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Authors	Galliano, Frédéric, Nersesian, Angelos, BIANCHI, SIMONE, De Looze, Ilse, Roychowdhury, Sambit, Baes, Maarten, CASASOLA, VIVIANA, Cassará, Letizia P., Dobbels, Wouter, Fritz, Jacopo, Galametz, Maud, Jones, Anthony P., Madden, Suzanne C., Mosenkov, Aleksandr, Xilouris, Emmanuel M., Ysard, Nathalie
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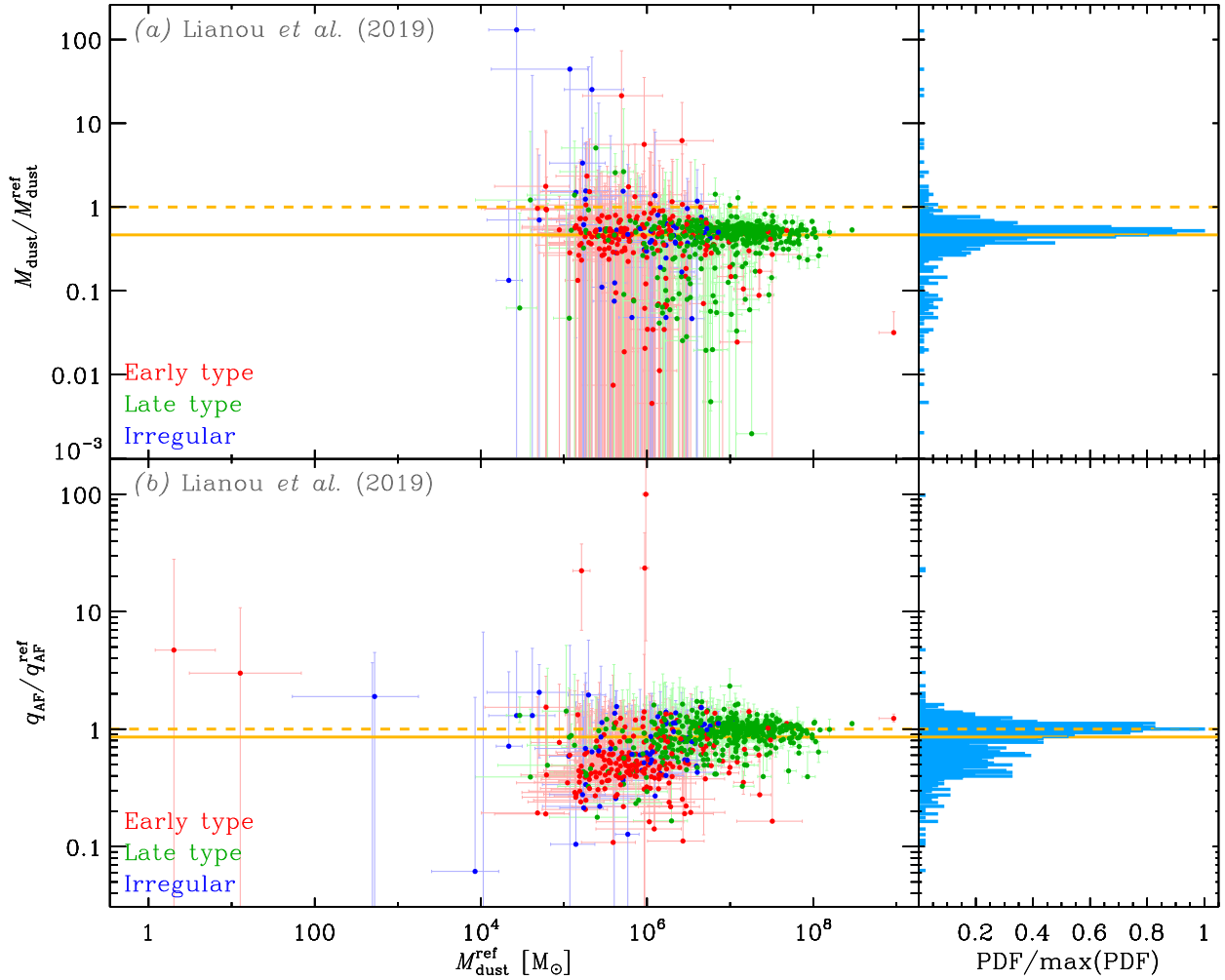


Fig. 7. Comparison to Lianou et al. (2019). Same conventions as Fig. 4.

Sculptor dwarf elliptical galaxy. This is not an outlier to the relation, but it indisputably lies outside of its group.

Panel b of Fig. 8 presents the relation between the specific gas mass, and the dustiness. Such a relation was previously presented by Cortese et al. (2012), Clark et al. (2015), and De Vis et al. (2017b). There is a clear negative correlation between these two quantities, showing that when a galaxy evolves, its ISM gets progressively enriched in dust and its gas content gets converted to stars. There is one notable feature deviating from this main sequence: a vertical branch at $sM_{\text{gas}} \simeq 0.1$, exhibiting a systematically lower dustiness. This branch is mostly populated by ETGs and contains most of the ETGs of the relation. We discuss the likely origin of this branch in Sect. 4.1.2. Finally, the peculiar sources of panel a logically stand out in this panel too.

1. PGC 166077 is the blue SUE at $Z_{\text{dust}} \simeq 0.05$. It is not a clear outlier, as $\text{CR}_{95\%}(Z_{\text{dust}}) = [0.01, 0.13]$.
2. NGC 5355 and NGC 4322 are the red SUEs at $sM_{\text{gas}} \simeq 0.4$ and $sM_{\text{gas}} \simeq 1.5$, respectively.
3. The bottom red SUE, at $sM_{\text{gas}} \simeq 1600$, is ESO 351–030.

Panel c of Fig. 8 shows the relation between the specific dust mass and the specific star formation rate, sSFR. This relation was previously presented by Rémy-Ruyer et al. (2015) and De Vis et al. (2017b). It was also discussed in Cortese et al. (2012) with sSFR replaced by its proxy NUV- r . In the same way, but on resolved 140 pc scales, it was shown in M 31 by

Viaene et al. (2014). There is a clear positive correlation between the two quantities. The different galaxy types are grouped in distinct locations: (i) ETGs are clustered around $10^{-4} \lesssim \text{sSFR} \lesssim 0.01 \text{ Gyr}^{-1}$; (ii) LTGs are clustered around $0.01 \lesssim \text{sSFR} \lesssim 1 \text{ Gyr}^{-1}$; (iii) Irregulars tend to lie around $0.1 \lesssim \text{sSFR} \lesssim 10 \text{ Gyr}^{-1}$, but are more scattered than the other types, with a systematically lower sM_{dust} than what the extrapolation of the trend would suggest. This scaling relation provides an interesting approximation to derive the dust content from SFR and M_* , two quantities which usually are easy to estimate. In particular, the relation is quasi-linear in the low sSFR regime, with:

$$\frac{M_{\text{dust}}}{M_{\odot}} \simeq 7.3^{+10.4}_{-6.1} \times 10^7 \times \frac{\text{SFR}}{M_{\odot} \text{ yr}^{-1}} \quad \text{for } \text{sSFR} \lesssim 0.1 \text{ Gyr}^{-1}, \quad (7)$$

with $\text{CR}_{95\%}(M_{\text{dust}}/\text{SFR}) = [0.12, 53] \times 10^7 \text{ yr}$.

Panel d of Fig. 8 shows the variation of the dustiness as a function of the metallicity (Eq. (1)). Such a relation is one of the most common benchmarks for global dust evolution models (cf. Sect. 5), and has been presented by numerous studies (e.g., Lisenfeld & Ferrara 1998; James et al. 2002; Draine & Li 2007; Galliano et al. 2008b; Galametz et al. 2011; Rémy-Ruyer et al. 2014; De Vis et al. 2017a). There is a clear correlation between the two quantities, reflecting the progressive dust enrichment of the ISM, built from heavy elements injected by stars at the end of their lifetime. Few ETGs are present, due to the lack of reliable gas metallicity estimates for these objects.