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One correlation to rule them all (linking young stars, clouds, and galaxies).

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Abstract

The star formation rate linearly correlates with the dense gas mass involved in the formation of stars both for distant galaxies and star-forming clouds in our Galaxy. Similarly, recent studies confirm that the mass accretion rate and the circumstellar gas disk mass of young, Class II stars are also linearly correlated. This poster shows that both relations can be unified. We find a statistically significant, roughly linear correlation between the rate of gas transformed into stars and the mass of gas directly involved on star formation, ranging 16 orders of magnitude and encompassing kpc-size galaxies, pc-size star forming clouds within our Galaxy, and young stars with au-size protoplanetary disks. In order to explain this finding we propose a bottom-up hypothesis suggesting that a relation between the stellar mass accretion rate and the total (disk+envelope in Class 0/I stars) circumstellar mass drives the correlation in clouds (hosting protostars) and galaxies (hosting clouds). Lines of evidence supporting this hypothesis and a future observational test are provided. If this scenario was confirmed, theories aiming to explain the correlations for stars, clouds, and galaxies should not remain isolated from each other. Instead, all scales and physical systems involved in one single, global correlation must be considered. Additional details can be found in Mendigutía, Lada, & Oudmaijer, 2018, A&A, 618, A119. (See poster).