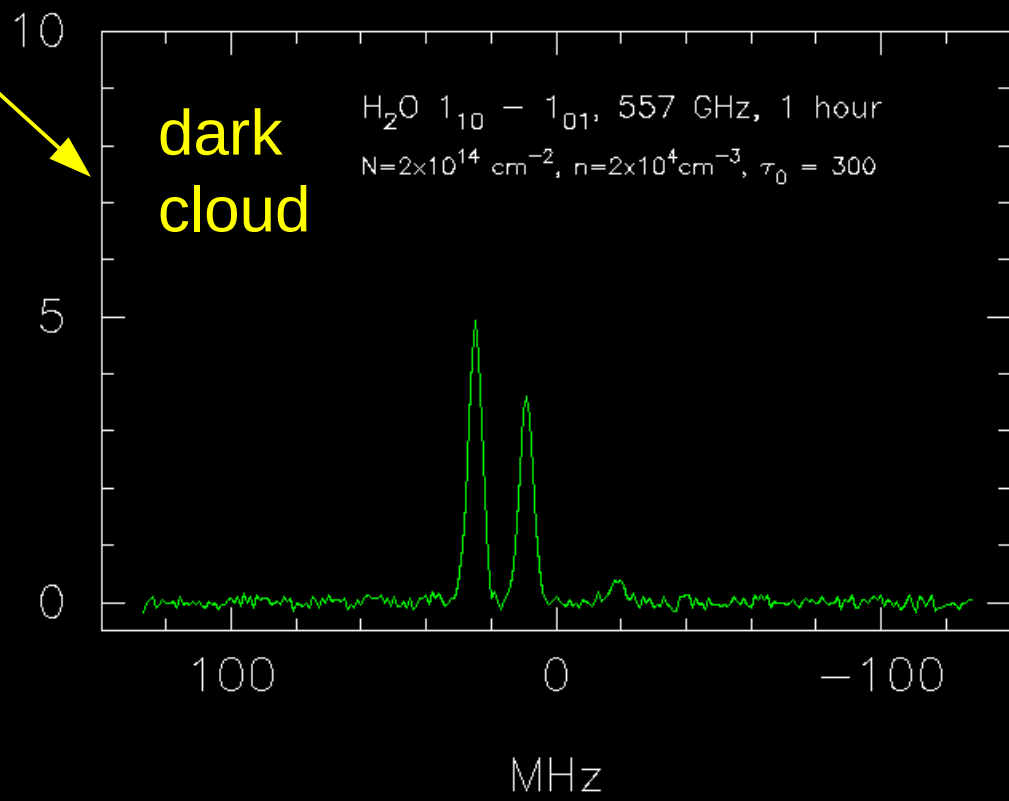
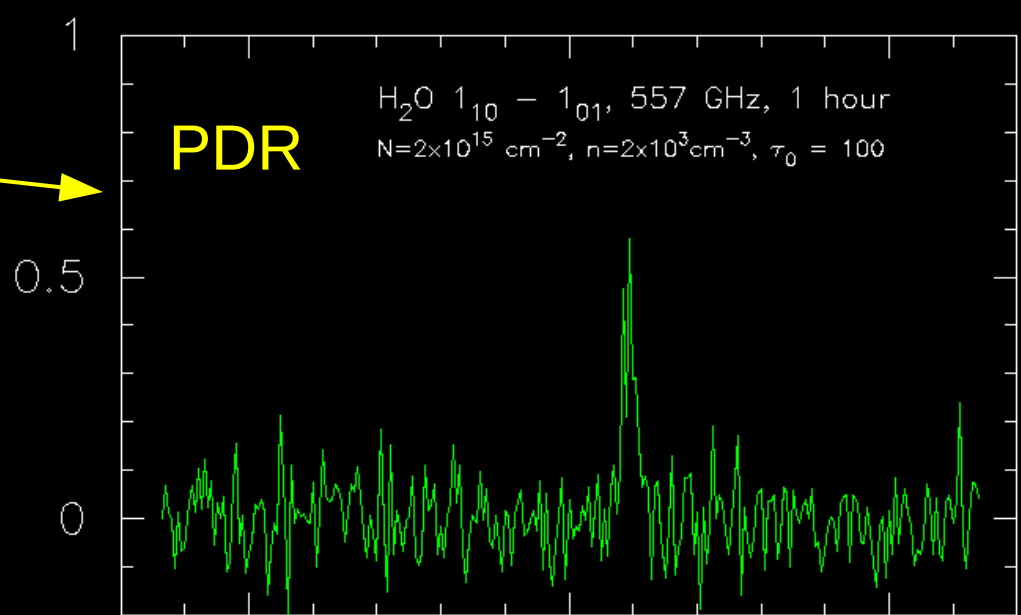




8-24 micron image at  $l=11^\circ$

Note that for dark clouds, the gas-phase abundance of water is much higher than when adding grains... the opposite situation from photodissociated regions.

04/14/10



MHz