DustPedia

A Definitive Study of Cosmic Dust in the Local Universe

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National Observatory of Athens

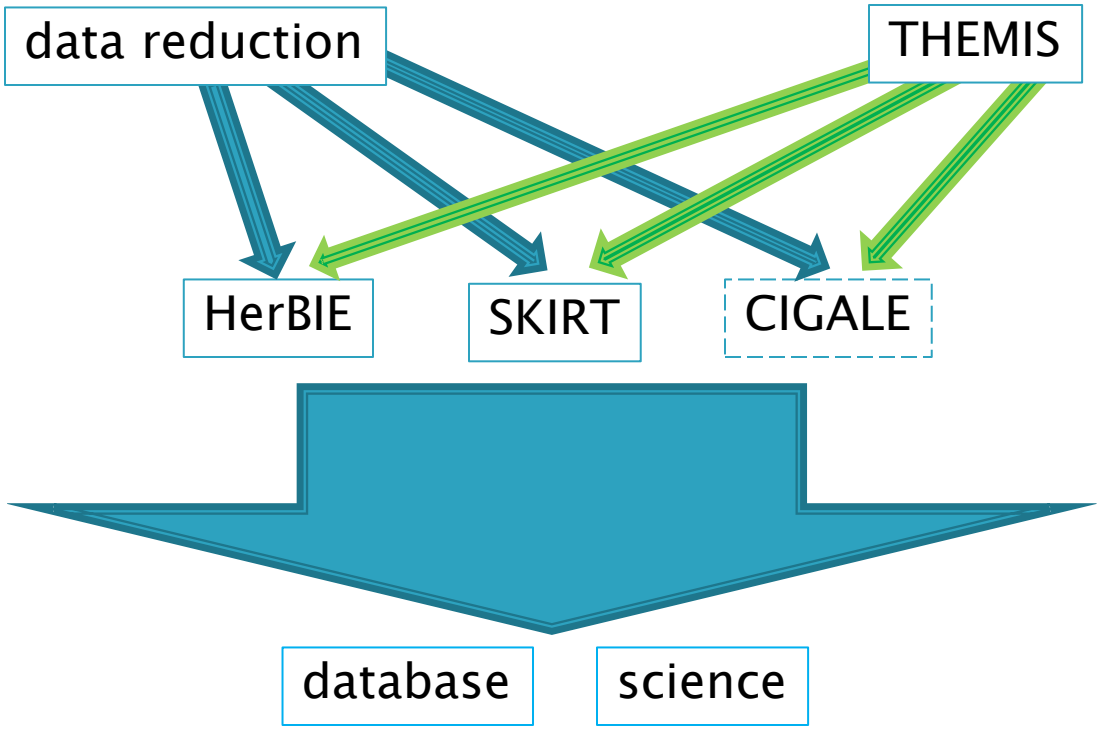
DustPedia

DustPedia is a project funded by the EU (grant agreement number 606847) under the heading 'Exploitation of space science and exploration data (FP7-SPACE-2013-1)' and is a collaboration of six European institutes: Cardiff University (UK), National Observatory of Athens (Greece), Instituto Nazionale di Astrofisica (Italy), Universiteit Gent (Belgium), Commissariat à l'énergie atomique (France), Université Paris Sud (France).

Objectives

- Create a multiwavelength imagery and photometry database of all nearby galaxies with Herschel observations.
- Analyze the data using state-of-the-art dust grain model included in Radiative Transfer and SED fitting tools.
- Derive scaling relations of fundamental parameters for galaxies of different morphological types and environment.
- Update the database with the model derived parameters.

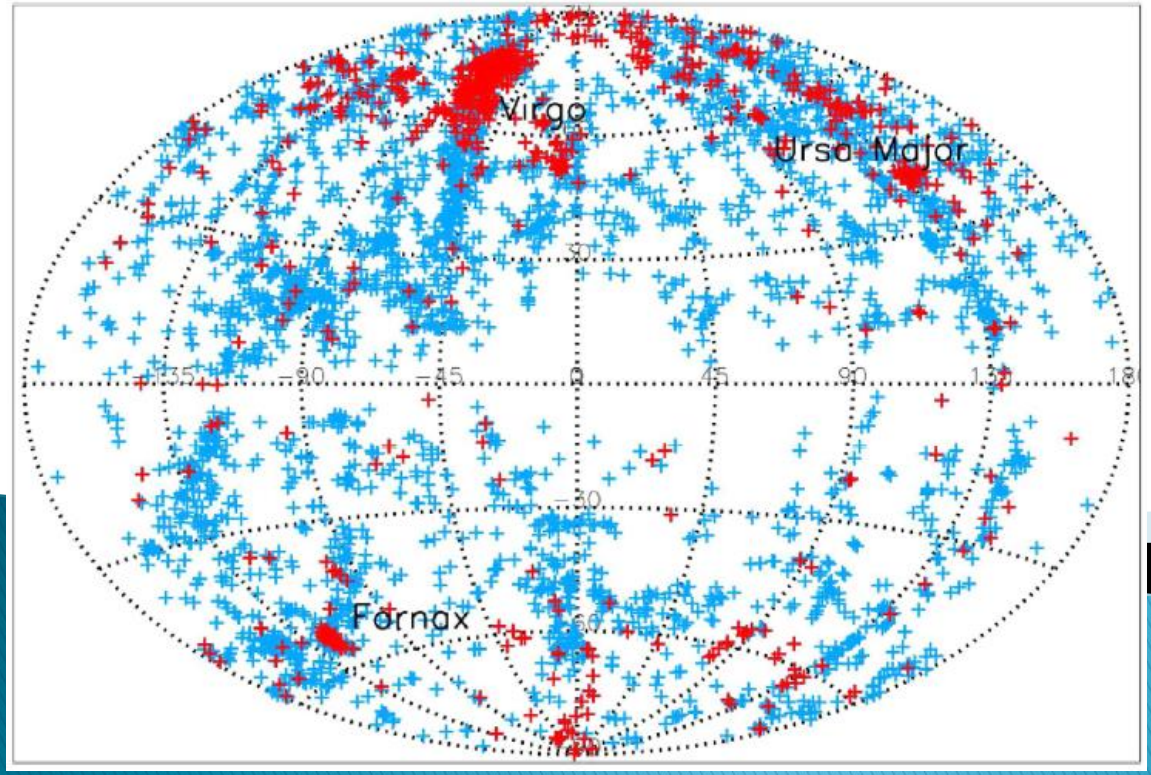
The DustPedia strategy



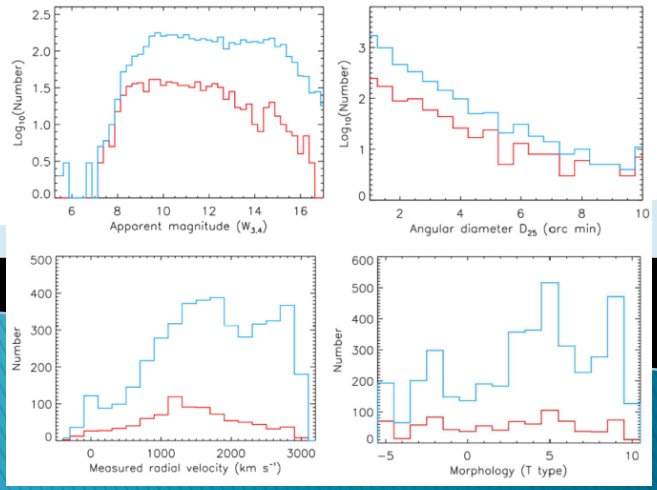
The DustPedia sample

4259 galaxies within D=40 Mpc, detected at WISE 3.4 μm and with size greater than 1 arcminute.

875 galaxies with Herschel detections.

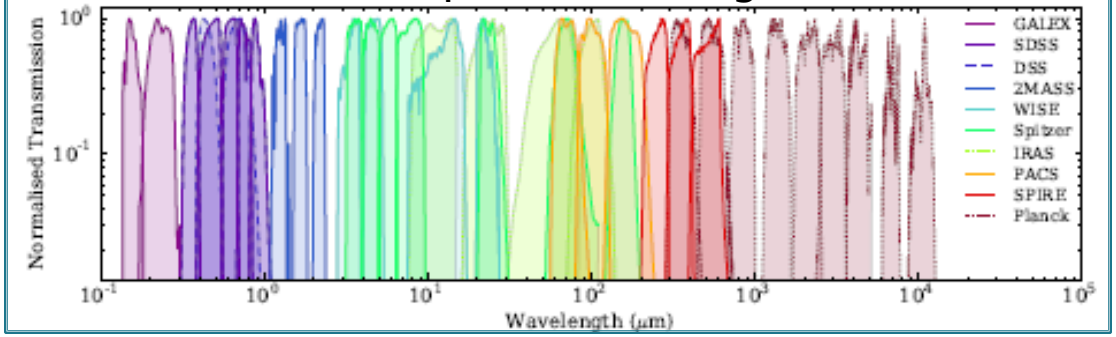


Selection Criterion	Number
LEDA	4259
LEDA+WISE$_{5\sigma}$	4231
LEDA+WISE$_{5\sigma}$+PACS	829
LEDA+WISE$_{5\sigma}$+SPIRE	907
LEDA+WISE$_{5\sigma}$+PACS+SPIRE	798
LEDA+WISE$_{5\sigma}$+PACS/SPIRE+Inspection	876

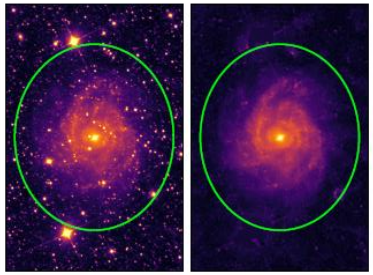


The DustPedia photometry

spectral coverage

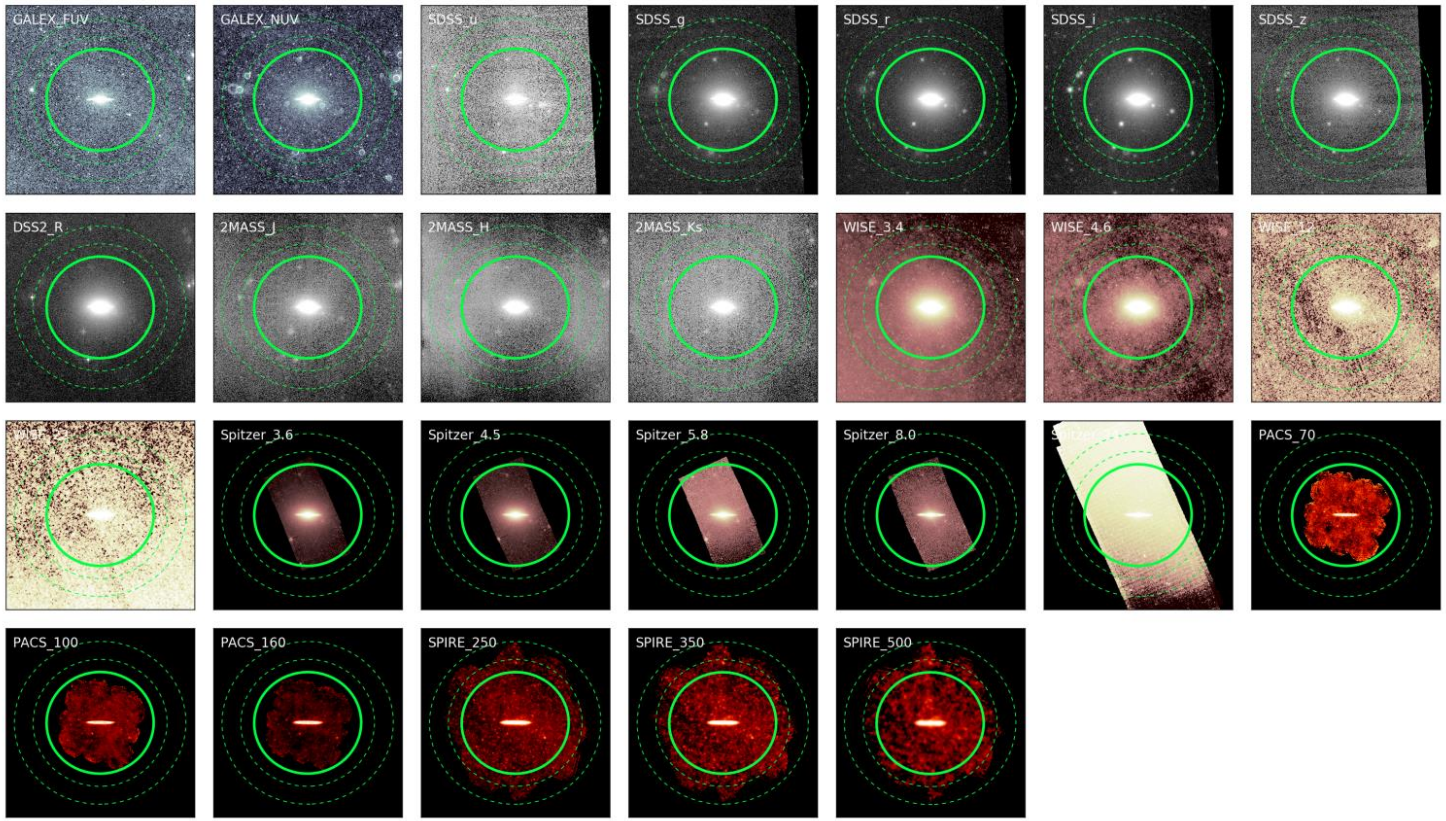


stars subtraction

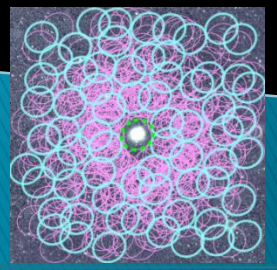


sky subtraction

NGC4594



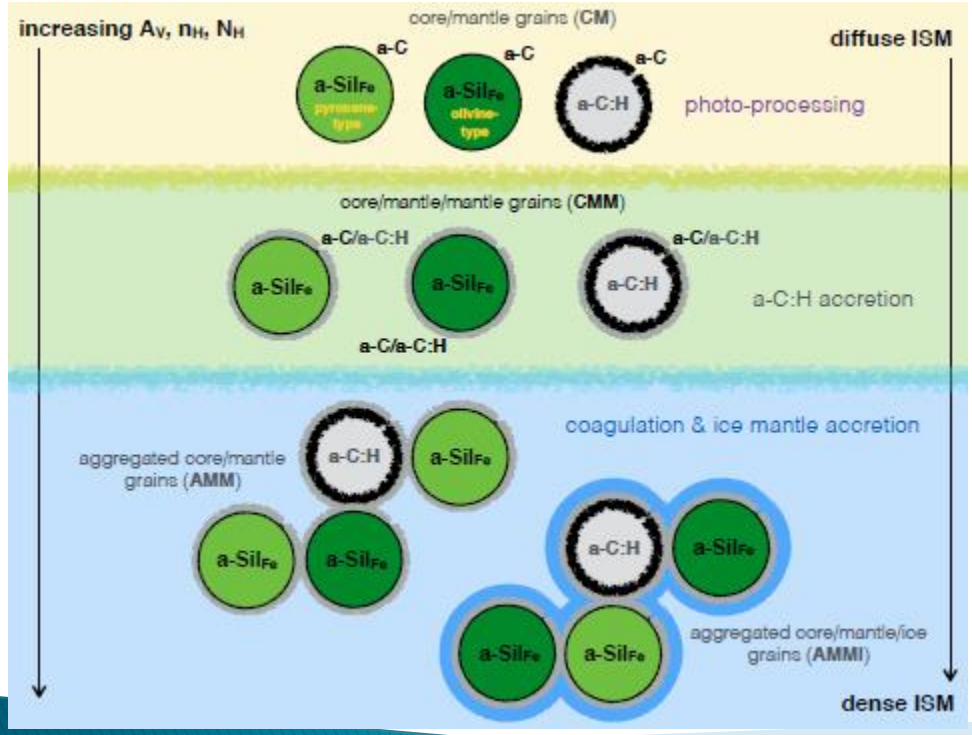
sky noise determination



THEMIS

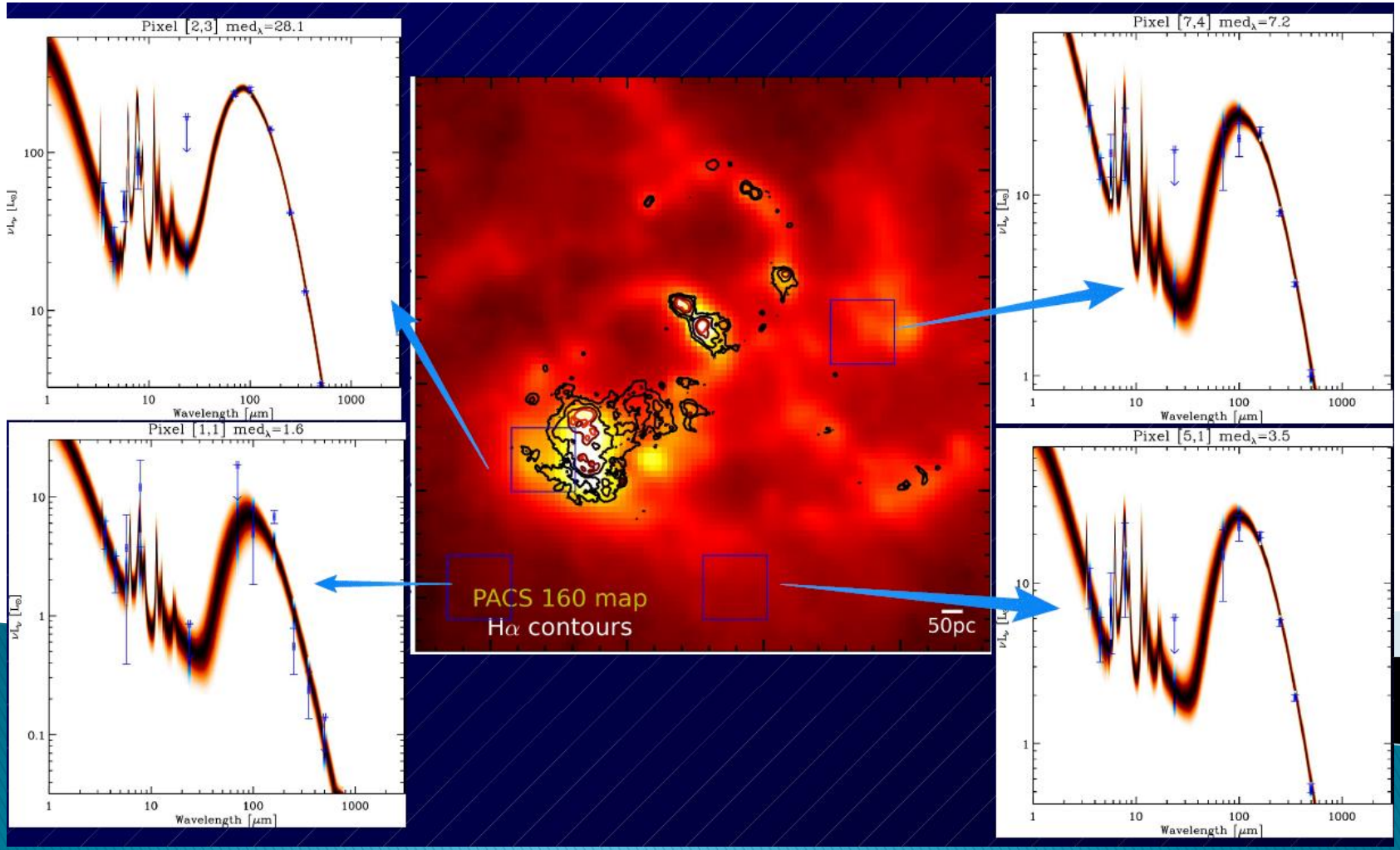
The Heterogeneous dust Evolution Model for Interstellar Solids

http://www.ias.u-psud.fr/themis/

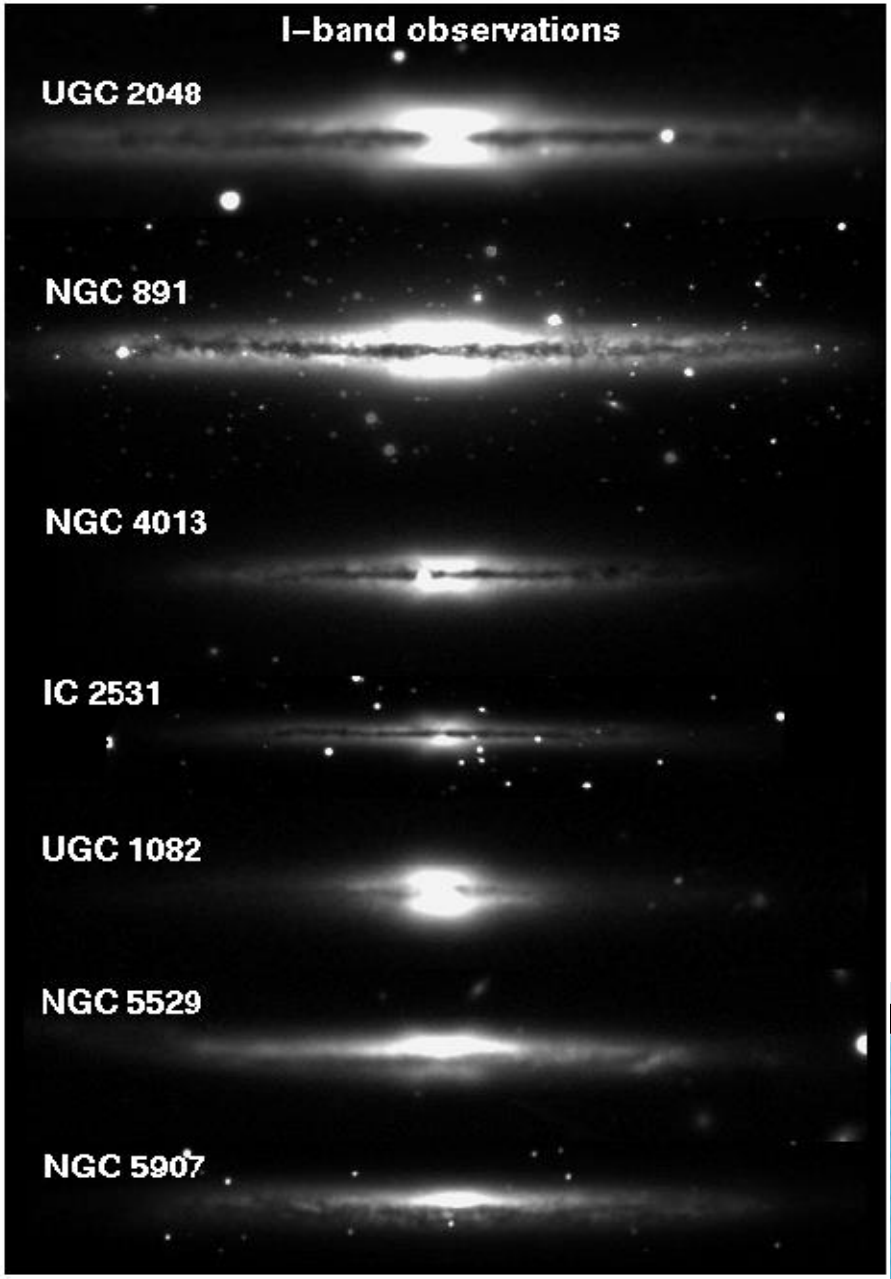


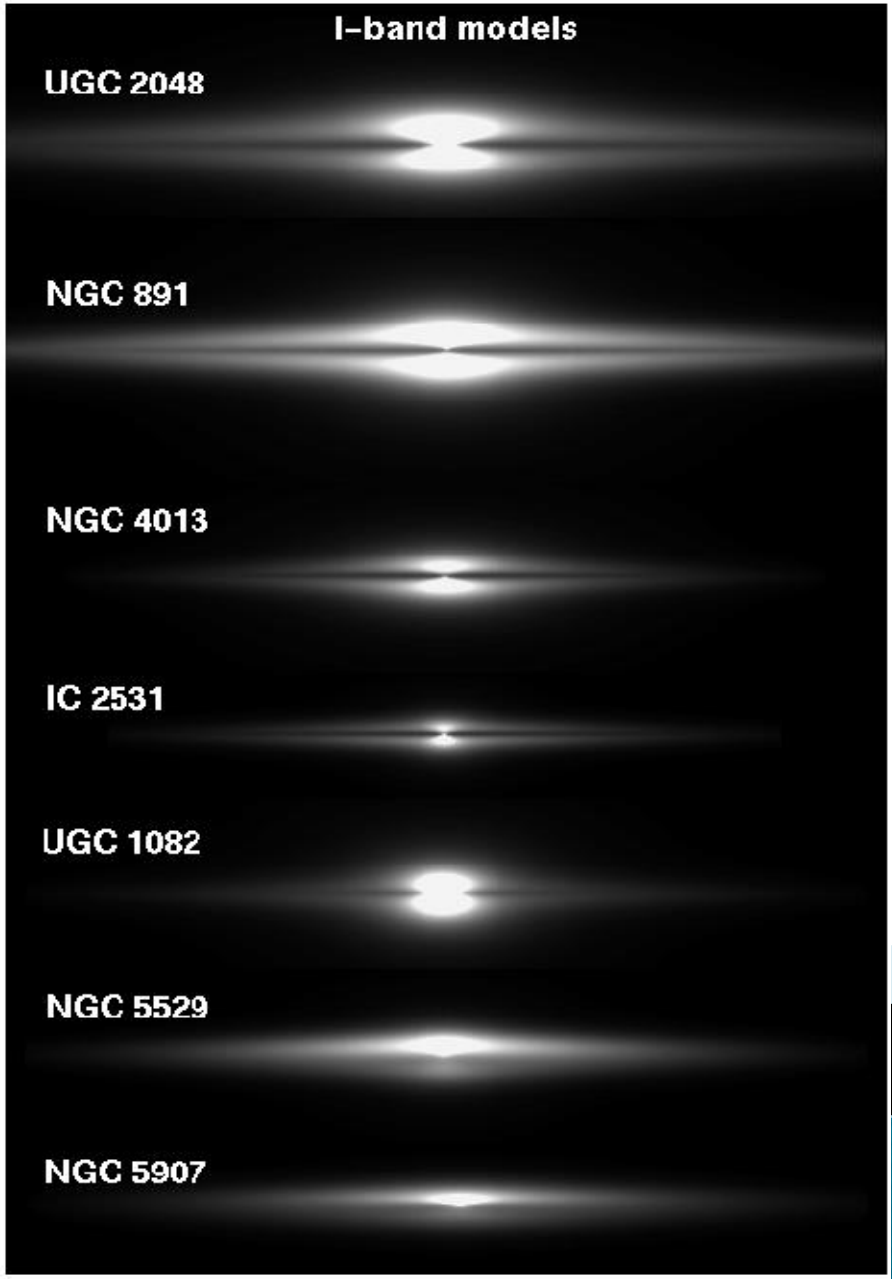
THEMIS is a self-consistent, unifying and global dust modelling framework, which is built upon the properties of amorphous hydrocarbon and amorphous silicate materials that have been measured in the laboratory (Jones et al. 2013, 2014). The main difference between THEMIS and previous grain models is in how small carbon grains are treated. Previous dust mixtures assumed neutral and charged PAHs to reproduce aromatic features, and small graphite or amorphous carbons to account for the mid-IR continuum. The THEMIS dust model accounts for this ensemble of observables with hydrogenated amorphous carbons (HACs). THEMIS has been developed to include the evolution of these materials and the dust size distribution in the transition to dense regions (Ysard et al. 2015a and b, Jones et al. 2017), and in energetic regions (Bocchio et al. 2012, 2013, 2014), to explain H2 formation in PDRs (Jones & Habart 2015) and provide a link with elemental depletions and the diffuse interstellar bands (Jones 2013, 2014). Full details of the THEMIS model are described in Jones et al. (2017).

HiERarchical Bayesian Inference for dust Emission



Radiative Transfer modeling



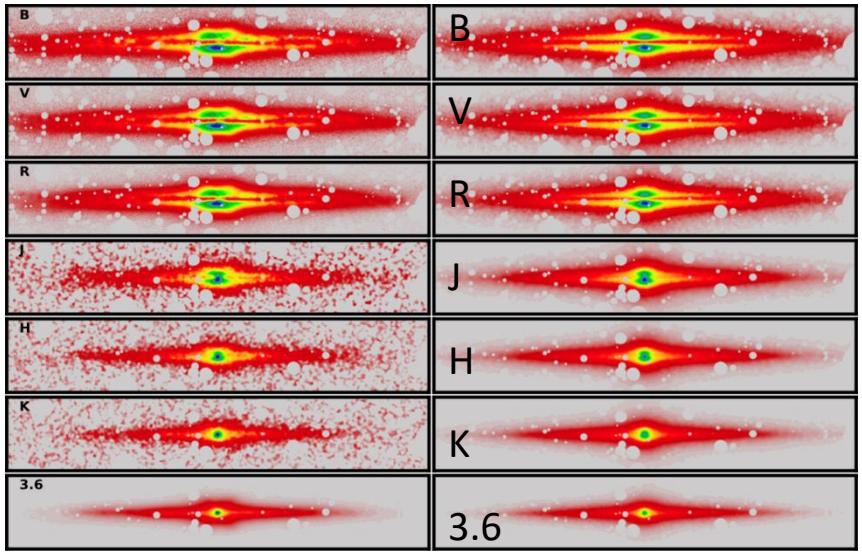


M. Xilouris, Y.I. Byun, N.D. Kylafis, E.V. Paleologou and J. Papamastorakis 1999, A&A, 344, 868

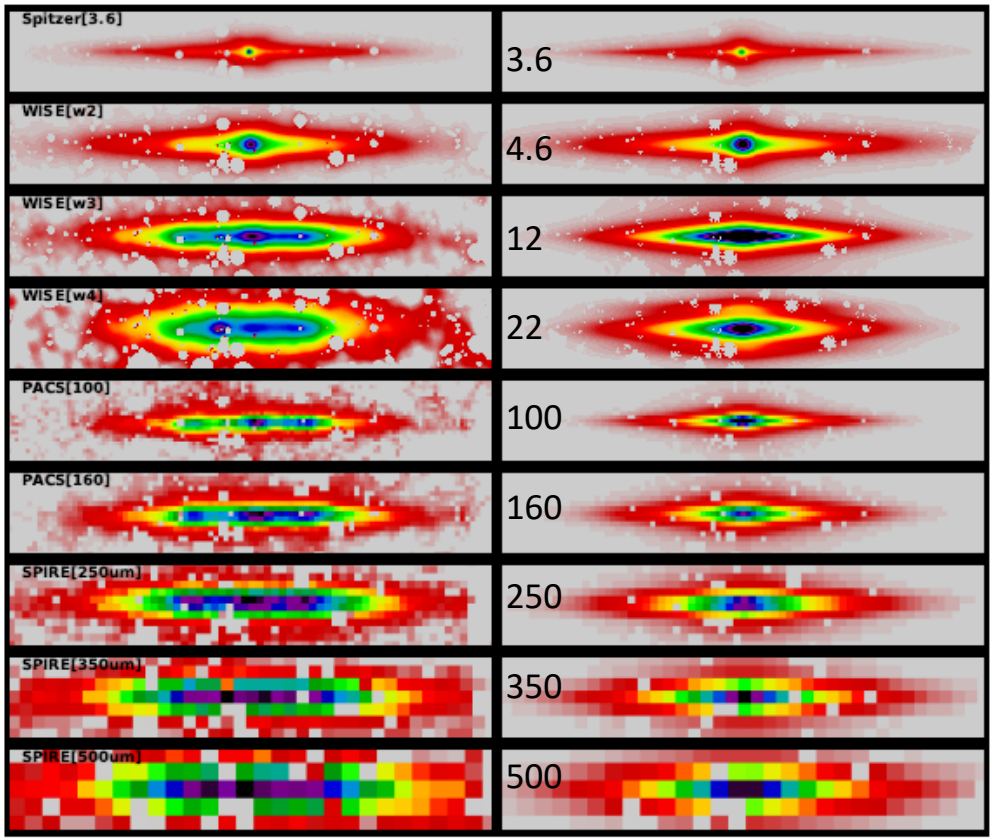
Stellar Kinematics Including Radiative Transfer

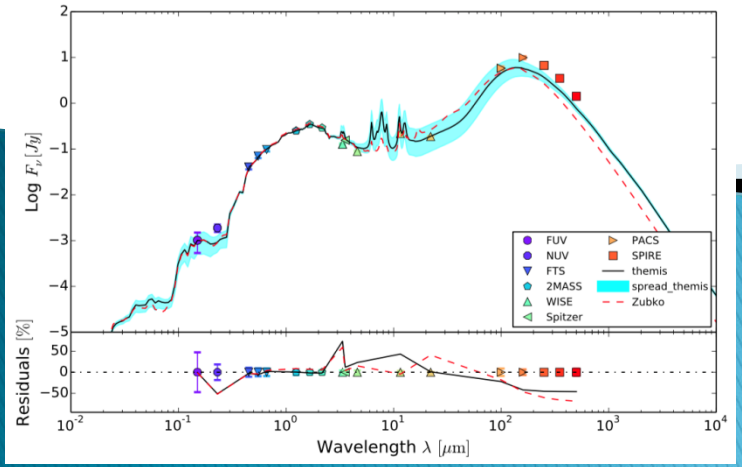
IC 2531

Observation | model



Observation | model

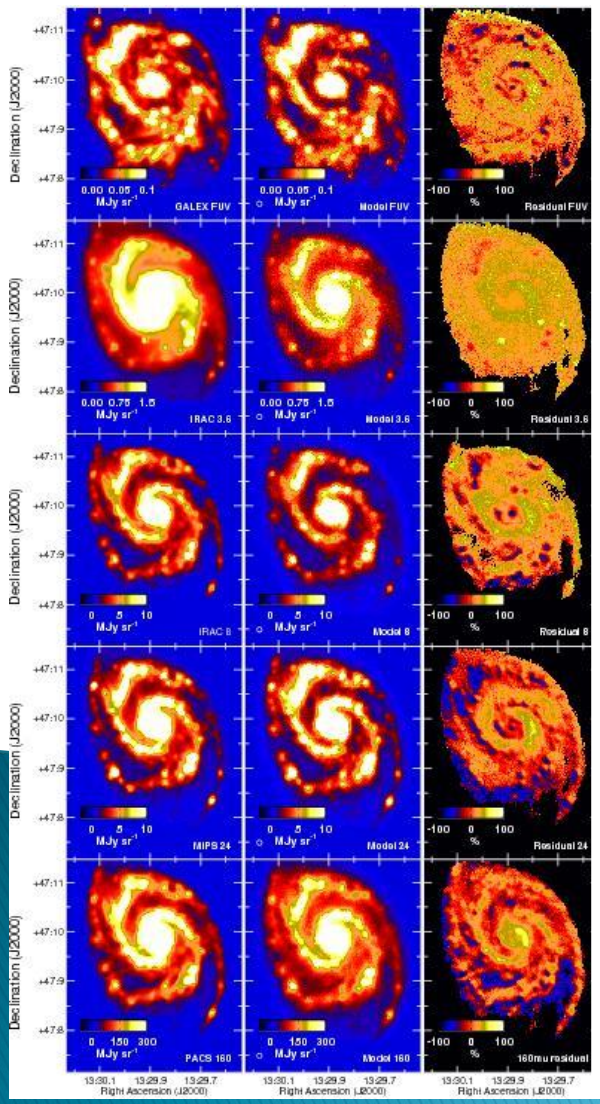


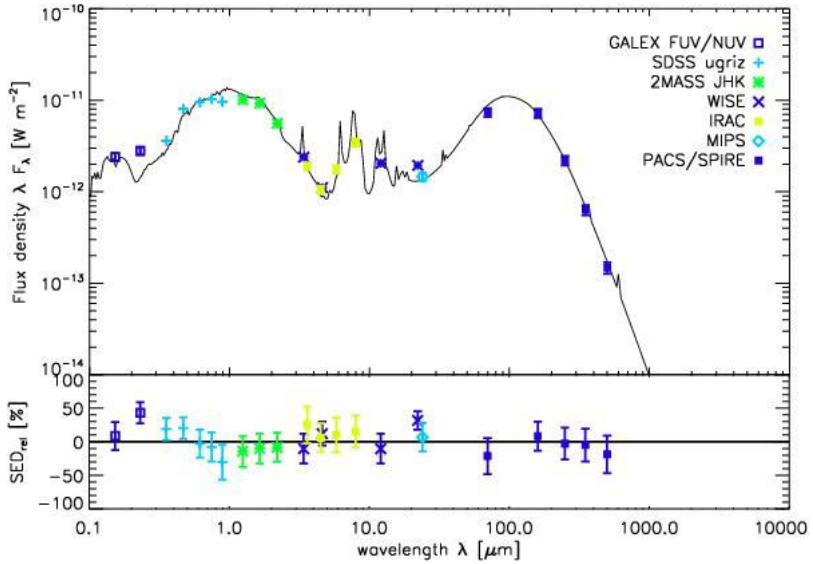


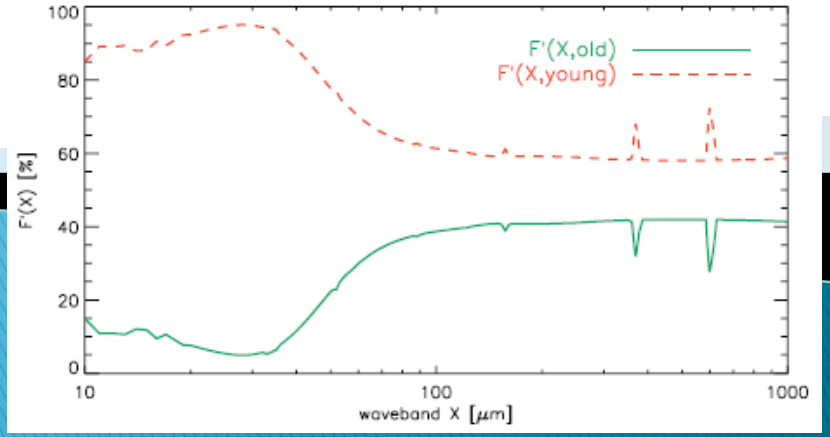
Mosenkov et al., 2016, A&A, 592, 71

Stellar Kinematics Including Radiative Transfer

www.skirt.ugent.be



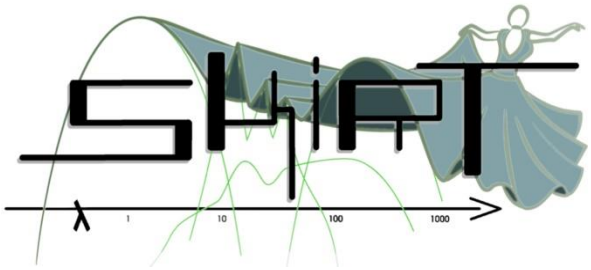




Stellar Kinematics Including Radiative Transfer
Future: prototypical galaxies

NGC 1068 (M77):
face-on spiral galaxy with a Seyfert 2 nucleus

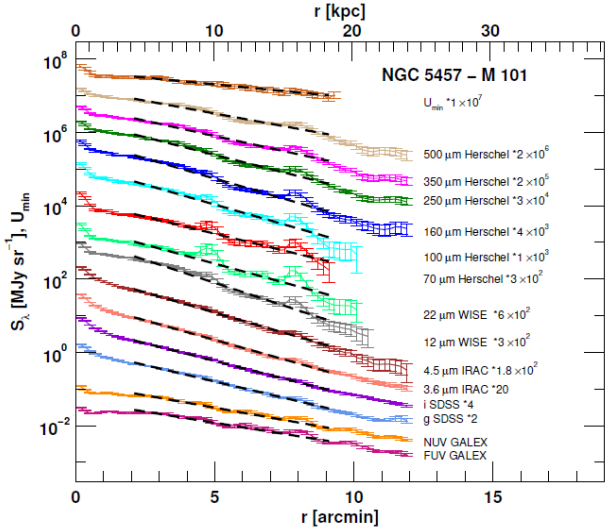
NGC 1365 and/or M83
face-on barred spiral galaxies

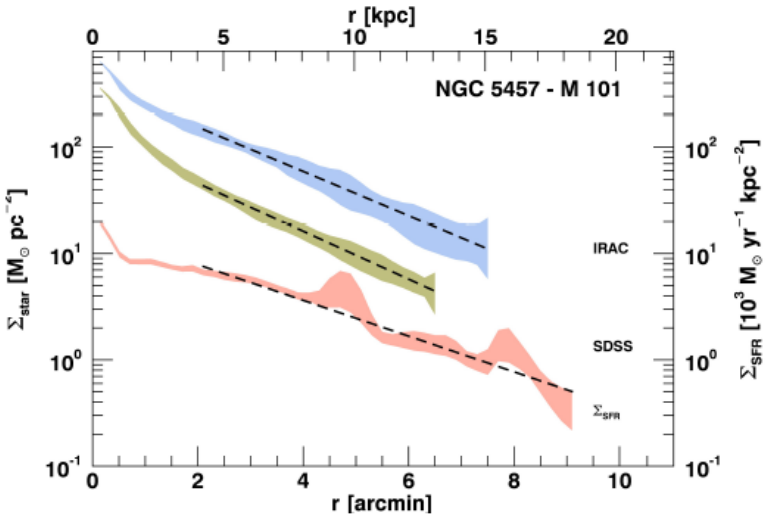


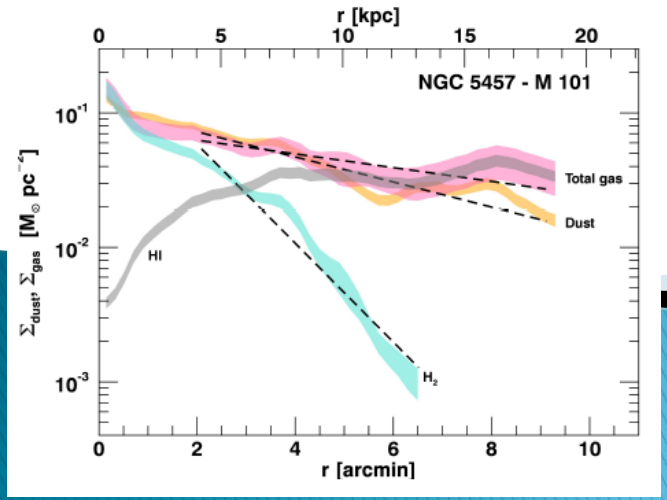
Stellar Kinematics Including Radiative Transfer
Future: statistical sample

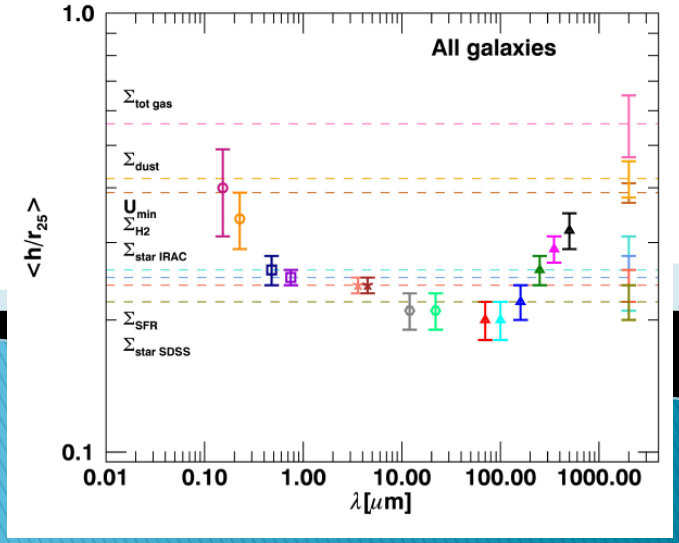
Morphology of the galaxies

"Radial distribution of dust, stars, gas, and star-formation rate in DustPedia face-on galaxies"
Casasola et al. 2017, A&A, in press

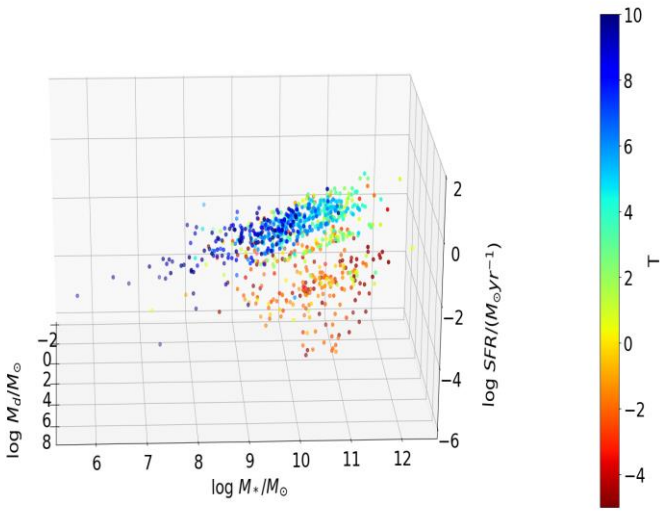


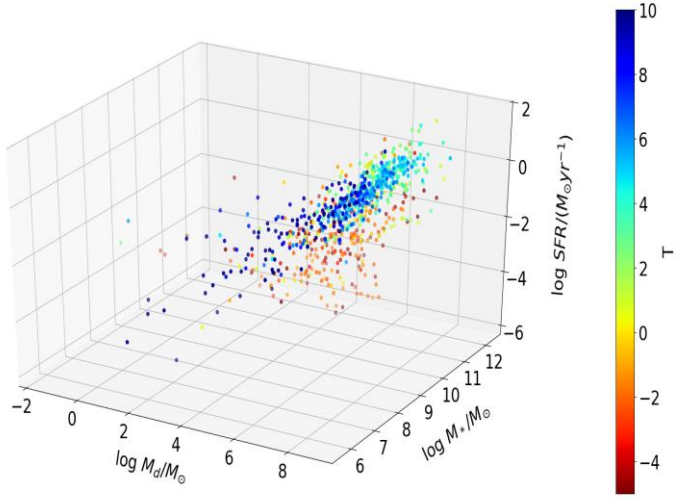




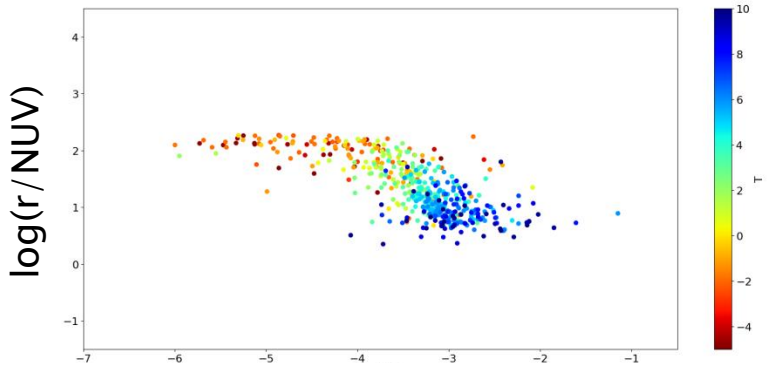


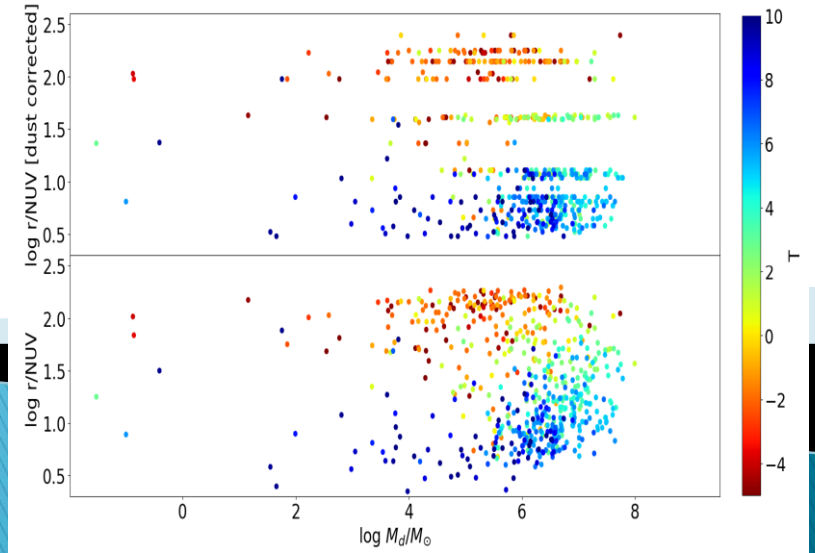
Scaling relations



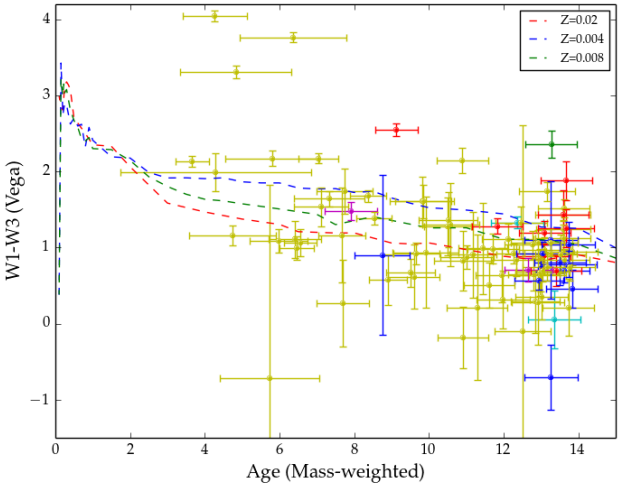


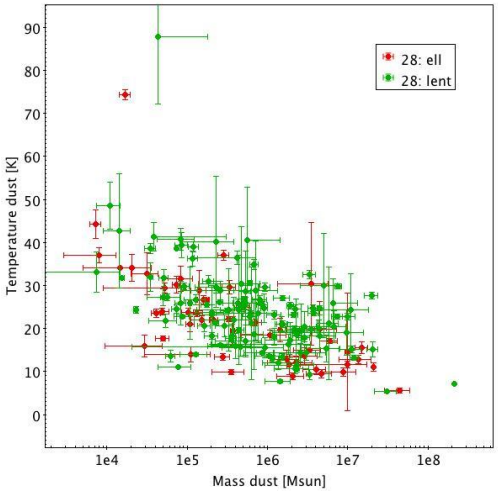
Distribution of the DustPedia galaxies in the M_{dust}, M_{stars}, SFR volume.



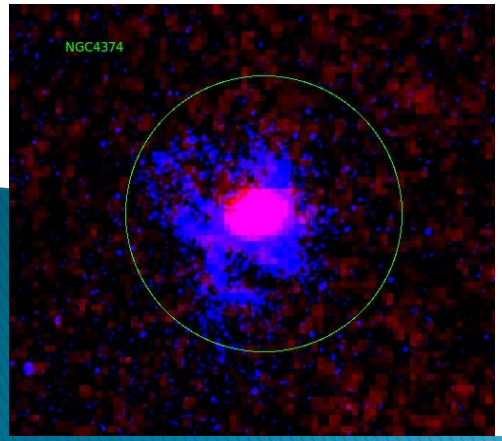


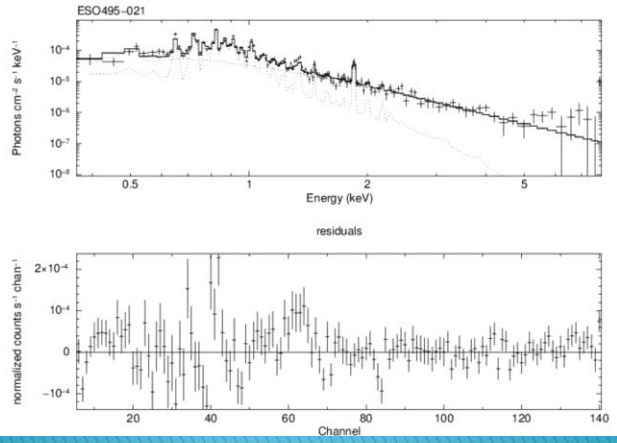
Early-type galaxies

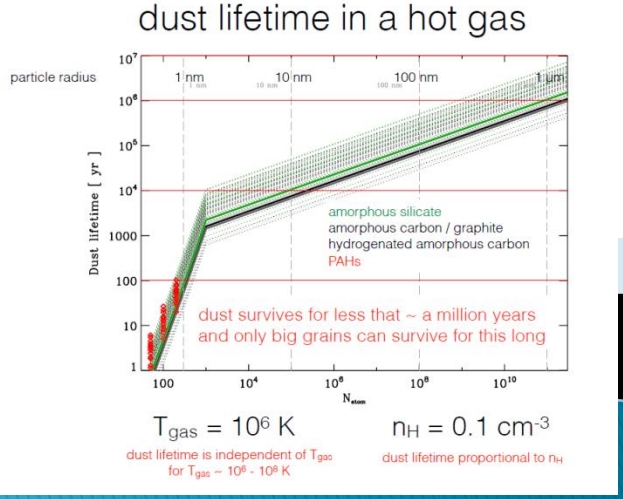




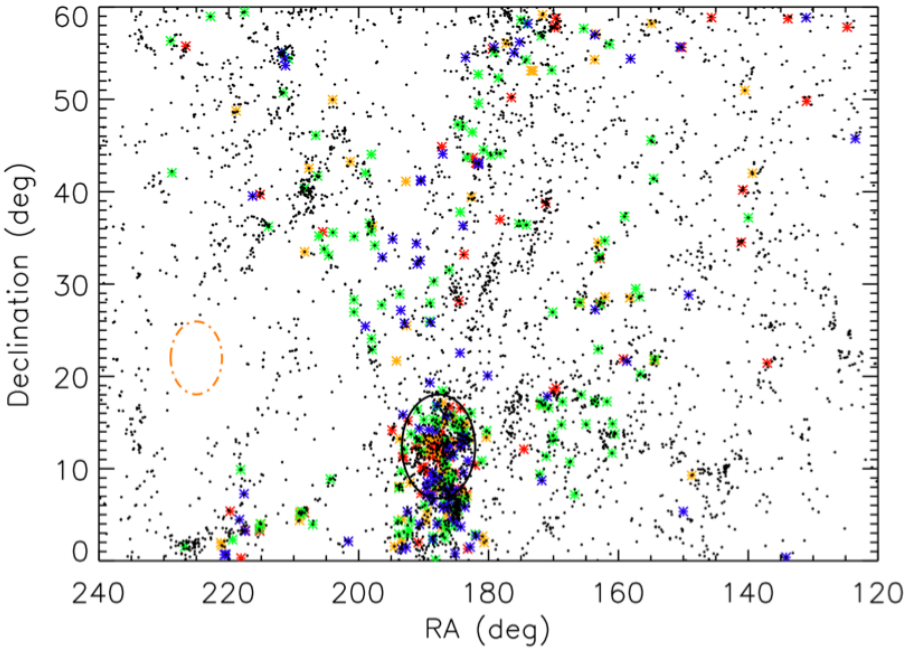
Investigate the dust lifetimes and relative contributions of photon versus electron collisional heating of dust grains and the survival of the dust grains of different sizes in these galaxies.

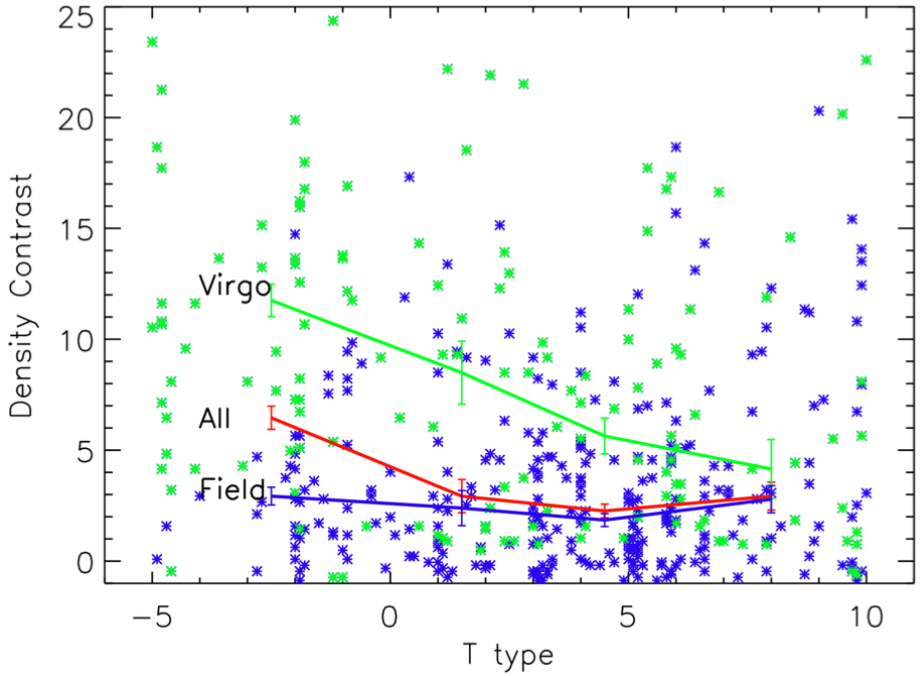






Environmental effects on DustPedia galaxies



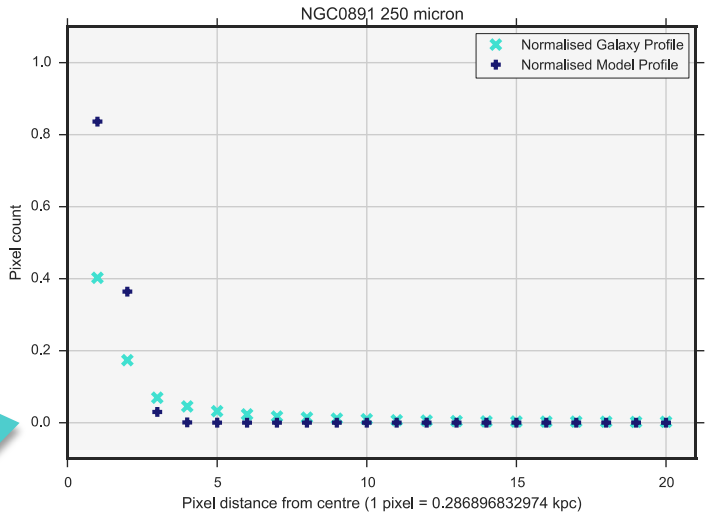


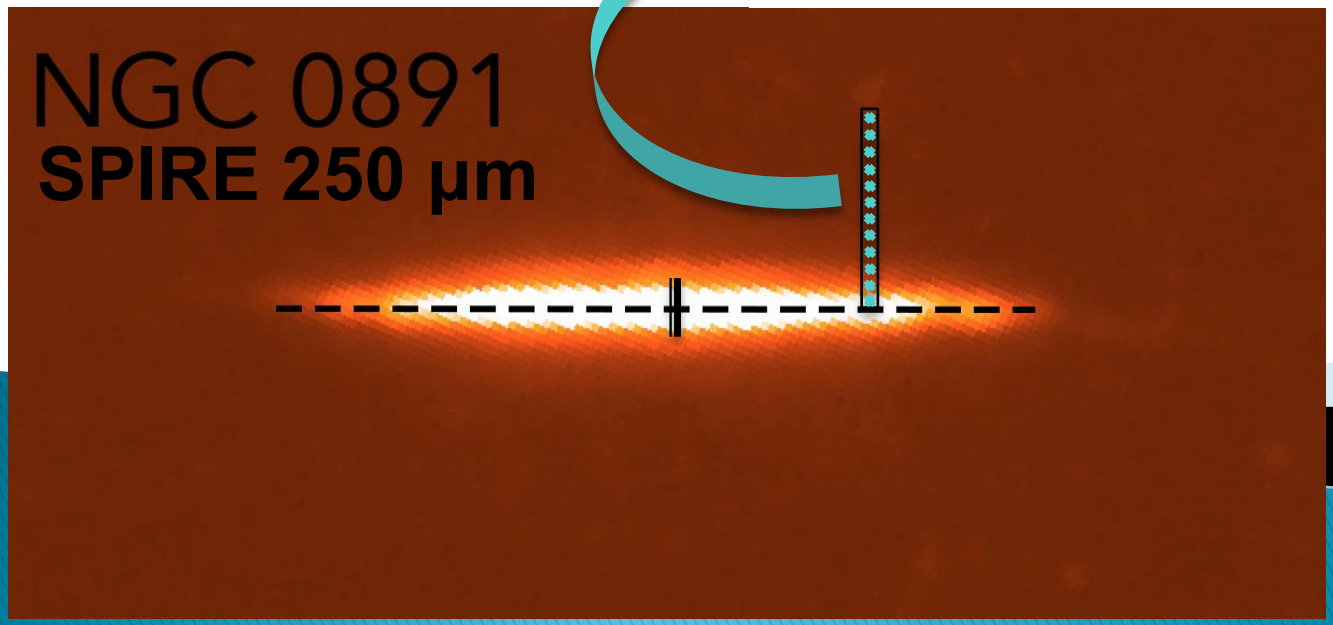
We are carrying out an investigation into how the local environment may affect the properties of DustPedia galaxies.

We have dust mass and temperature, stellar mass and star formation rates (WISE 12μ) and a density contrast parameter (using SDSS galaxies).

Cosmological implications

The Distribution of Dust Above the Mid-Plane of Edge-On Galaxies

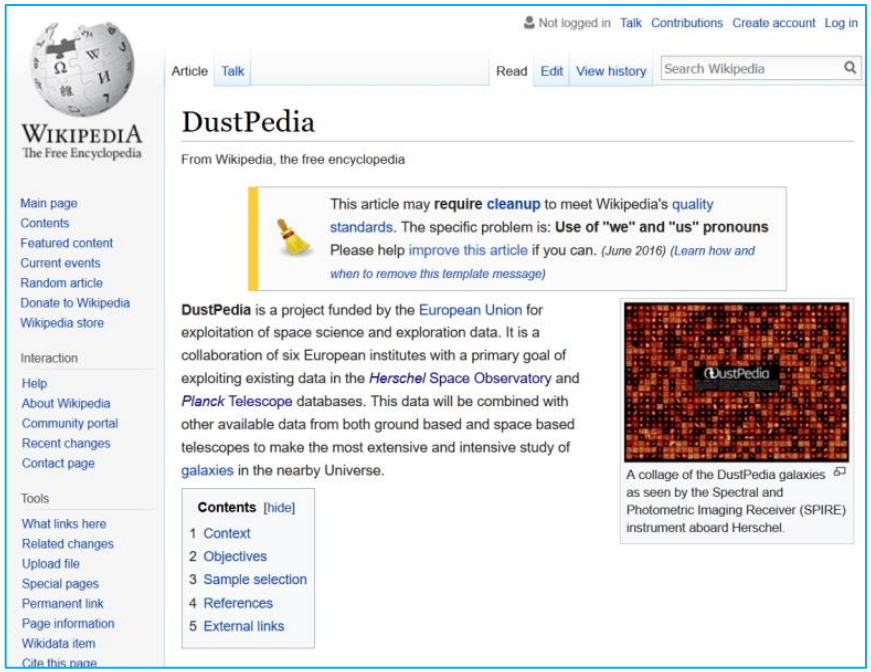




DustPedia on the web

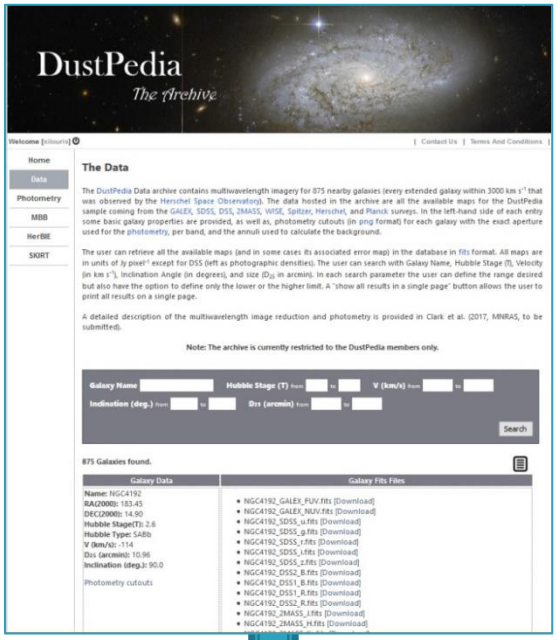
dustpedia.com

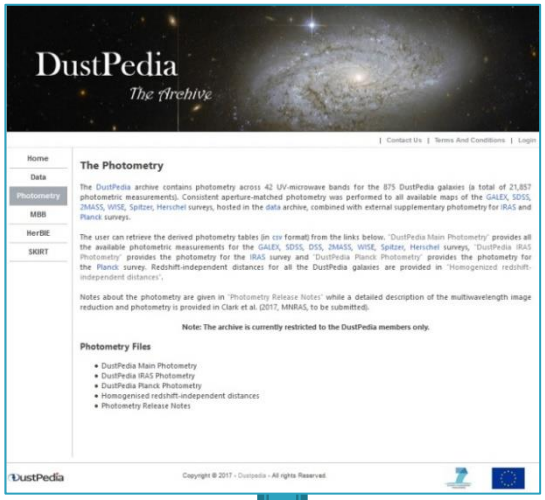
DustPedia on WikiPedia

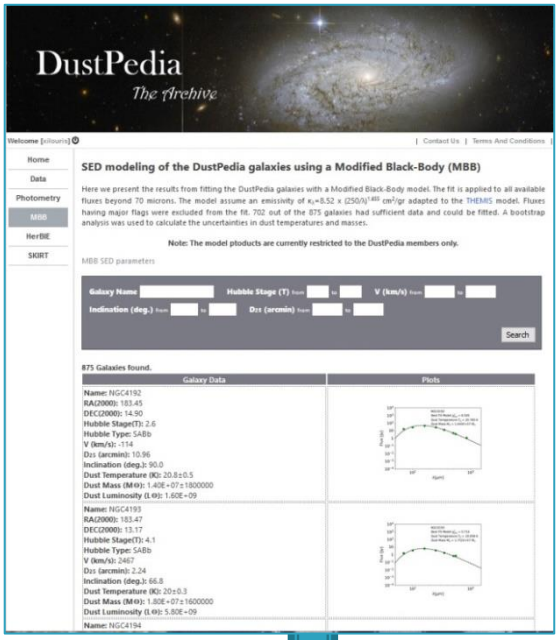


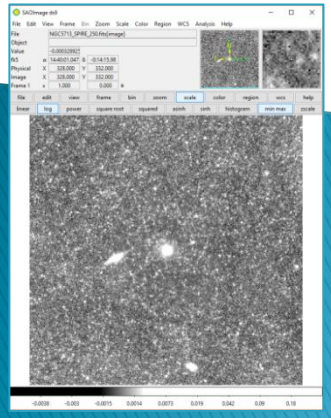
The DustPedia database

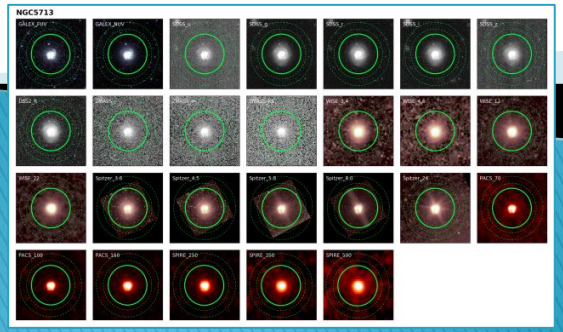
dustpedia.astro.noa.gr

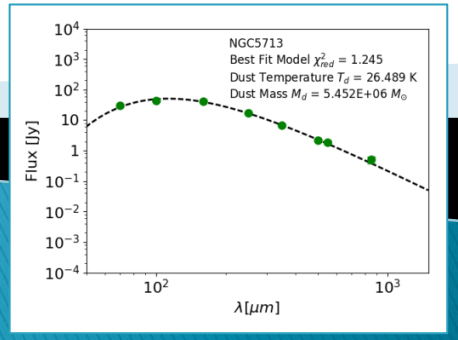


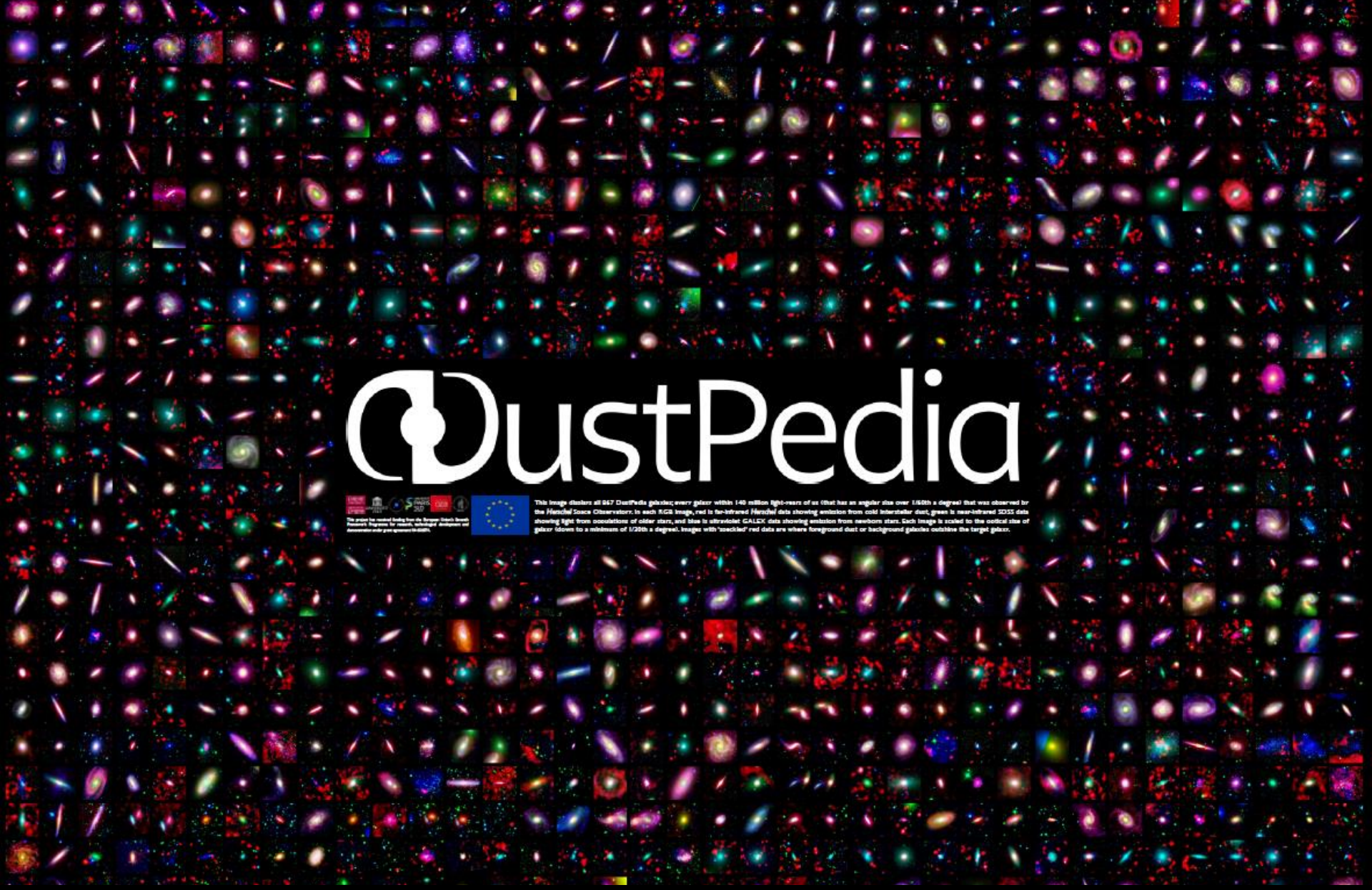












Davies J., Baes M., Bianchi S., Jones A., Madden S., Xilouris M., Bocchio M., Casasola V., Cassara L., Clark C., De Looze I., Evans R., Fritz J., Galliano F., Lianou S., Mosenkov A.V., Smith M., Verstocken S., Viaene S., Vika M., Wagle G., Ysard N., "DustPedia – A Definite Study of Cosmic Dust in the Local Universe", 2017, PASP, 129, 4102