H_2 formation and PDR model

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H_2 formation in PDR model
$dn(H_2)/dt = \alpha\, n(H)\, n_H$

- "Jura 1974" formation rate $\alpha = 3\ 10^{-17}\ cm^3 s^{-1}$
- Le Bourlot et al. 95 : $\alpha = 0.5 \langle n_g\, \sigma \rangle\, v_H$ calculated for a Mathis power law distribution of grain sizes

$\langle n_g\, \sigma \rangle =$ $\frac{3}{4} \cdot \frac{1.4 m_H G}{\rho_g} \cdot \frac{1}{\sqrt{a_{min} a_{max}}}$ $= 1.95\, 10^{-21}\ cm^2$, $v_H = 1.45\ 10^4\ T^{0.5}$ cm/s

with $G = 1/100$, $\rho = 3 g\ cm^{-3}$, $a_{min} = 0.03\mu$, $a_{max} = 0.3\mu$, $\alpha = 1.4\, 10^{-17}\ T^{0.5}\ cm^3 s^{-1}$

- A_v dependent formation rate from Herma studies

$$\eta = a_0 \exp\left(a_1 \tanh(a_2 A_V)\right)$$

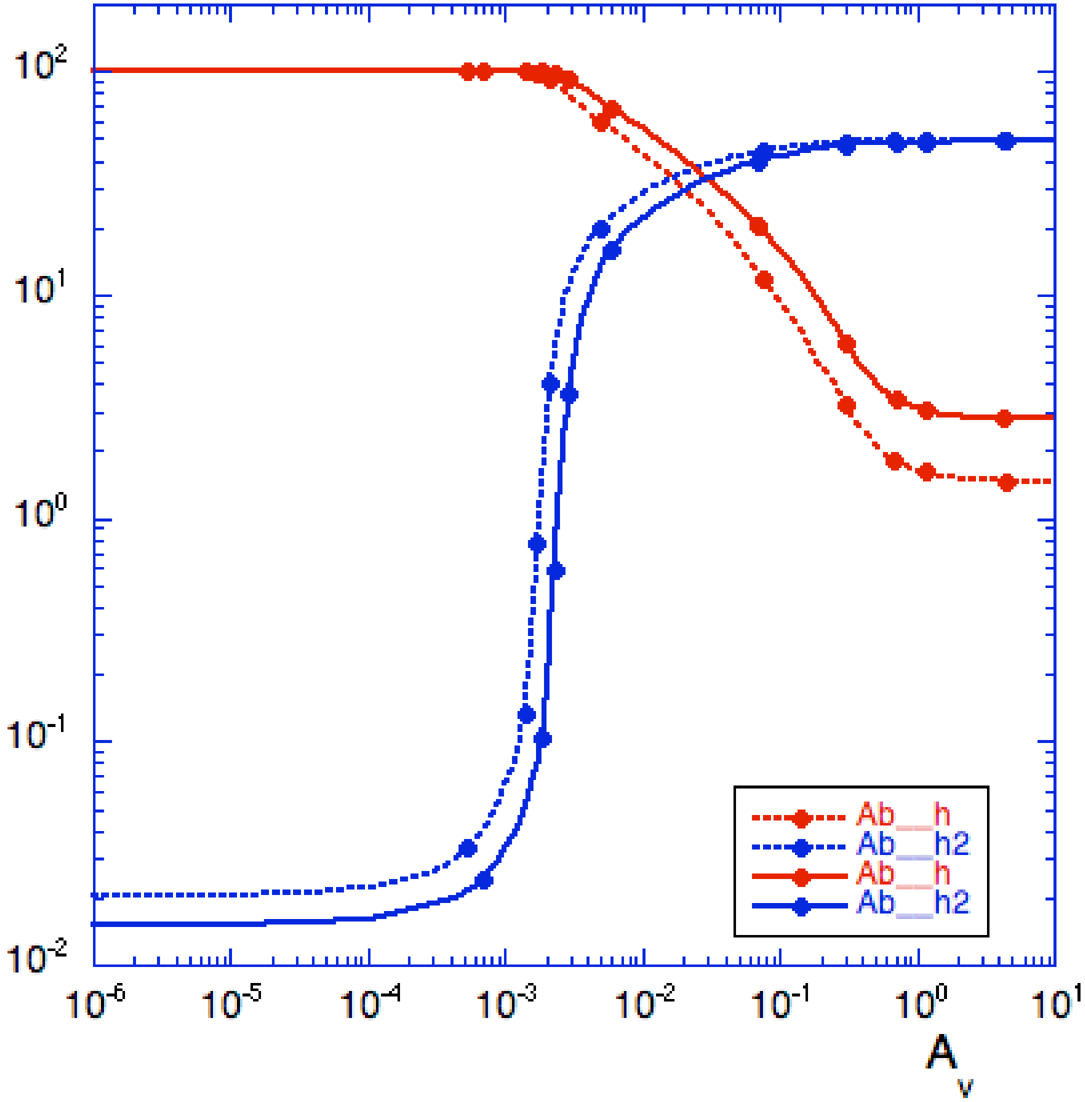
$$a_0 = \exp\left(\min(2.13 \arctan(281(r - 0.02)) - 3.656, 62000(r - 0.01) - 8)\right)$$

$$a_1 = \min(24.2 \exp(-97.18 r), 1423 r - 4.11)$$

$$a_2 = \max(-134 r + 1.43, 299 r - 2.88)$$

Comparison between "standard" and A_v dependent formation rate (I)

- n_H = 100 cm^{-3}
- χ = 1
- T = 60K
- ζ = 5 10-17 s^{-1}
- Full line : Av dependent formation rate
- dotted line "standard" formation rate



Comparison between "standard" and A_v dependent formation rate (II)

Table 1: H and H_2 column densities in cm^{-2}

Molecule	Av= 0.7	Av=1	Av=2	Av=3
H	7.94(19)	8.89(19)	1.18(20)	1.46(20)
	1.27(20)	1.45(20)	2.00(20)	2.53(20)
H_2	6.10(20)	8.84(20)	1.80(21)	2.71(21)
	5.87(20)	8.56(20)	1.76(21)	2.66(21)

1st line: results form Le Bourlot et al. prescription

2nd line : Av dependent term of H. Cuppen

- Factor of 2 on H column density result
- negligible effect on molecular content
- Extension to dense photodissociation regions such as the Orion bar (role of dust temperature ….)