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Francesco Salvestrini - Investigating molecular gas scaling relations in the local Universe: What drives the cycle of star formation?

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In this work, we extend the “classical” study of the fundamental properties of galaxies tracing the cycle of star formation (SF), star formation rate (SFR), molecular gas mass (MH2) and stellar mass (M_star), by investigating the role of two more fundamental components of the interstellar medium (ISM): dust and atomic gas. We extensively investigate the scaling relations among the galaxy properties and ISM component above listed, aiming at understanding which are the conditions that makes local galaxies more molecular gas rich and, thus, more able to form new stars. To this purpose, we collect ~130 local galaxies drawn from the DustPedia sample, which benefit from a detailed and extended characterization in terms of galaxy properties, as well as a wealth collection of multiwavelength data. In particular, we select galaxies with archival low-J CO observations mapping the entire disk of the galaxies, in order to derive solid MH2 estimates (with respect to single-pointing observations with single-dish antenna), key to reduce the dispersion observed in molecular gas scaling relations. Furthermore, by using classical statistical methods, as well as a random forest regression approach, we investigate the properties of the galaxies that are responsible for the observed scatter in the most common scaling relation involving the molecular gas mass (namely, molecular gas main sequence and Kennicutt-Schmidt relation). We confirm recent results on the fundamental role of M_star in the cycle of SF, even if it loses importance as the galaxy stellar population grow older, as well as the non-secondary role of the dust component. Finally, as a by-product of this accurate study of the molecular gas scaling relation, we investigate the reliability of photometric measurements (focusing on the mid-IR e far-IR regimes) in predicting the molecular gas content observed in our sample, both at galactic and sub-kpc scales.

Session Classification: Local Universe