Constraining the embedded phase of star formation in the PHANGS-JWST survey

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By providing a wealth of spectral tracers probing various interstellar medium (ISM) phases at an unprecedented spatial resolution, JWST is now in the position to provide a new view of the matter cycling in galaxies and of its conversion to form new stars. While previous studies have focused on characterizing the physical properties and timescales associated with the conversion of cold molecular clouds (traced by CO) into young massive stars (traced by Hα; e.g., Kim+21, Chevance+22), a wider variety of ISM phases can now be probed : the neutral atomic gas and diffuse ISM trough PAHs (e.g, Sandstrom+23), the hot molecular gas reservoirs through rotational H_2 lines (e.g, Hernandez+23), or the regions of embedded star formation (e.g, Kim+23).

To make the most of these revolutionary observations, complex modeling tools, tailored for resolved observations, are crucially needed. In nearby spiral galaxies, mapping the spatial correlation and decorrelation between tracers enables characterizing the temporal evolution of the gas reservoirs and their associated timescales (e.g., Kruijssen+14,Kruijssen+18). I will showcase first results obtained on galaxies from the PHANGS-JWST survey, using the latter method to derive the molecular cloud assembly time and the duration of the embedded phase of star formation, traced by the 21um band. Finally, I will discuss the implications of such results for current models and simulations of the multiphase ISM in unresolved galaxies, near and far.

References: Kim J., et al. 2021, MNRAS, 504, 1, 487-509 - Chevance M., et al . 2022, MNRAS, 509, 1, 272-288 - Sandstrom, K., et al. 2023, ApJ, 944, 2, L8 - Hernandez S., et al. 2023, ApJ, in press - Kim J., et al. 2023, ApJL, 944, 2, L20 - J. M. D. Kruijssen and Longmore S., 2014, MNRAS, 439, 4, 3239-3252 - J. M. D. Kruijssen, et al. 2018, MNRAS, 479, 2, 1866-1952