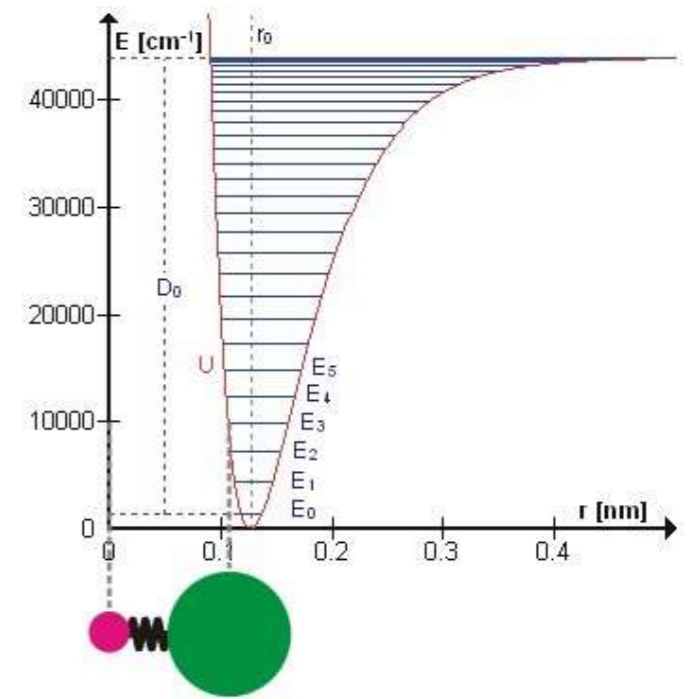
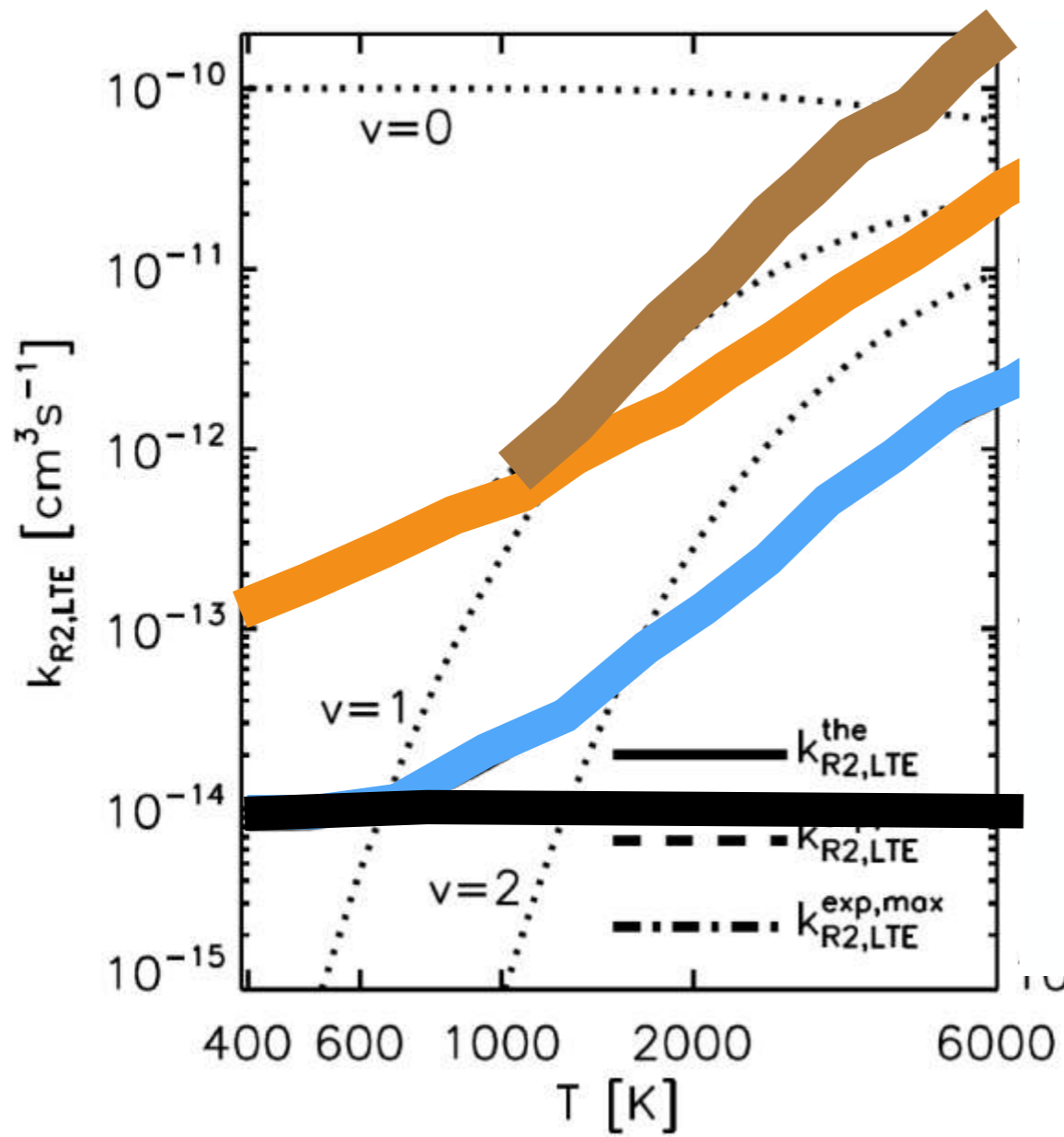


Transition specifics are connected to XUV & FUV stellar fluxes **Finding 2:**

$\text{He}^+ + \text{H}_2 (v) \rightarrow \text{He} + \text{H} + \text{H}^+$  is very sensitive to quantum number  $v \rightarrow \rightarrow \rightarrow$  *strong T-dependence.*



Lots of qualitative/quantitative information on this subject from decades ago.



**experimental, max**  
**experimental, min**  
**theory**

ce Meeting, 2026

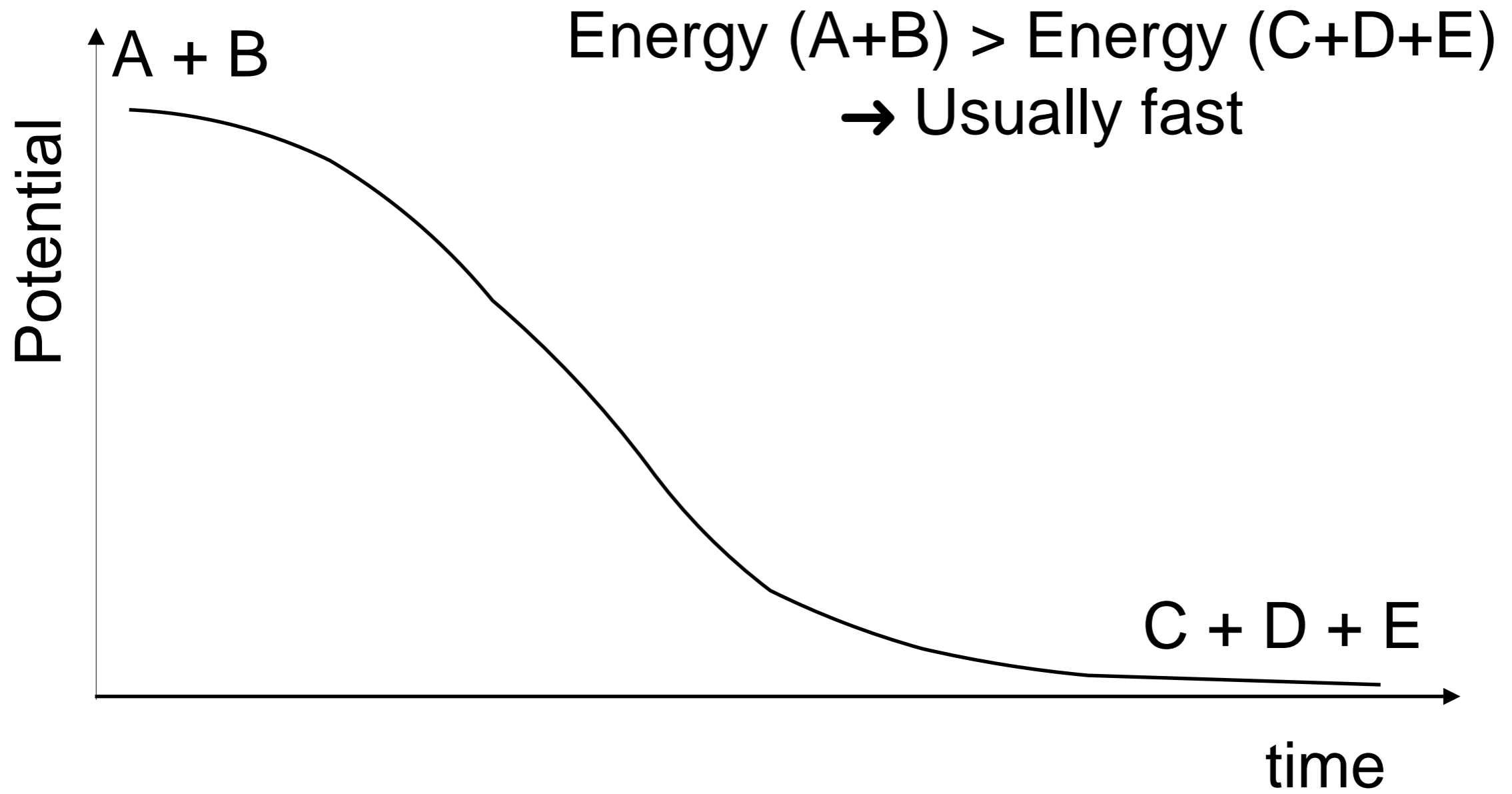
**Umist:**

**Astrochemistry comm'**

A chemical reaction is a collision.

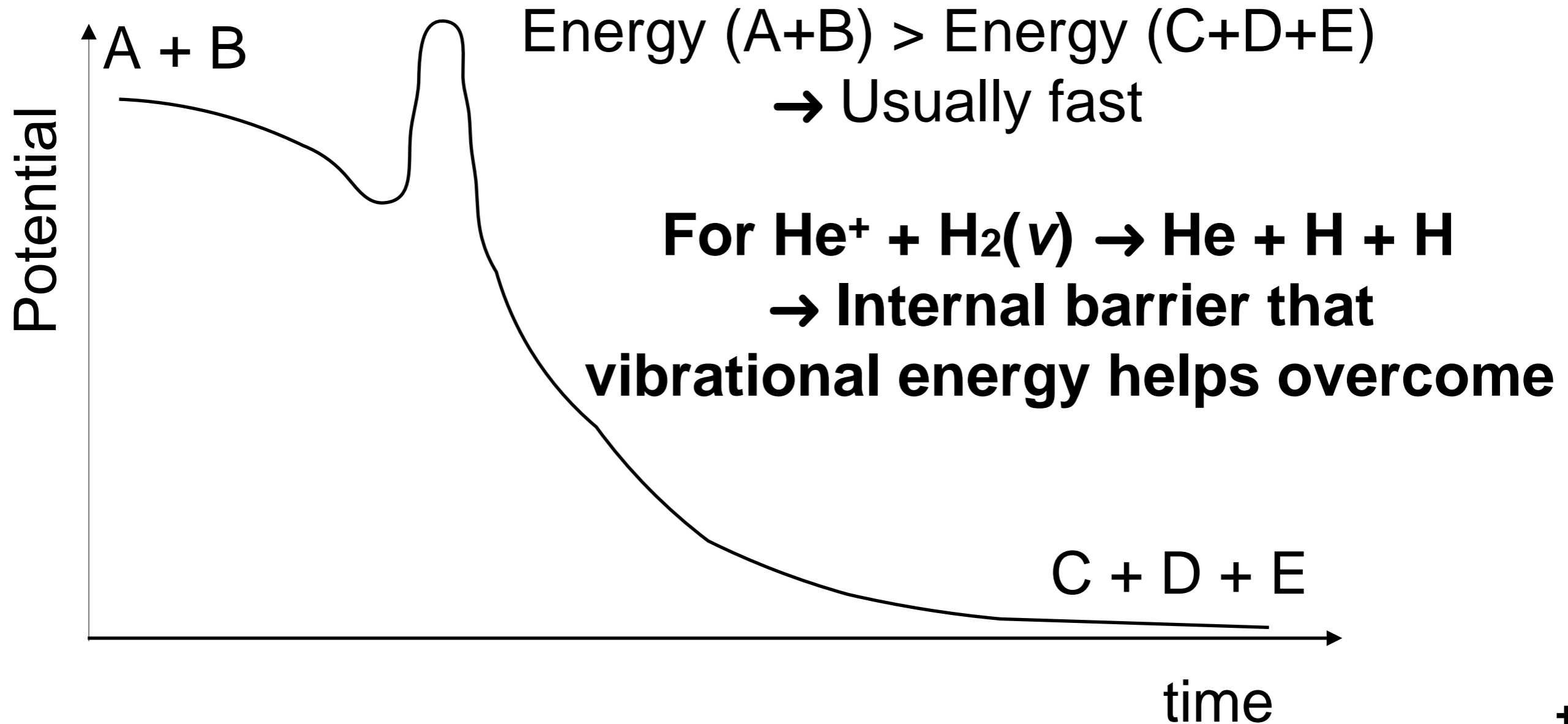
Outcome depends on interaction potential.

For exothermic reaction,  $A + B \rightarrow C + D + E$ :



A chemical reaction is a collision.  
Outcome depends on interaction potential.

For exothermic reaction,  $A + B \rightarrow C + D + E$ :

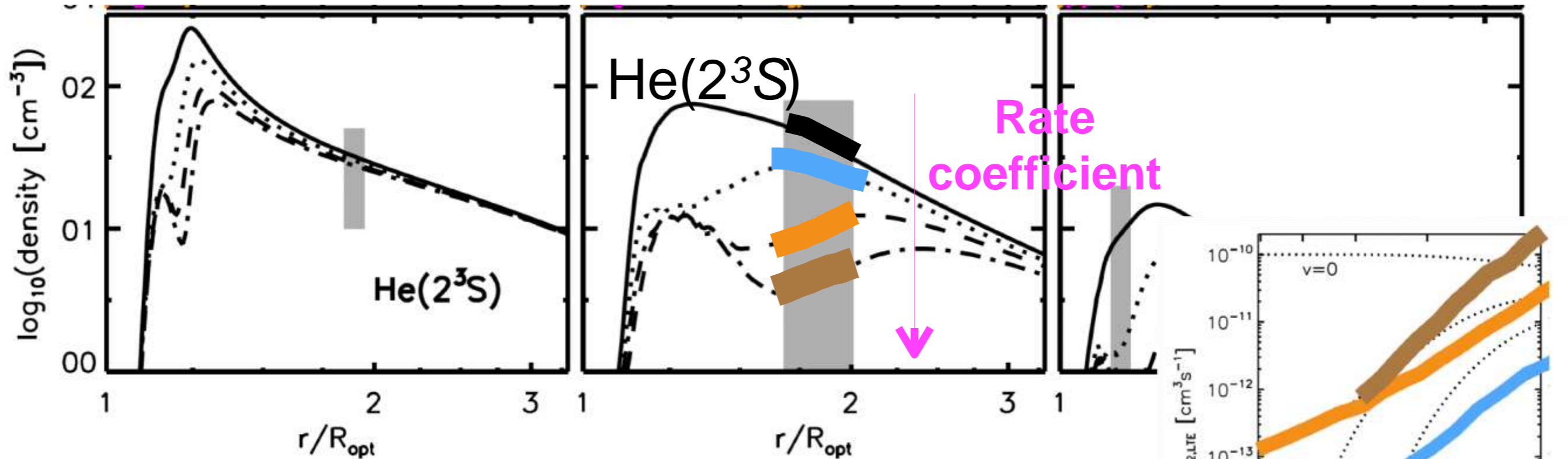


# GM+2025, He( $2^3S$ ) densities predicted for the 4 proposed prescriptions of rate coefficient

HAT-P-11b

GJ 3470 b

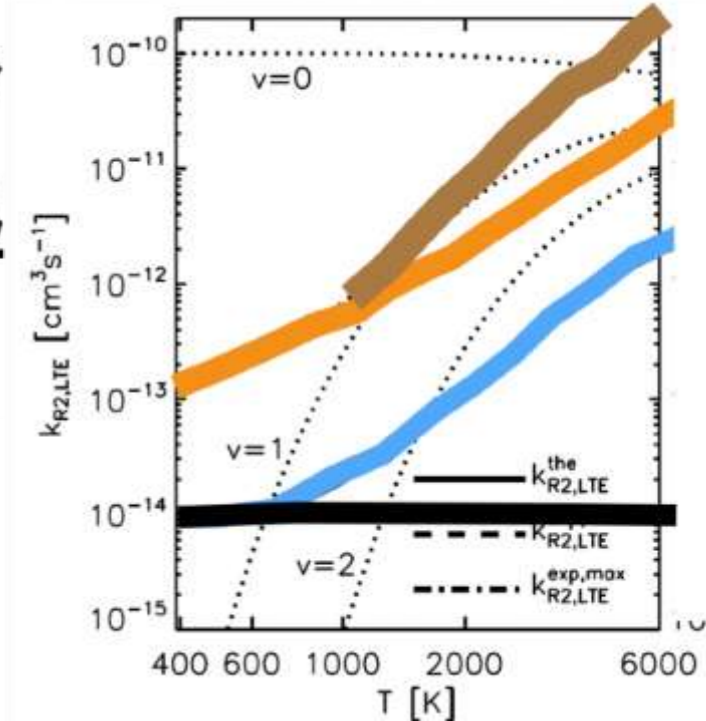
GJ 436 b



When  $\text{H}_2$  survives, reaction



significantly attenuates the He I triplet line at  $1.08 \mu\text{m}$

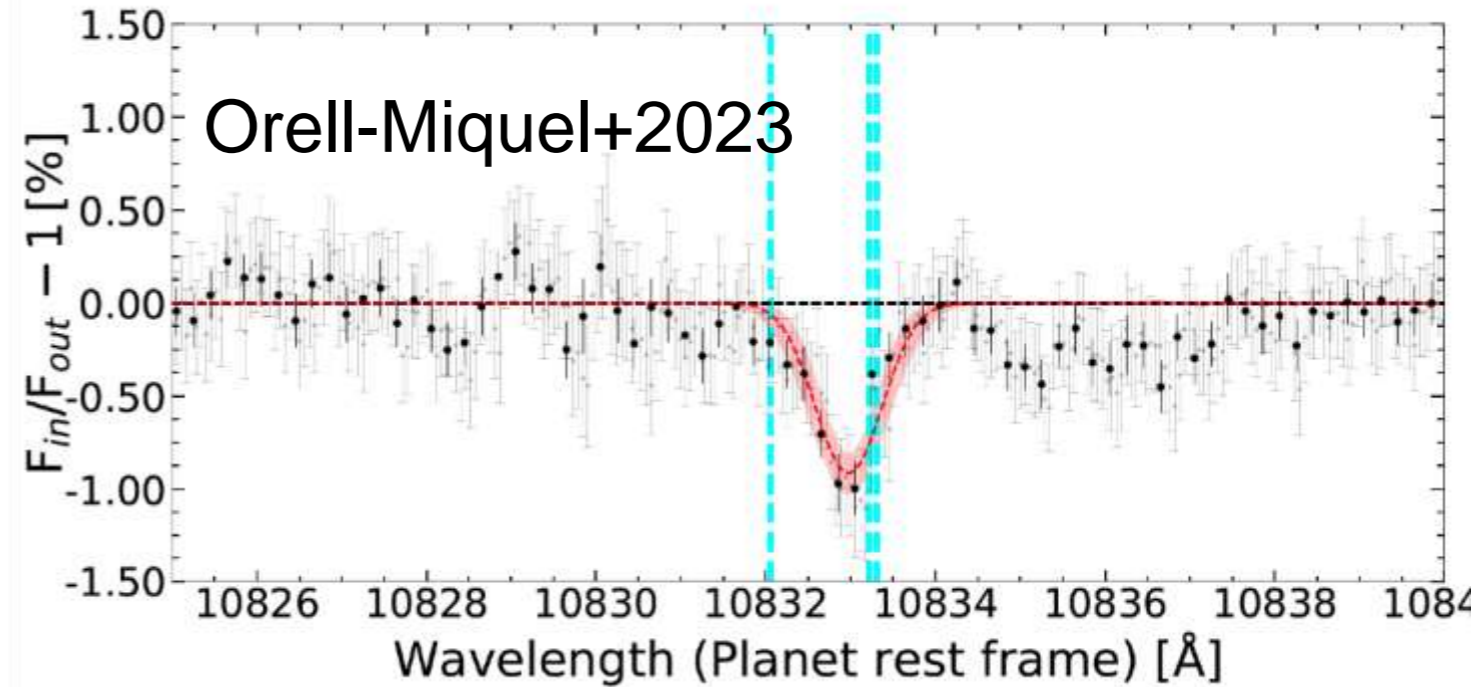
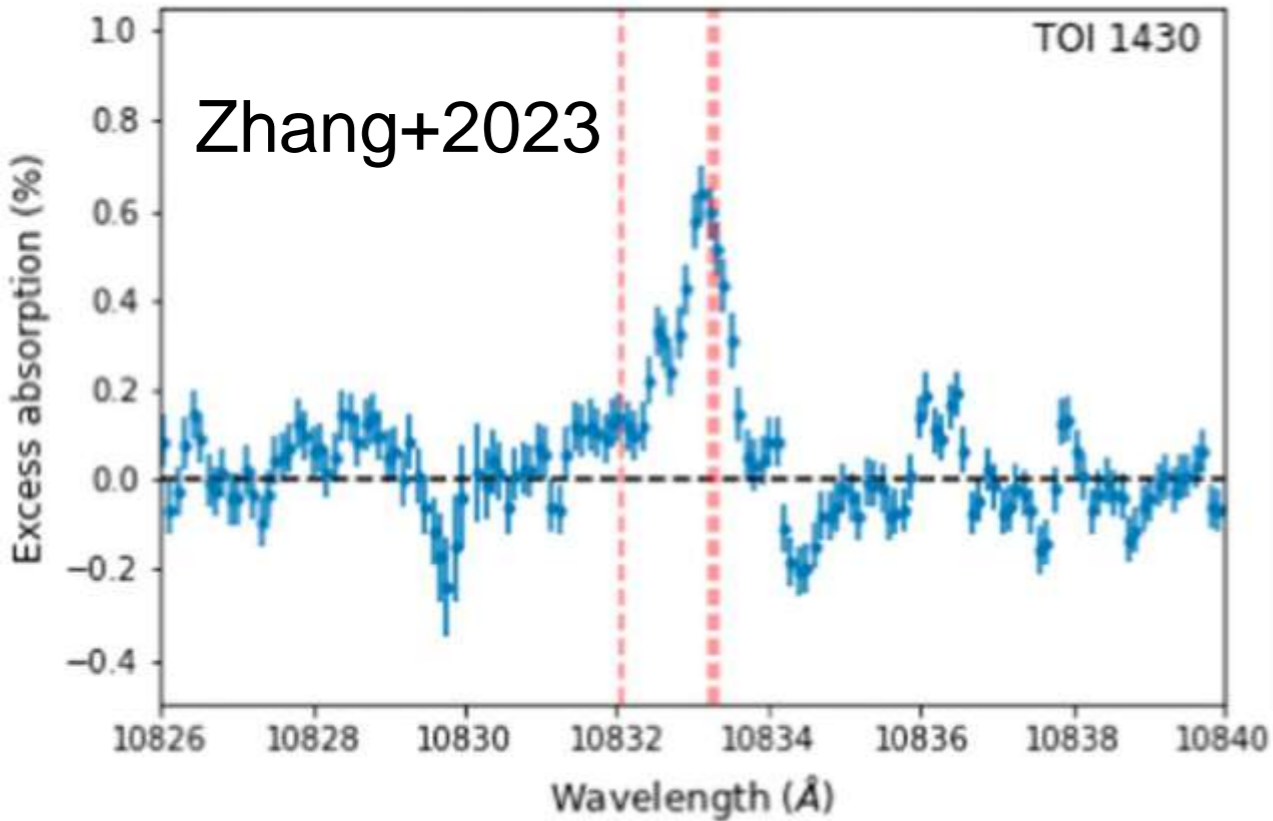


→ No need to reduce He/H

**TOI-1430 b (*aka* HD 235088 b)**

$R_p/R_\oplus \sim 1.98$  ;  $M_p/M_\oplus \sim 4.15$  ;  $a=0.071$  AU ;  $T_{eq} \sim 800$  K  
@ upper edge of radius gap

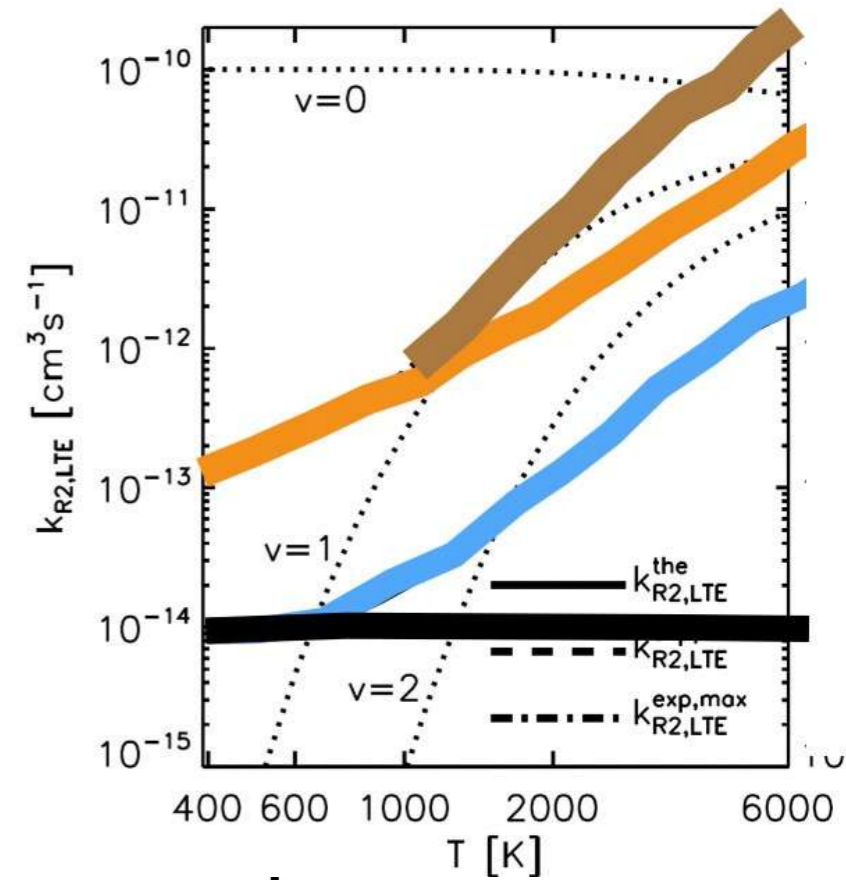
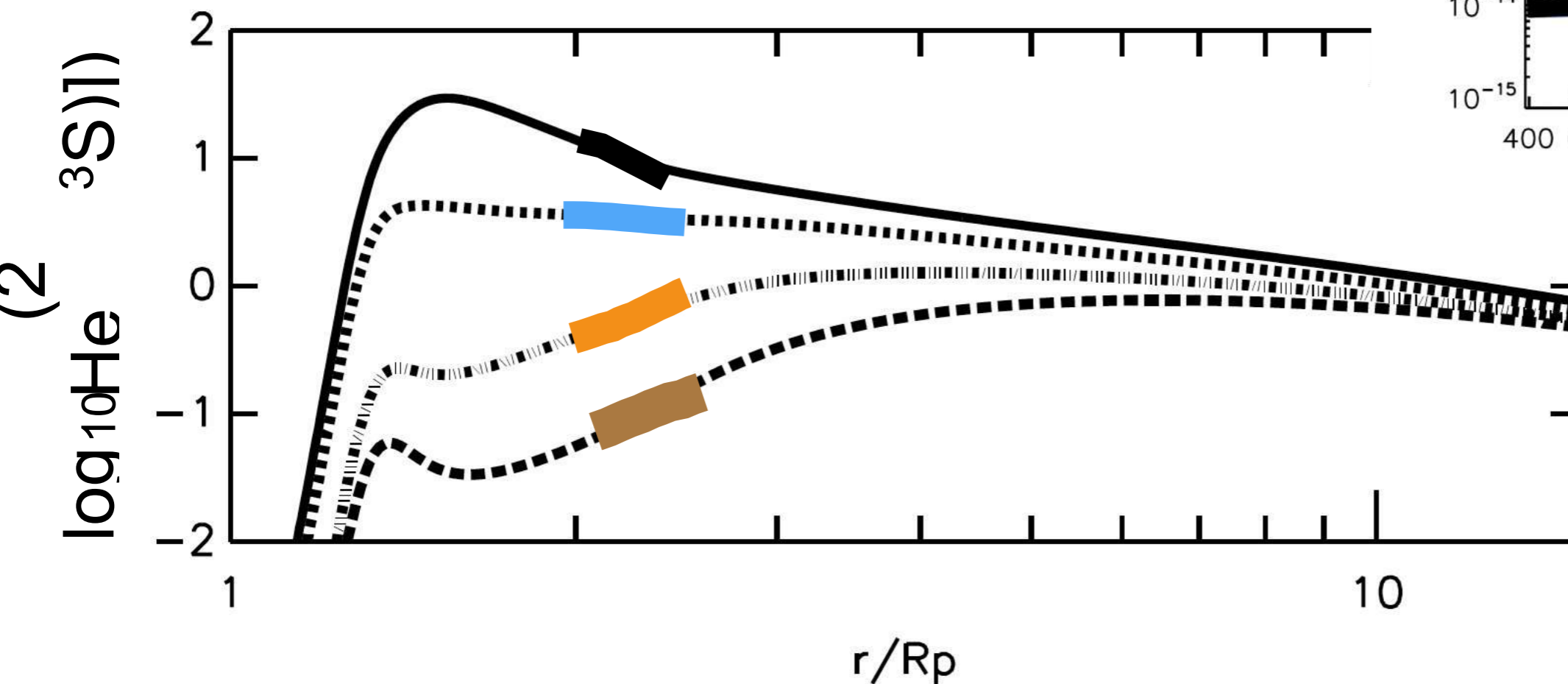
# Smallest planet for which a spectroscopic detection of an atmospheric feature has been reported



Excess Absorption~0.6%    Excess Absorption~0.9% **TOI-**

**Model:** Excess Absorption~0.37-0.6%  
 $\leq 0.6-0.9\%$  from measurements

**Assumed solar He/H !!**



**1430 b (*aka* HD 235088 b)**

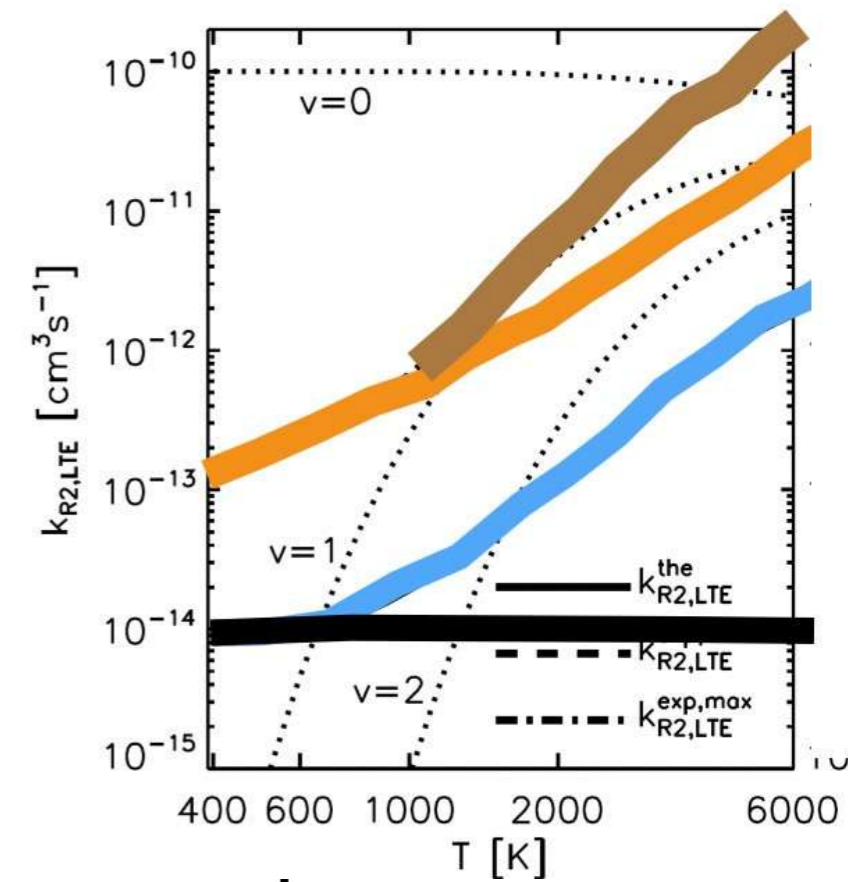
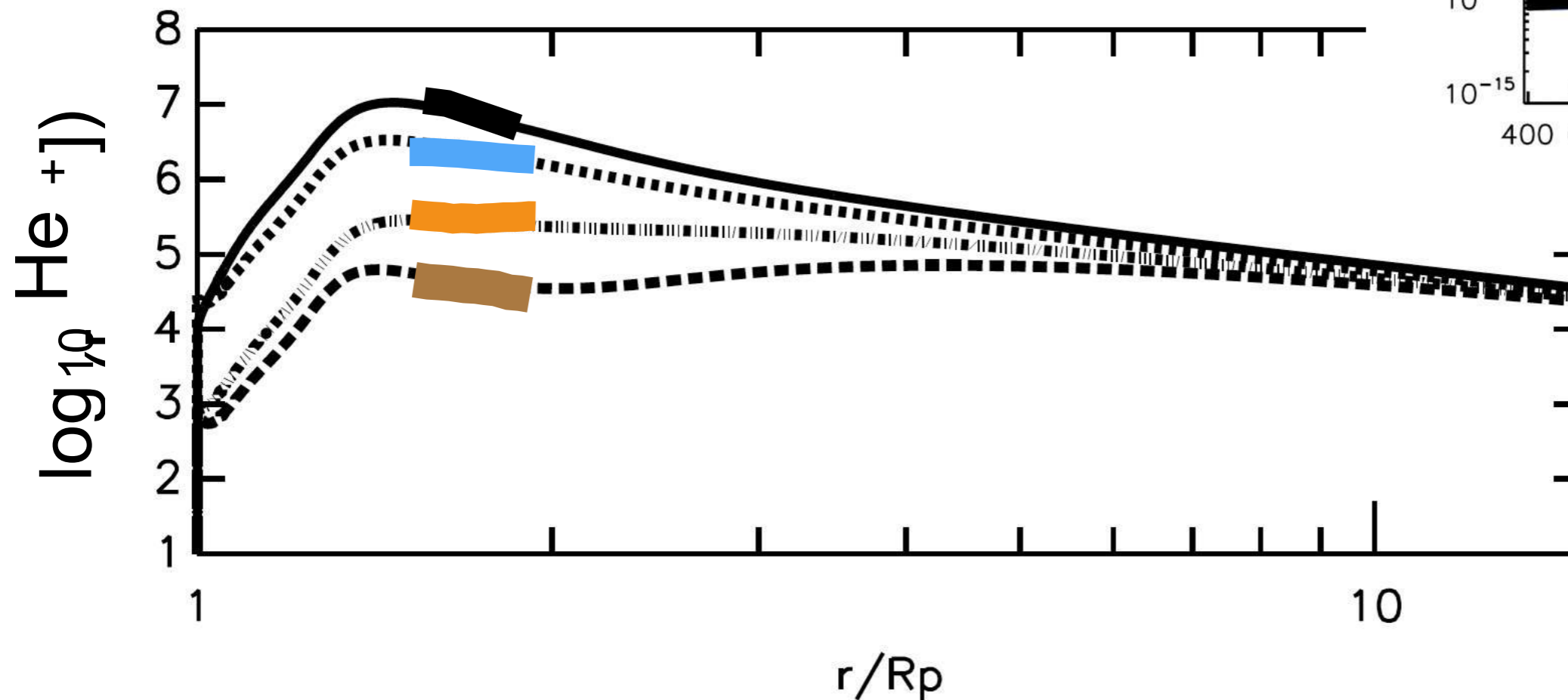
# Recap

Chemically, sub-neptunes are a different type of beast...

Molecularity is important in their upper atmospheres...  
(also re: heavier molecules, GM, *in prep.*)

# Implications on overall interpretation, in particular on He/H

**Model:** Excess Absorption  $\sim 0.37\text{-}0.6\%$   
 $\leq$  Measurements



(connected with formation, interior structure, etc...) **TOI-1430 b (*aka* HD 235088 b)**

# TOI-1430 b (*aka* HD 235088 b)

