Insights into the Carbon chemistry of Mon R2

J. R. Rizzo^1, A. Fuente^2, and S. Garcia-Burillo^2

1 - Universidad Europea de Madrid, Spain
2 - Observatorio Astron\'omico Nacional, Spain

Aiming to learn about the chemistry of the dense PDR around the ultracompact (UC) HII region in Mon R2, we have observed a series of mm-wavelength transitions of C$_3$H$_2$ and C$_2$H. In addition, we have traced the distribution of other molecules, such as H^{13}CO^{+}, SiO, HCO, and HC$_3$N. These data, together with the reactive ions recently detected, have been considered to determine the physical conditions and to model the PDR chemistry. We then identified two kind of molecules. The first group, formed by the reactive ions (CO$^+$, HOC$^+$) and small hydrocarbons (C$_2$H, C$_3$H$_2$), traces the surface layers of the PDR and is presumably exposed to a high UV field (hence we called it as ``{\it high UV}'', or HUV). HUV species is expected to dominate for visual absorptions $2<A_{\mathrm V}<5$\,mag. A second group (less exposed to the UV field, and hence called ``{\it low UV}'', or LUV) includes HCO and SiO, and is mainly present at the edges of the PDR ($A_{\mathrm V}>5$\,mag). While the abundances of the HUV molecules can be explained by gas phase models, this is not the case for the studied LUV ones. Although some efficient gas-phase reactions might be lacking, grain chemistry sounds like a probable mechanism able to explain the observed enhancement of HCO and SiO. Within this scenario, the interaction of UV photons with grains produces an important effect on the molecular gas chemistry and constitutes the first evidence of an ionization front created by the UC HII region carving its host molecular cloud. The physical conditions and kinematics of the gas layer which surrounds the UC HII region were derived from the HUV molecules. Molecular hydrogen densities $>4\,10^6$ cm^{-3} are required to reproduce the observations. Such high densities suggest that the HII region could be pressure-confined by the surrounding high density molecular gas.

Reference: Astrophysical Journal, in press
Status: Manuscript has been accepted

Weblink:

Comments:

Email: jricardo.rizzo@uem.es