30 Years of Photodissociation Regions:
A symposium to honor David Hollenbach's lifetime in science
Asilomar, CA, USA - June 28th to July 3rd, 2015

INVITED TALK

The chemistry of PDRs

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The chemistry of PDRs is driven by the penetration of FUV photons. Depending on the FUV radiation strength and gas density, different physical processes and chemical reactions control the molecular composition as a function of cloud depth. Traditionally considered as *harsh* environments to host a rich chemistry, modern-day observations using multi-wavelength techniques and broad-band spectrometers do show a distinctive "PDR molecular content".

Specific "PDR molecules" are the CF^+, CO^+, HOC^+, CH^+, SH^+, OH^+ or H_2Cl^+ ions. Their formation represents the first steps of the PDR chemistry. The list of molecules detected in prototypical PDRs such as the Horsehead or the Orion Bar steadily increases. It ranges from well-known radicals (e.g. C_2H, CN, OH, HCO), heavy ions such as l-C_3H^+ involved in the formation of small hydrocarbons (e.g., C_3H_2 and C_3H), isotopologues and isotopomers (e.g., ^{13}CCH, C^{13}CH, DCN and HNC), to PAHs and even complex organic molecules (COMs such as CH_3CN, CH_3NC, HCOOH, CH_2CO, etc.). Explaining the presence of COMs in PDRs is particularly challenging, and opens new avenues for grain surface and ice-mantle photodesorption studies.

The emission from all the above species not only reflects subtle chemical and excitation processes (photoreactions, reactions with vibrationally excited H_2, state-to-state formation, fractionation reactions, photo-erosion of grains, etc.), also they trace the steep gradients in the PDR gas properties (physical conditions, molecular fraction, ionization fraction, etc.) as a function of cloud depth. Their emission not only dominates the spectra of galactic PDRs and star-forming regions near massive stars. They are also becoming powerful diagnostic tools to understand the emission from sources as different as the nuclei of distant galaxies, planetary nebulae, protostellar shocks irradiated by FUV fields, or the illuminated surfaces of protoplanetary disks.

In this contribution I will review the on-going observational and modeling efforts made to characterize the chemistry of PDRs. I will also show the first ALMA images of the Orion Bar.

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