Galaxy Structure and Mode of Star Formation in the SFR-Mass Plane from z ~ 2.5 to z ~ 0.1

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We analyze the dependence of galaxy structure (size and Sersic index) and mode of star formation (\Sigma_SFR and SFR_IR/SFR_UV) on the position of galaxies in the SFR versus Mass diagram. Our sample comprises roughly 640000 galaxies at z~0.1, 130000 galaxies at z~1, and 36000 galaxies at z~2. Structural measurements for all but the z~0.1 galaxies were based on HST imaging, and SFRs are derived using a Herschel-calibrated ladder of SFR indicators. We find that a correlation between the structure and stellar population of galaxies (i.e., a 'Hubble sequence') is already in place since at least z~2.5. At all epochs, typical star-forming galaxies on the main sequence are well approximated by exponential disks, while the profiles of quiescent galaxies are better described by de Vaucouleurs profiles. In the upper envelope of the main sequence, the relation between the SFR and Sersic index reverses, suggesting a rapid build-up of the central mass concentration in these starbursting outliers. We observe quiescent, moderately and highly star-forming systems to co-exist over an order of magnitude or more in stellar mass. At each mass and redshift, galaxies on the main sequence have the largest size. The rate of size growth correlates with specific SFR, and so does \Sigma_SFR at each redshift. A simple model using an empirically determined SF law and metallicity scaling, in combination with an assumed geometry for dust and stars is able to relate the observed \Sigma_SFR and SFR_IR/SFR_UV, provided a more patchy dust geometry is assumed for high-redshift galaxies.

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table. Revision includes sample upgrade and appendix with extensive robustness analysis

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