

30 Years of Photodissociation Regions:

A symposium to honor David Hollenbach's lifetime in science
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INVITED TALK

Tracers of PDRs at High Redshift

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I plan to cover the current state of the knowledge and future prospects for tracing the physical conditions of the photodissociation regions in high redshift systems. The workhorse line is the 158 μm [CII] transition which has now been reported from about 50 high redshift galaxies. The [CII]/far-IR continuum luminosity ratio is a measure of the strength of the ambient FUV radiation fields, which together with the source luminosity yields the size of the emitting regions. This ratio varies by about a factor of 100 from the low ratios seen in local ULIRG galaxies and distant AGN dominated systems to very high values (in excess of 0.01) seen in luminous star formation dominated systems. This simple tracer has already been used to demonstrate that unlike the collision-induced, confined and very intense starbursts found in local ULIRG galaxies, many of the highest luminosity star forming systems at intermediate redshifts ($z \sim 1-3$) are dominated by very extensive, but moderate intensity star formation regions. Star formation in these systems likely arises from within massive molecular disks in a "quiescent" Schmidt-Kennicutt law mode. I will also cover high redshift surveys in the [OI] line and the mid-IR PAH features and discuss their added value in constraining the heating and cooling of PDRs at high redshift, prospects for other tracers (e.g. molecular hydrogen rotational line emission), and the utility of the [NII] line for constraining the fraction of the [CII] emission that arises from ionized gas. I will finish with speculations on the expected brightness of the [CII] line from very early times.