Ultraviolet H_2 luminescence in molecular clouds induced by cosmic rays

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Prasad & Tarafdar (1983) first presented a quantitative method for estimating the UV emission in the Lyman-Werner bands of H2 collisionally excited by CR particles.

Sternberg et al. (1987) evaluated the Lyman-Werner band emission of CR-excited H2 and computed the resulting photodissociation rates of several interstellar molecules, focusing in particular on the effects of the CR-generated UV flux on the chemistry of H2O and simple hydrocarbons.

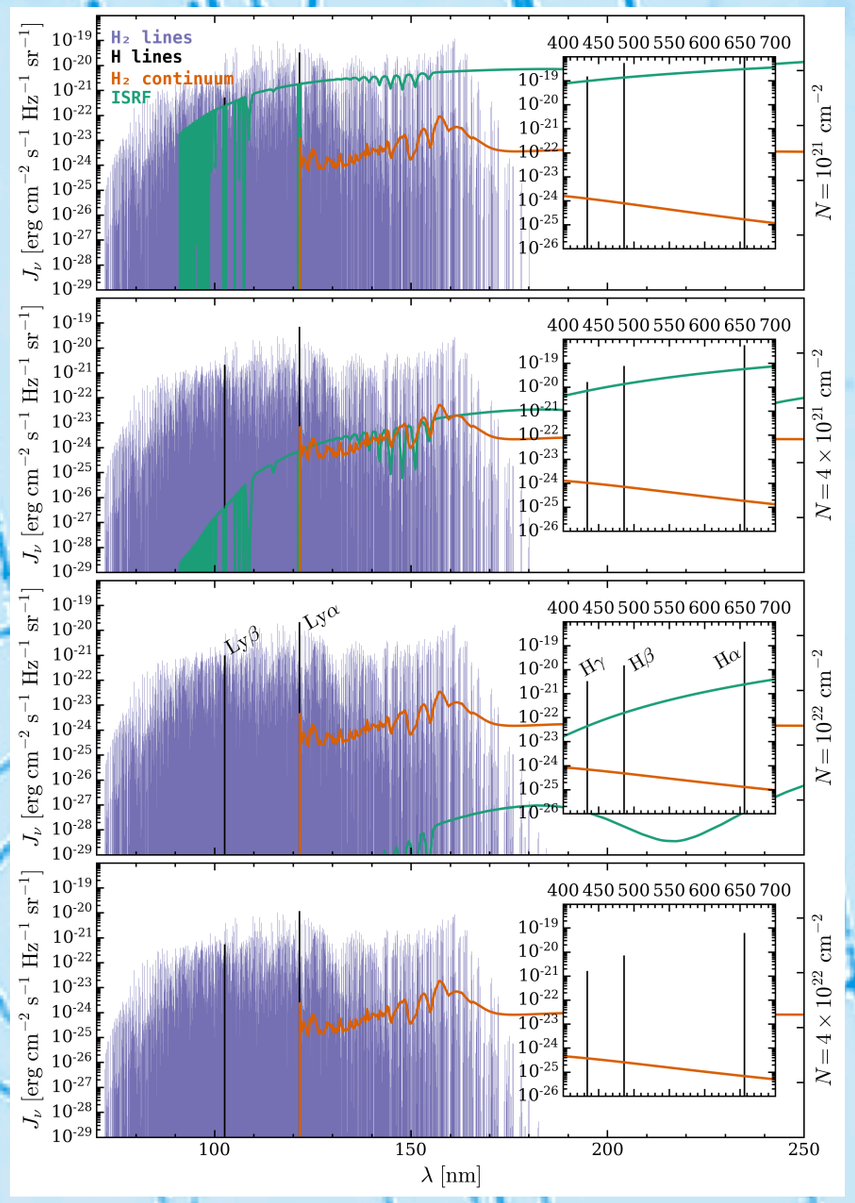
Gredel et al. (1987,1989) included several excited electronic states of H2 to evaluate photodissociation and photoionisation rates of a large set of molecules.

RECENT ADVANCES

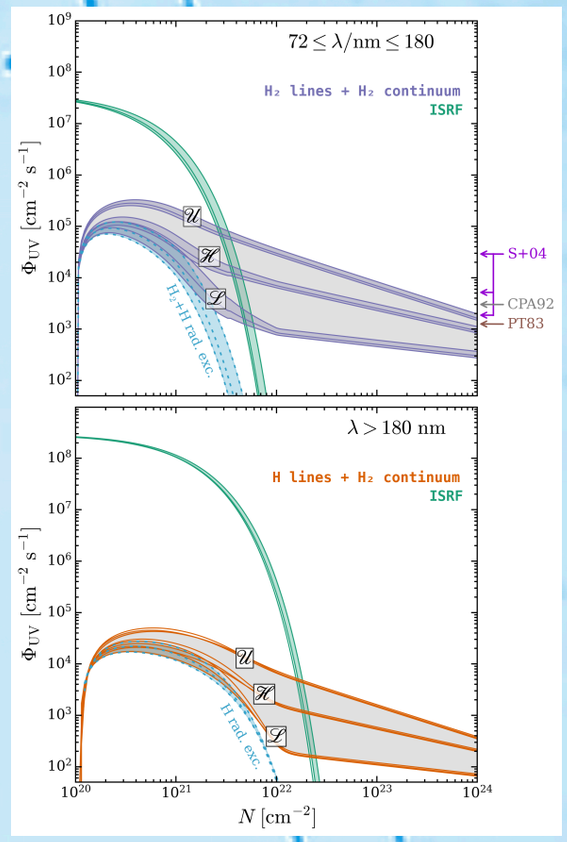
1) accurate calculations of collisional excitation cross sections (**Scarlett et al. 2023**) and spontaneous emission rates (**Abgrall et al. 1993a,b,c, 1997, 2000; Liu et al. 2010; Roueff et al. 2019, Glass-Maujean, priv. comm.**), all of which are rotationally resolved;

2) comprehensive insights into the propagation and attenuation of the Galactic CR flux within molecular clouds (**Padovani et al. 2009, 2018a, 2022**);

3) robust calculation of secondary electron fluxes resulting from the ionisation of H2 by CRs (**Ivlev et al. 2021**).



Expected mean intensity from H_2 lines, H_2 continuum, H lines, and ISRF at four H_2 column densities



Photon fluxes as a function of the H_2 column density

Photodissociation and photoionisation rates normalised to the cosmic-ray ionisation rate, as a function of the *isomeric H_2 composition* and *dust properties* can be found at https://github.com/marcopadovani/UVfluorescence