30 Years of Photodissociation Regions:

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REVIEW TALK

Models of PDRs: State of the art

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PDR modelling has a long history (Tielens and Hollenbach 1985). State-of-the-art PDR codes simulate the physical and chemical processes in neutral interstellar gas computing as consistently as possible and in a coupled way the radiative transfer, the thermal processes and the chemistry (Le Petit et al. 2006). If at first, these codes have been developed to study the H/H_2 transition, they are now able to model the formation of complex molecules in the gas phase and on grains surfaces (Hollenbach et al. 2009), and to compute in detail energy transfers between the various energy reservoirs (thermal, internal, radiative energy, ...). Today, state-of-the-art PDR codes are among the most powerful tools we have to study in detail the many processes that take place in interstellar gas.

In this review, I will overview the state-of-the-art in PDR models. I will try to highlight where they succeed and where they fail. Often, failures of PDR codes come from a poor knowledge of atomic and molecular data. I will try to point out where experimental and theoretical data are urgently needed. With the increase of the sensitivity and of the resolution of new instruments as ALMA, we see that a new generation of PDR codes is required. One can wonder if the efforts have to be done towards a better modelling of the micro-physical processes or on taking into account clumpiness and the geometry of objects with 3D PDR codes (Bisbas et al. 2012). One the other hand, most of PDR codes are stationary and a key question is how to deal with stochastic processes, dynamics, and time dependent effects. I will try to answer to theses questions with several examples as the modelling of H_2 formation and of complex molecules on grains as well as the question of high-J CO as observed by Herschel.

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