The impact of H_{II} regions on Giant Molecular Cloud properties in nearby galaxies

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Star formation is known to be inefficient [I], with only a small fraction of the gas mass being turned into stars. A key process explaining this inefficiency is probably the feedback from young massive stars injecting momentum and energy back into the ISM, disrupting the surrounding molecular gas. The main driver of this process has long been thought to be supernovae explosions (e.g. [2]). However recent results suggest that pre-supernova feedback mechanisms, such as stellar winds and photo-ionizing radiation, are also effective in disrupting the molecular gas before the supernova stage [3].

In this talk, I will present our efforts to investigate whether star formation feedback has an measurable impact on the physical properties of the molecular gas that surrounds H_{II} regions on ~100 pc scales in nearby galaxies. Using data from the PHANGS-ALMA and PHANGS-MUSE surveys, we performed a statistical analysis of ~30000 H_{II} regions and ~11000 giant molecular clouds in 17 galaxies in order to retrieve hints and imprints of the radiative feedback process on clouds.

We find that the physical properties of molecular clouds that are associated with H_{II} regions differ significantly from the properties of their parent distribution: They are denser, their peak temperature is higher, and their characteristic turbulent linewidth wider. Moreover, the GMC molecular mass and size are correlated with the H_{II} of the coincident H_{II} regions. These effects can not be explained by pre-existing co-variations of the GMC properties, i.e., the well-known Larson's and Heyer's relationships.

Taken together, our results suggest that the most massive H_{II} regions can indirectly heat molecular clouds and increase their characteristic turbulence at a scale of 100 pc. Confirmation of these results will require observations of targeted regions at higher angular resolution.

Références

[1] Chevance et al. 2021, MNRAS, 272, 288
[2] Leroy et al. 2008, ApJ, 2782, 2845
[3] Lucas et al. 2020, MNRAS, 4700, 4710