Laboratory evidence for isotope effects of surface processes

LERMA-Cergy laboratory

**Different sticking coefficients for H₂ and D₂**

- If we suppose that differences between H₂ and D₂ are due to their mass, then their sticking efficiency should be the same if the temperature is rescaled by a factor of 2...

- Our model is able to fit the theoretical values for H and D by Buch et al. 1991

**HID scrambling in ice mantles**

- If we consider that differences between H₂ and D₂ are due to their mass, then their sticking efficiency should be the same if the temperature is rescaled by a factor of 2.

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**Number of D is conserved!**

- Very efficient HID exchange on the onset of desorption:
  - gas phase ≠ solid phase!

**Desorption of pure H₂, HD, D₂**

- Dulieu et al. 2005

**Desorption of mixtures of isotopologues**

- E_{ads(H₂)} decreases D₂ dose increases

**Surface reactions: HNCO + H₂ → NH₂CHO**

- Hydrogenation of isocyanid acid...

- Will it lead to formamide?

**Proposed reaction scheme:**

\[ \text{HNCO (m/z=43)} \]
\[ \text{HNCO + H (m/z=43)} \]
\[ \text{HNCO + D (m/z=44)} \]


**Small difference dramatic effect:**

\[ \text{Amiaud et al. 2015 PCCP, 17, 30148} \]

- E_{ads} = 60meV → t_{residence} > 10^{13} days
- E_{ads} = 30meV → t_{residence} > 0.01 days!!!