Investigating the properties of the galaxies in the nearby Universe

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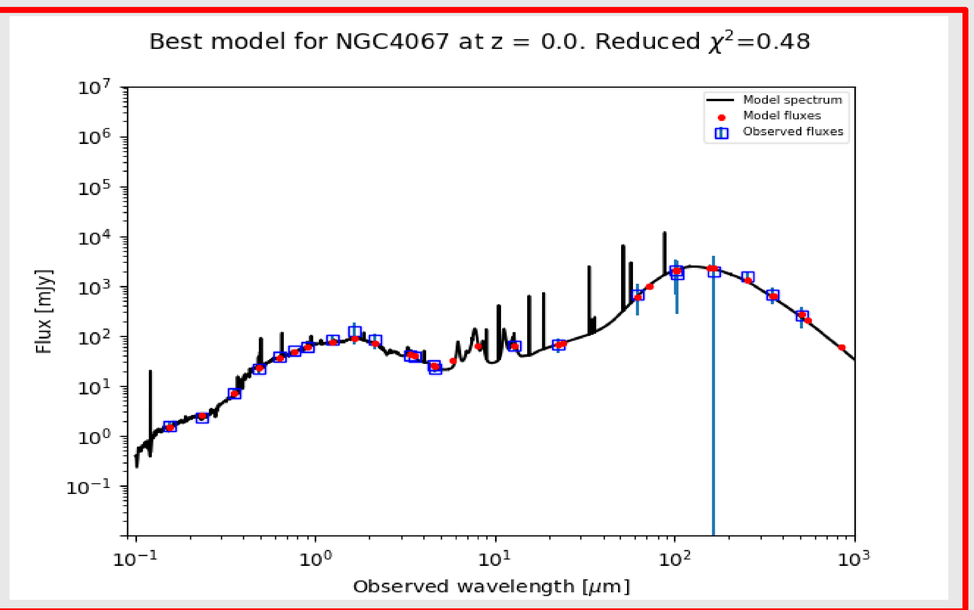
Introduction

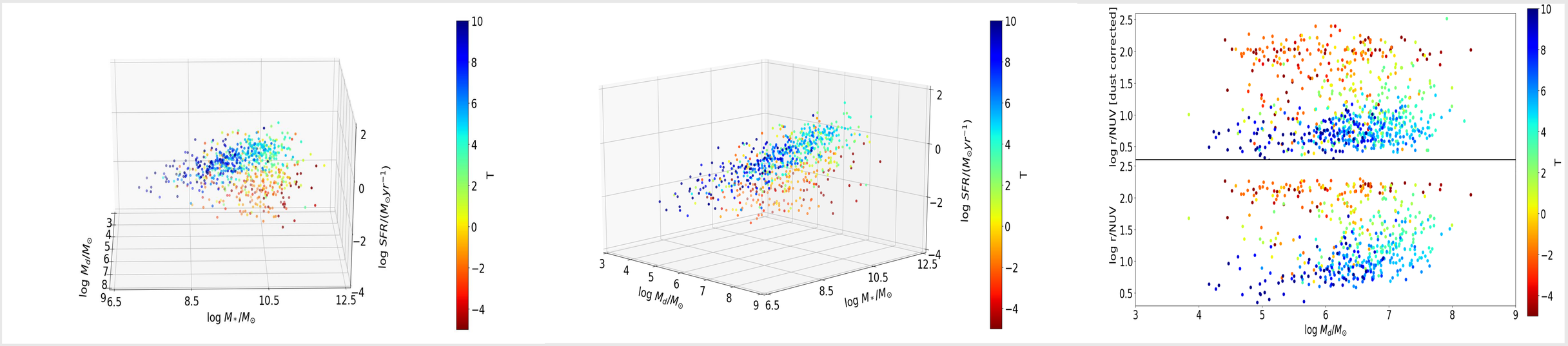
Within the framework of the DustPedia project (dustpedia.com) we are investigating the properties of the cosmic dust of 875 galaxies in the nearby Universe, all observed by the Herschel Space Observatory.

To achieve this goal we will make use of already developed codes for galaxy SED fitting (HerBIE, CIGALE) as well as Radiative Transfer modelling (SKIRT) including a state-of-the-art unifying dust grain model called THEMIS (Jones et al. 2017).

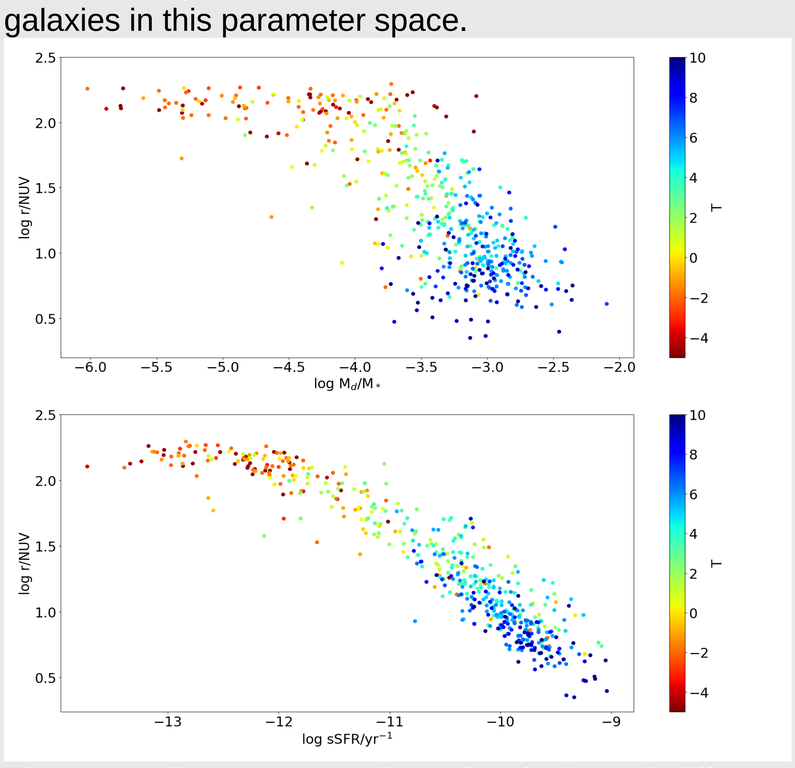
Using the existing photometry of the DustPedia galaxies from the far-UV to the sub-millimeter wavelengths (http://dustpedia.astro.noa.gr/) and preliminary results from CIGALE we fitted the DustPedia sample (see figure on the right for such an SED example) and determined physical properties of the galaxies, such as, the dust mass, the stellar mass, the star-formation rate, the dust attenuation, the bolometric luminosity as well as the unattenuated stellar light (both for the young and the old stellar components). Our future plan is to make use of this set of parameters to derive correlations and scaling relations for different morphological types of galaxies within the DustPedia sample (see Davies et al. 2017 for a more detailed description of the scopes of DustPedia).



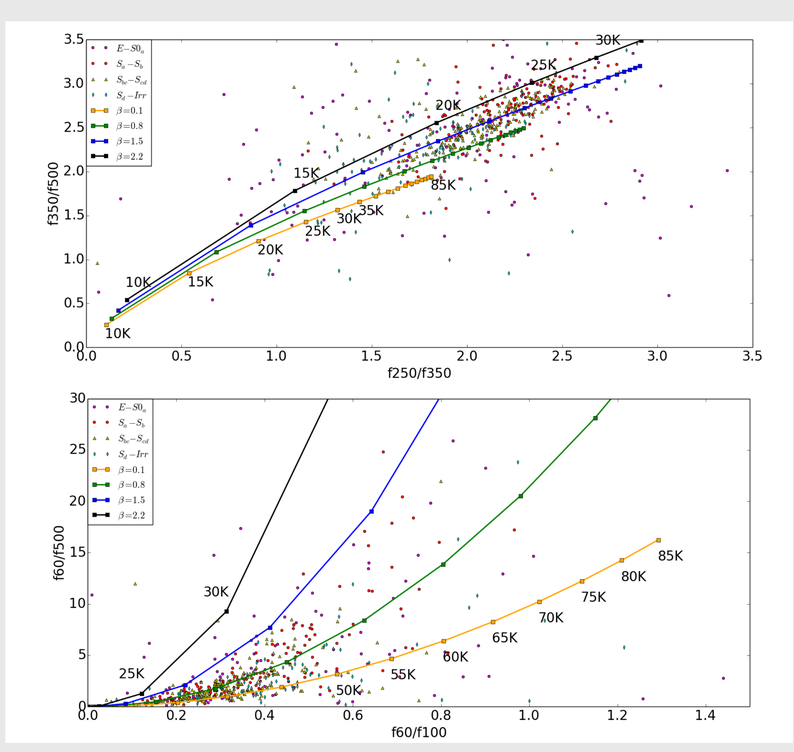
Preliminary results



We have investigated how the three most important physical parameters (the stellar mass, the dust mass and the star-formation rate) that govern galaxy evolution relate to each other for galaxies of different morphological types (left and middle panels, color-coded according to the Hubble Stage parameter). It is directly evident that late-type star-forming galaxies (blue and green points) tend to exhibit a tight correlation among all three quantities. On the other hand early-type galaxies (red points) show a large scatter. This bimodality is directly related to galaxy evolution indicating a “phase” transition from early- to late-type systems and vice versa. This bimodality is more sticking when looking at optical colors (e.g., r/NUV) with respect to the dust mass of the galaxies (right panel). In this plot we show the attenuated colors of the galaxies (bottom panel) with respect to the dust mass of the galaxies with the late-type galaxies clustering in regions of low optical colors, the early-type galaxies clustering in regions of large optical colors and a region in between (the so called “green valley”) which is mostly devoid of galaxies. This becomes more obvious when looking at the unattenuated colors (upper panel), derived by CIGALE, with a r/NUV color range between 1 and 2 mostly devoid of galaxies. We plan to further investigate this and to understand the lack of galaxies in this parameter space.



The very diverse properties of galaxies of different galactic types are more pronounced when looking at their r/NUV color distribution according to the dust mass (upper panel) and the specific star-formation rate (lower panel).



Efforts have been made to use far-infrared colors in order to predict the dust properties of galaxies of different morphological types. Combinations of far-infrared colors (60, 100 μm) and submillimiter colors (250, 350, 500 μm) can be used as proxies of the dust temperature.

Acknowledgements

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References

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