

DustPedia

A Definitive Study of Cosmic Dust in the Local Universe

Manolis Xilouris

National Observatory of Athens

DustPedia

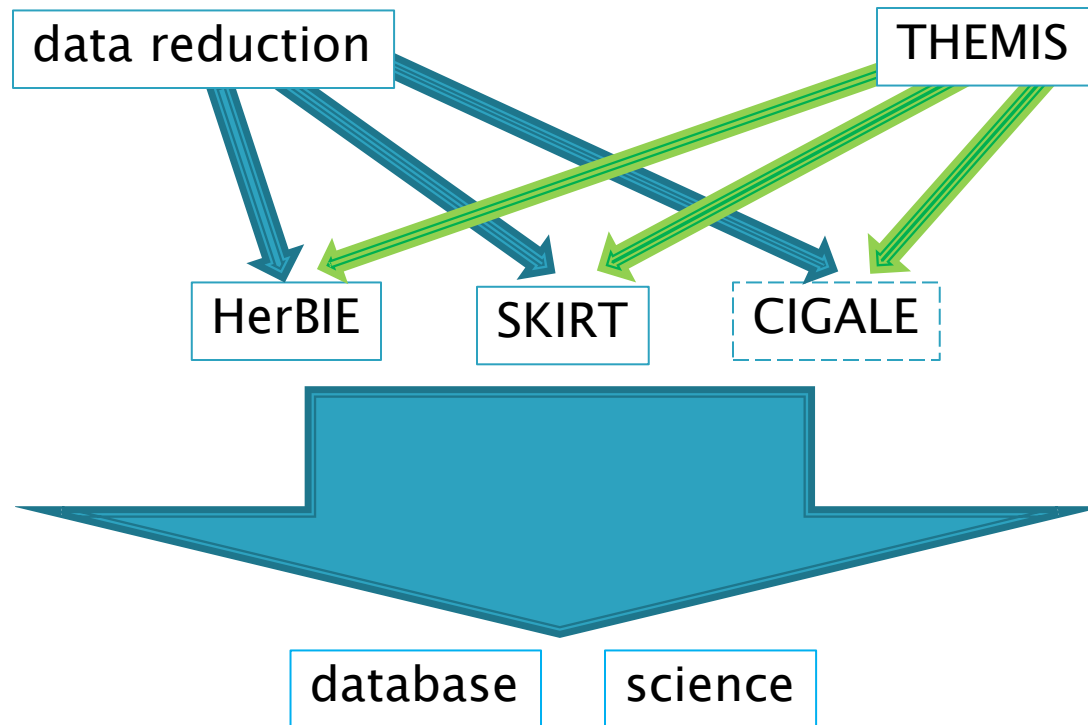
DustPedia is a project funded by the EU (grant agreement number 606847) under the heading 'Exploitation of space science and exploration data (FP7-SPACE-2013-1)' and is a collaboration of six European institutes: Cardiff University (UK), National Observatory of Athens (Greece), Istituto Nazionale di 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.



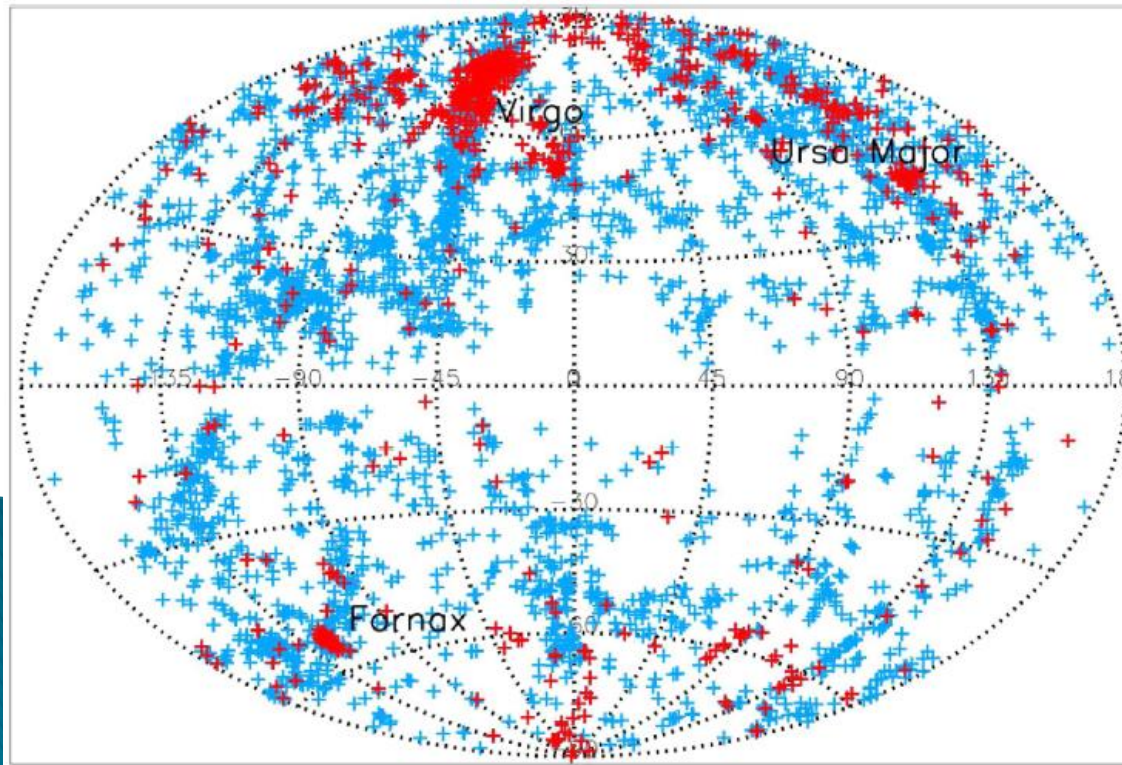
The DustPedia strategy



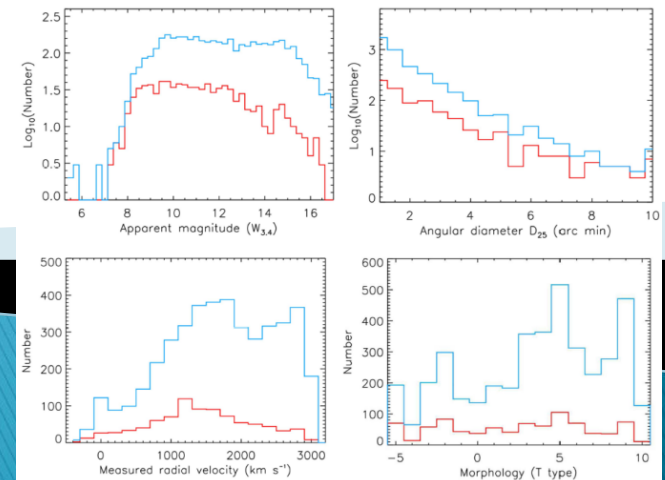
The DustPedia sample

4259 galaxies within $D=40$ Mpc, detected at WISE $3.4 \mu\text{m}$ and with size greater than 1 arcminute.

875 galaxies with Herschel detections.

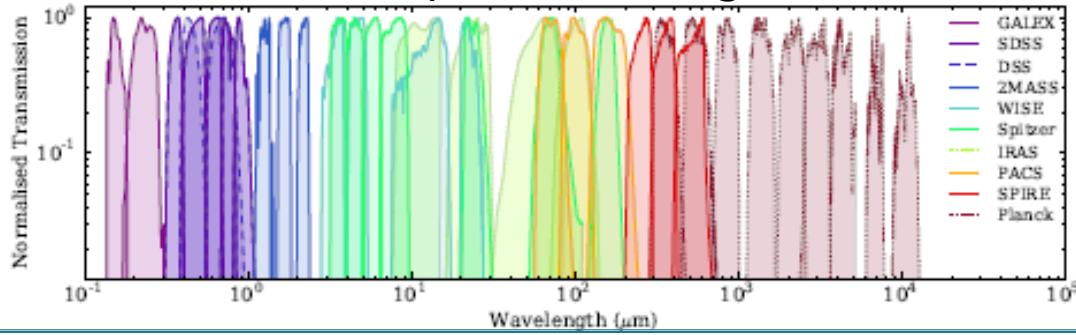


Selection Criterion	Number
LEDA	4259
LEDA+WISE _{5σ}	4231
LEDA+WISE _{5σ} +PACS	829
LEDA+WISE _{5σ} +SPIRE	907
LEDA+WISE _{5σ} +PACS+SPIRE	798
LEDA+WISE _{5σ} +PACS/SPIRE+Inspection	876

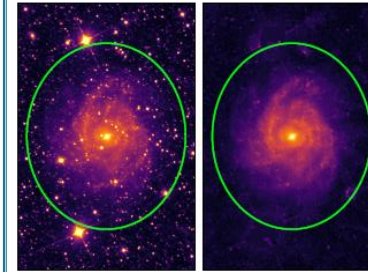


The DustPedia photometry

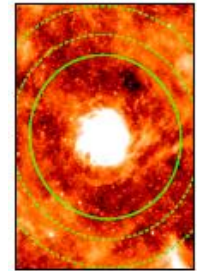
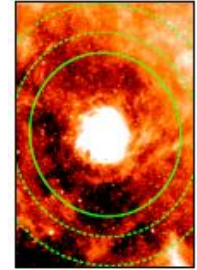
spectral coverage



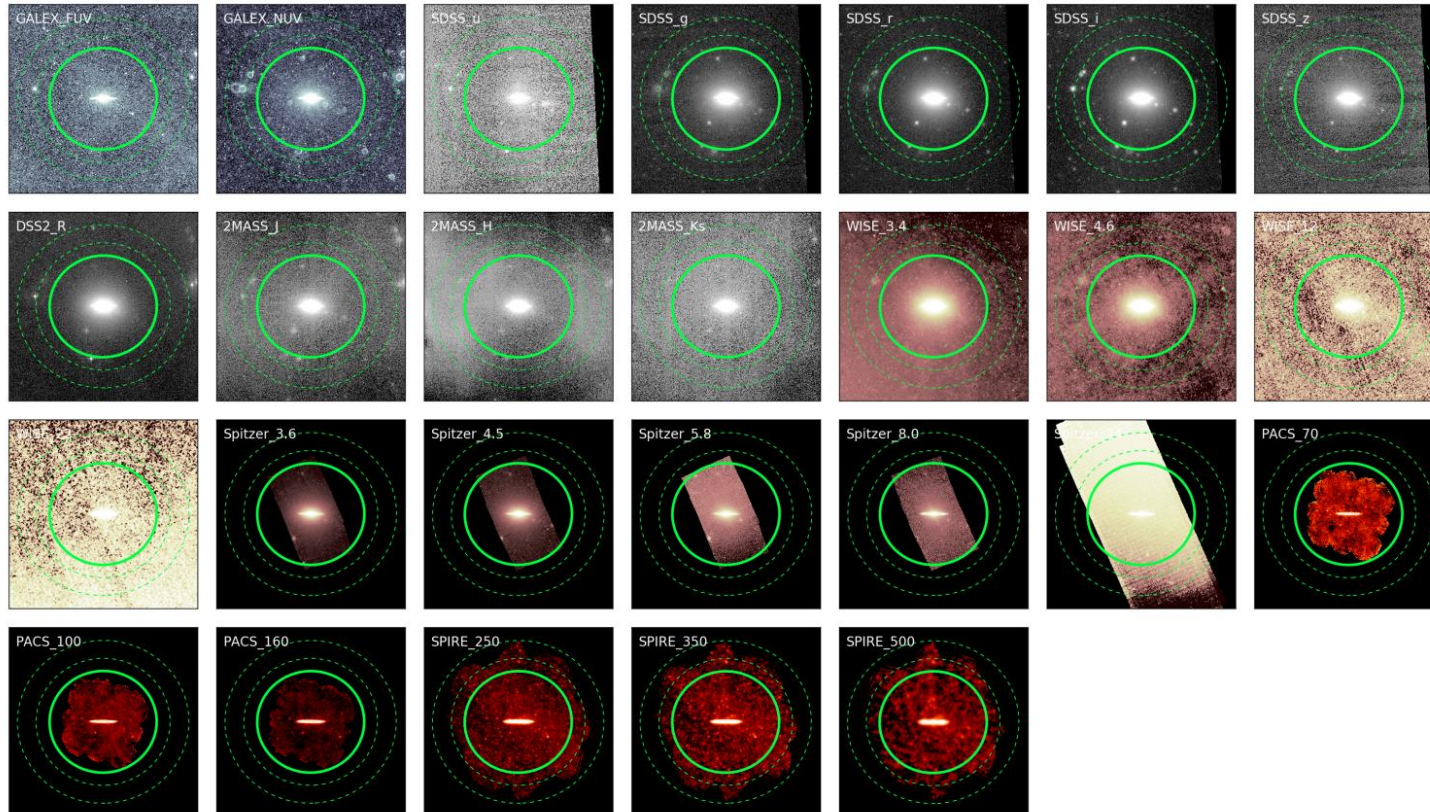
stars subtraction



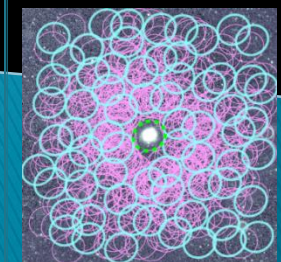
sky subtraction

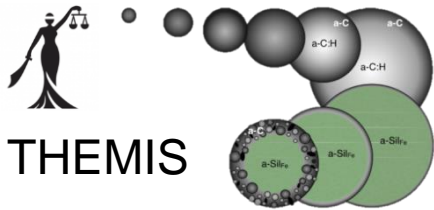


NGC4594



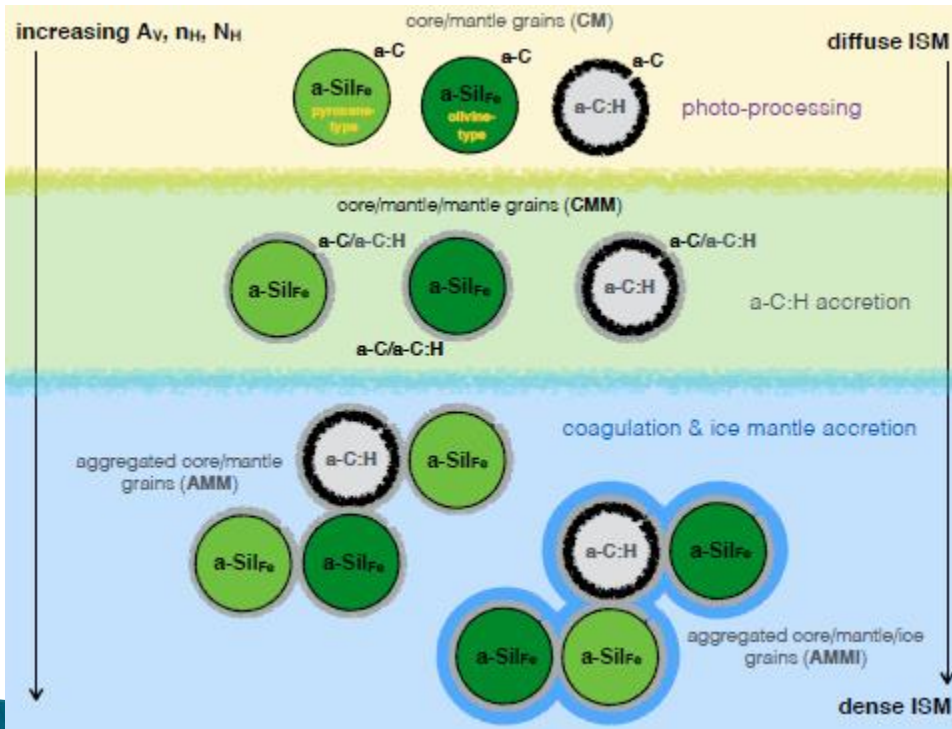
sky noise determination





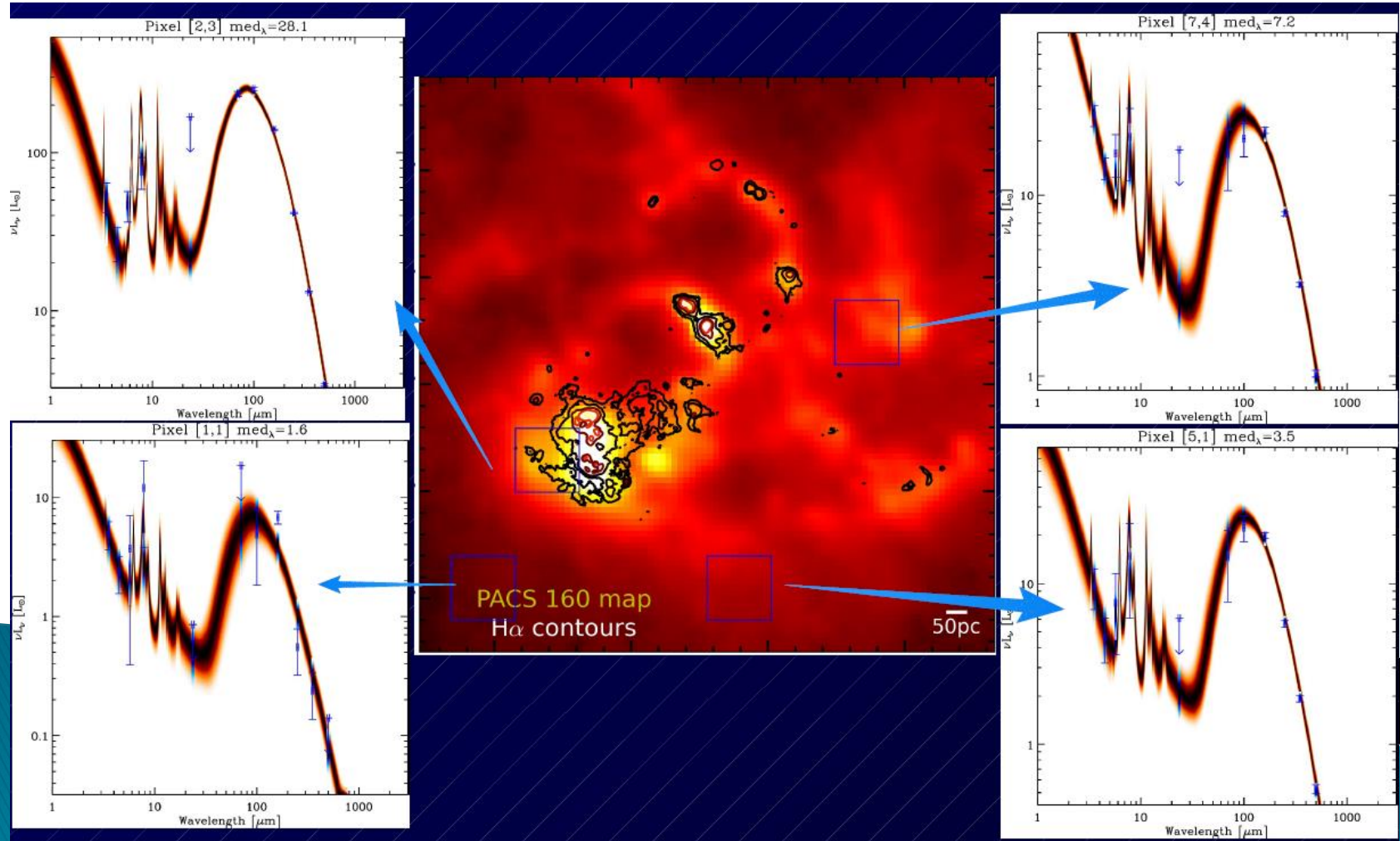
The Heterogeneous dust Evolution Model for Interstellar Solids

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

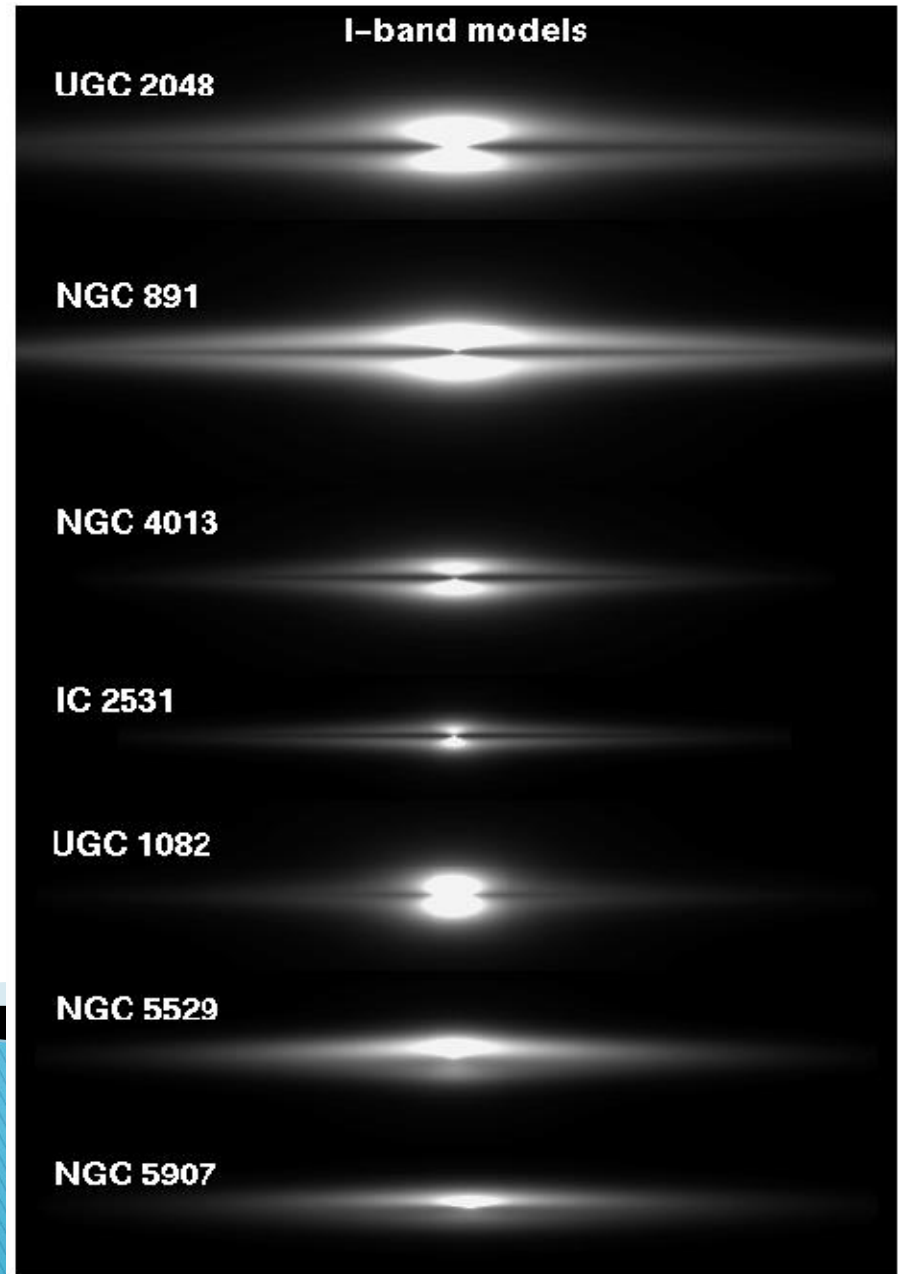
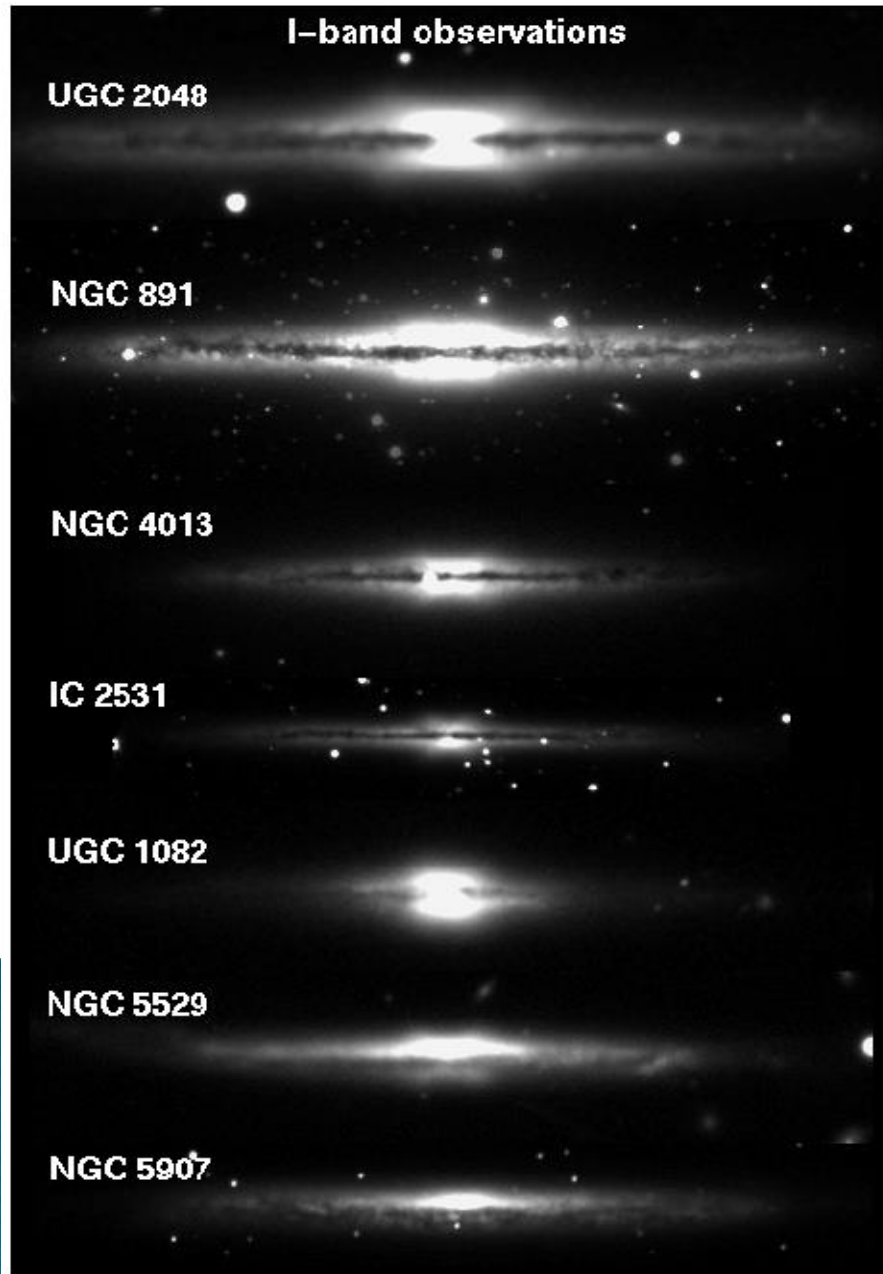


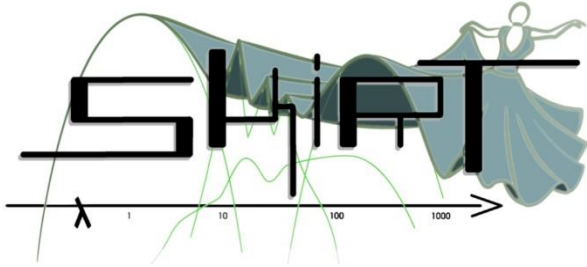
THEMIS is a self-consistent, unifying and global dust modelling framework, which is built upon the properties of amorphous hydrocarbon and amorphous silicate materials that have been measured in the laboratory (Jones et al. 2013, 2014). The main difference between THEMIS and previous grain models is 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





Stellar Kinematics Including Radiative Transfer

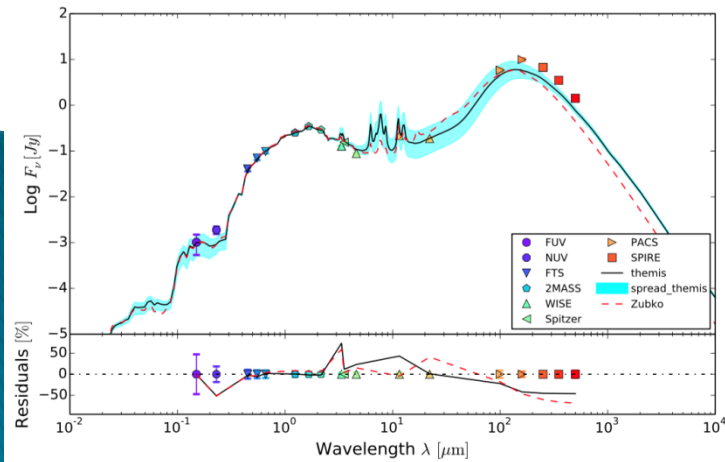
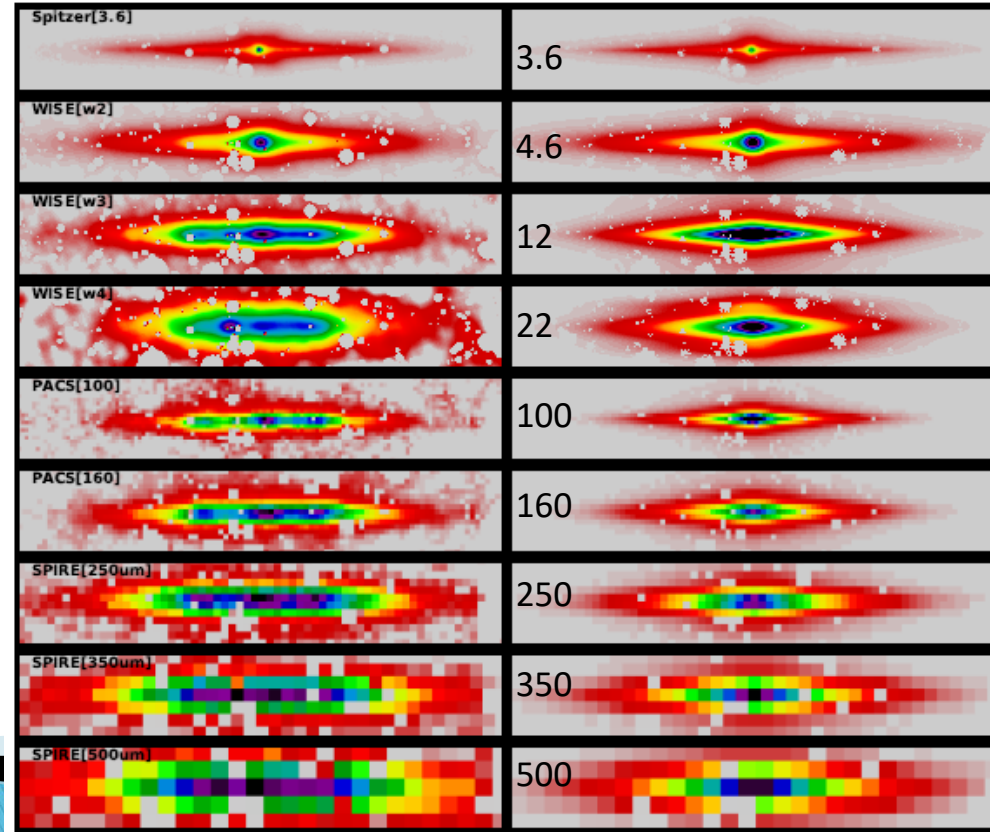
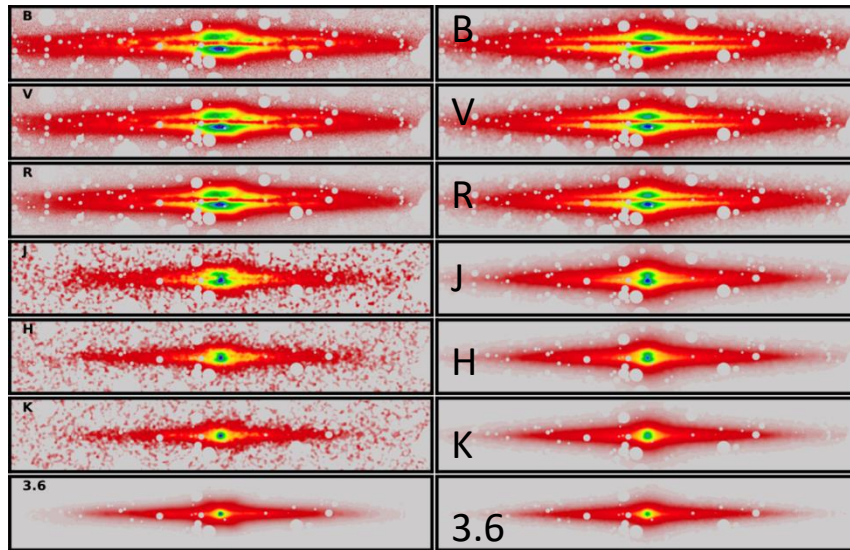
Observation

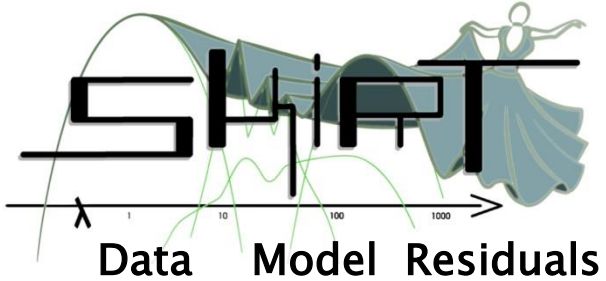
model

IC 2531

Observation

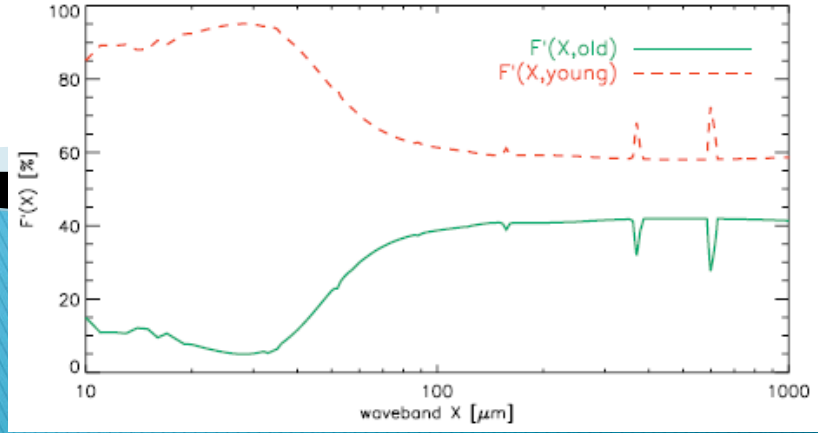
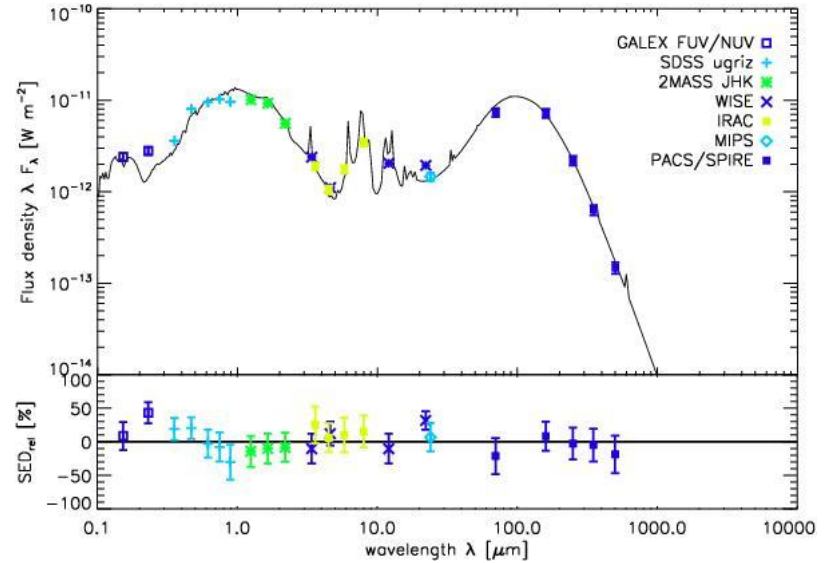
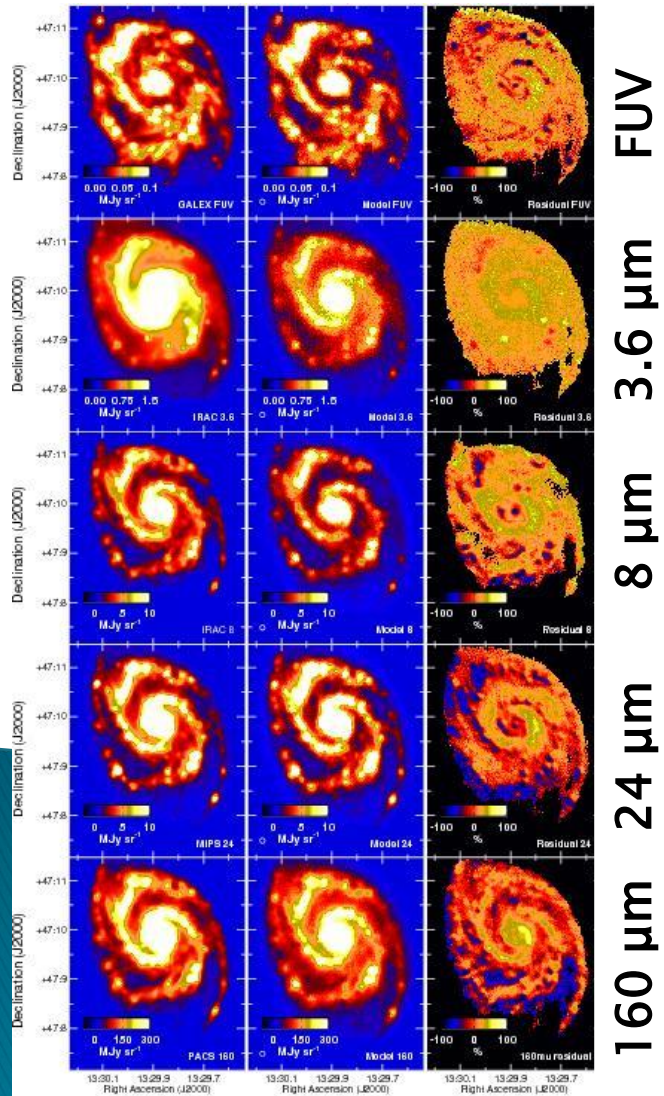
model

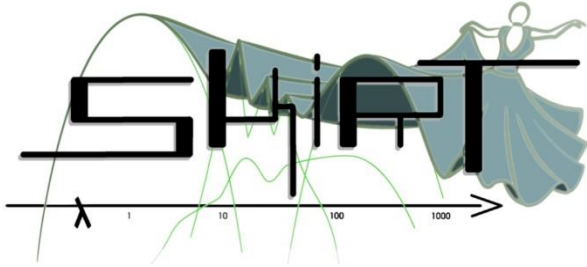




Stellar Kinematics Including Radiative Transfer

www.skirt.ugent.be





Stellar Kinematics Including Radiative Transfer Future: prototypical galaxies

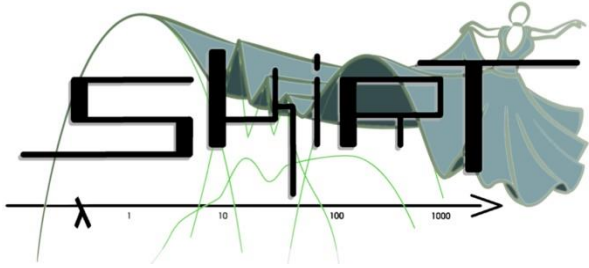


NGC 1068 (M77):
face-on spiral galaxy with a
Seyfert 2 nucleus

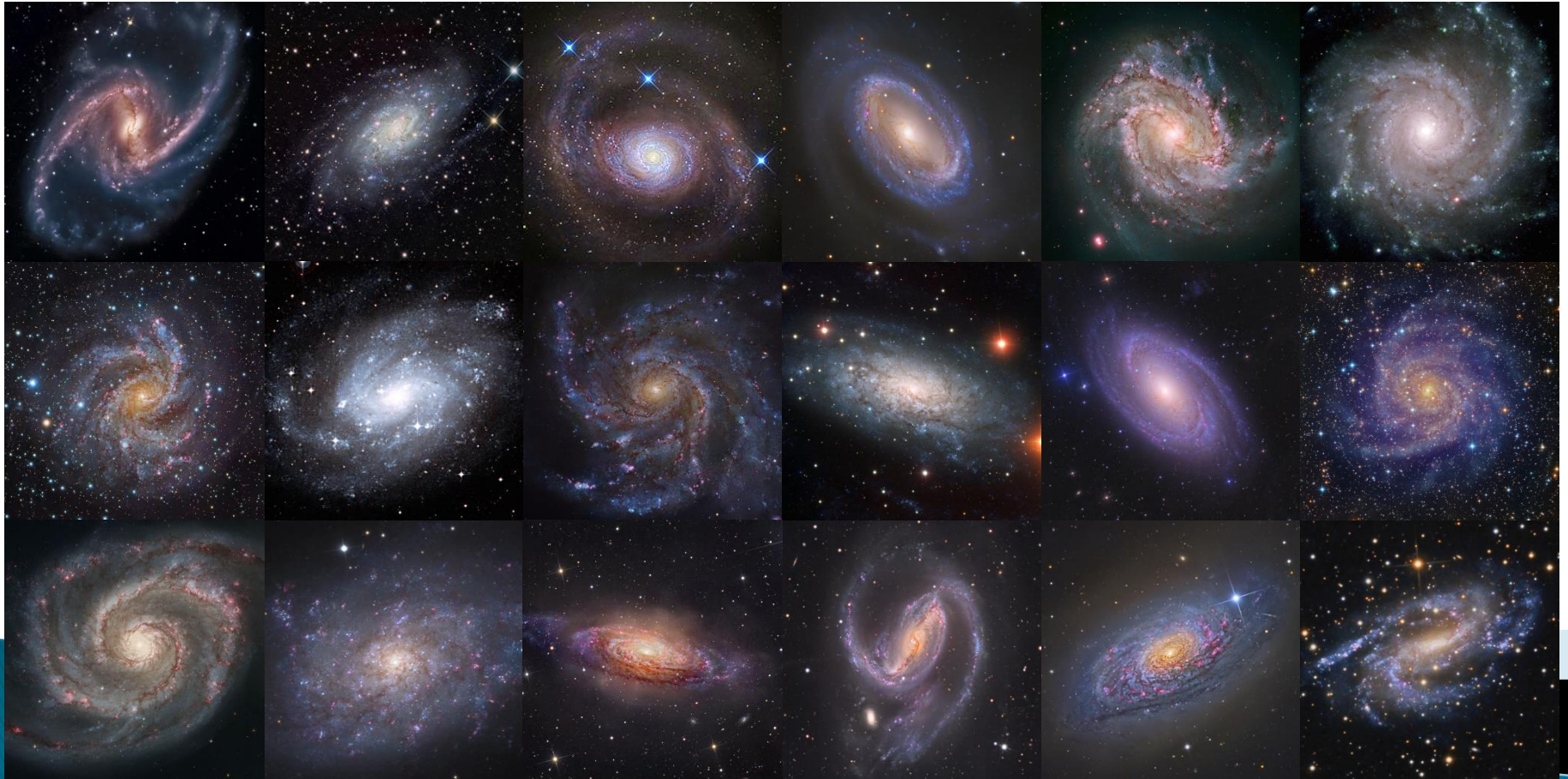


NGC 1365 and/or M83
face-on barred spiral galaxies



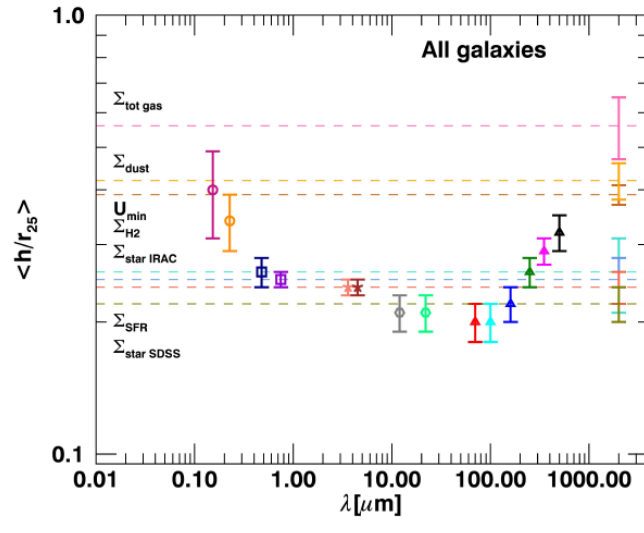
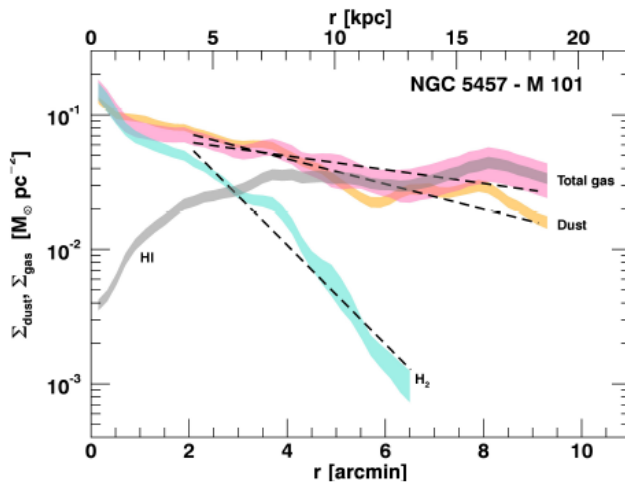
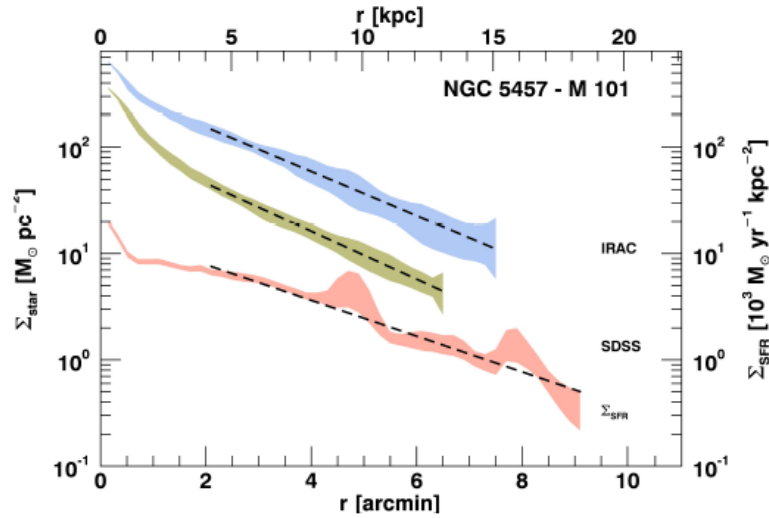
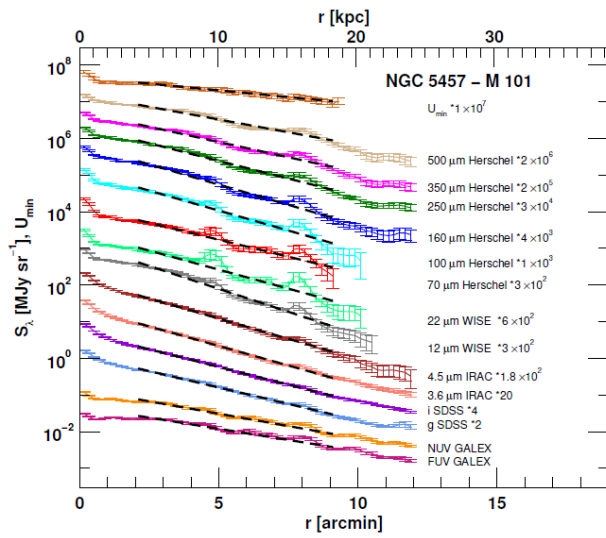


Stellar Kinematics Including Radiative Transfer Future: statistical sample

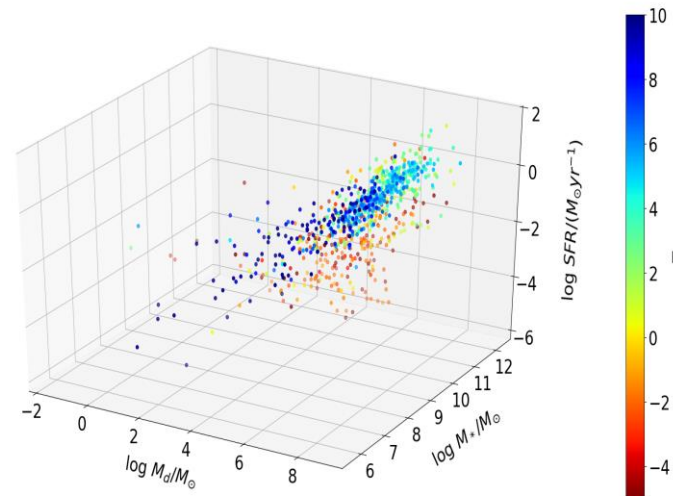
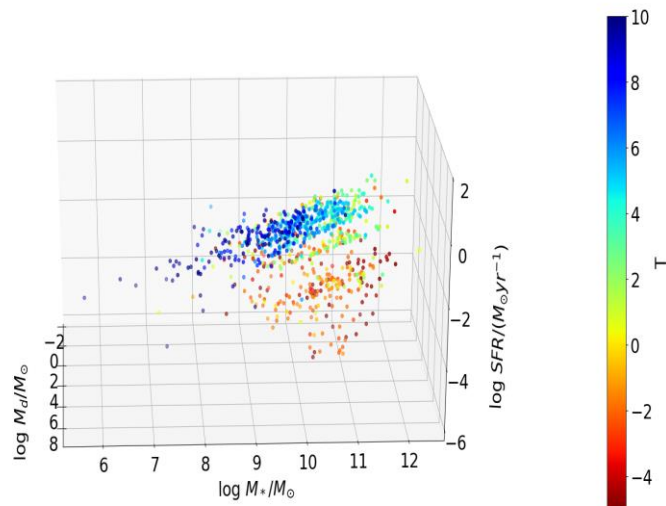


Morphology of the galaxies

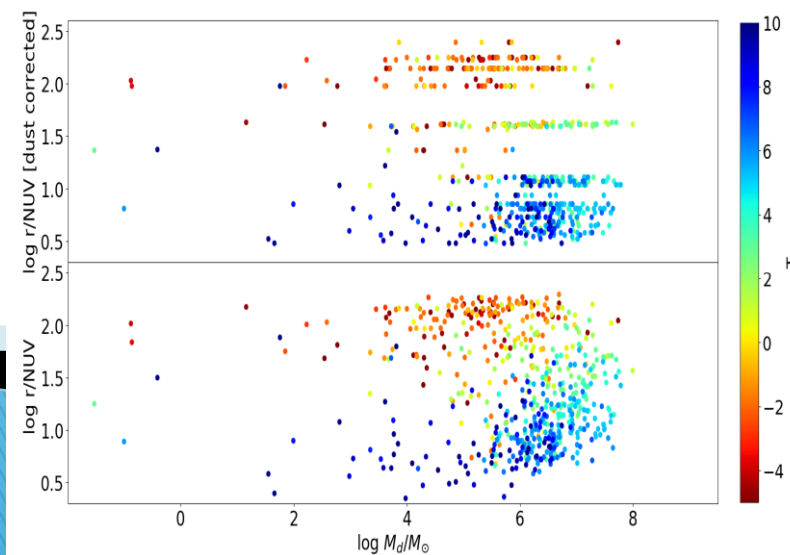
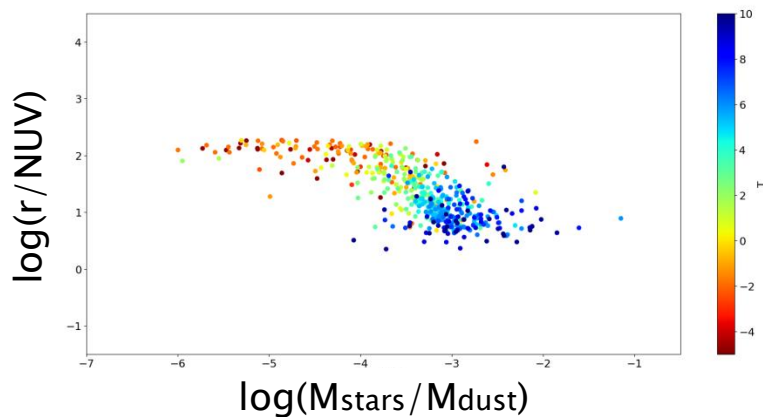
“Radial distribution of dust, stars, gas, and star-formation rate in DustPedia face-on galaxies”
 Casasola et al. 2017, A&A, in press



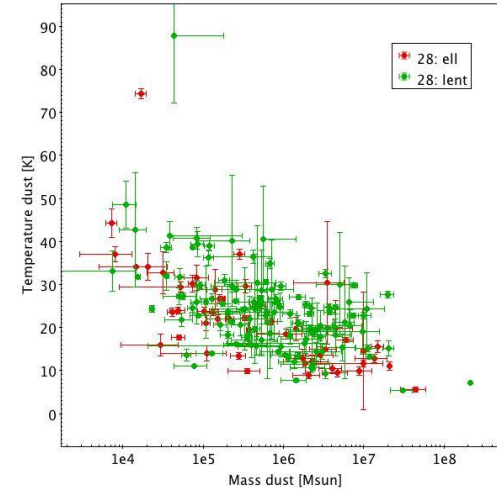
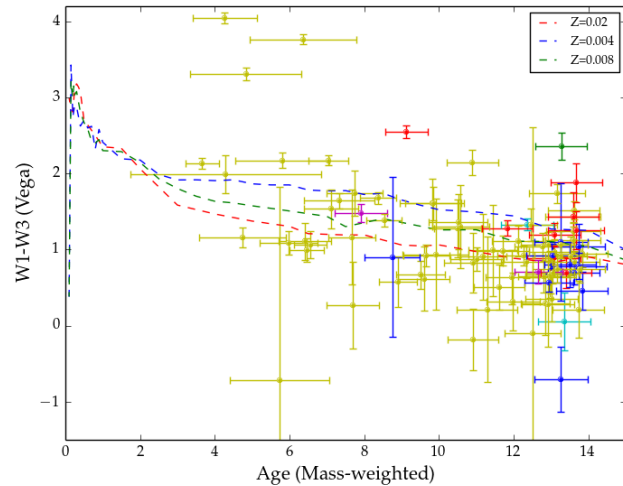
Scaling relations



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

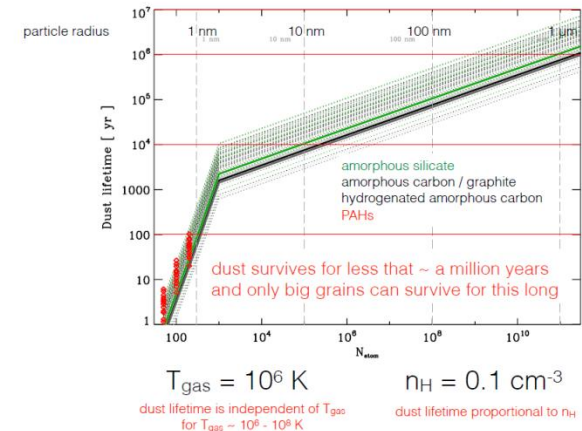
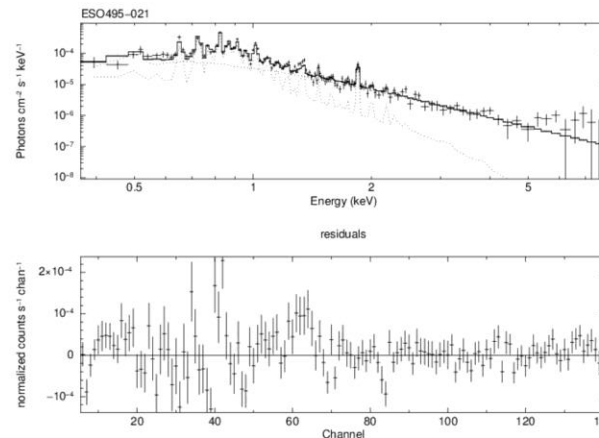
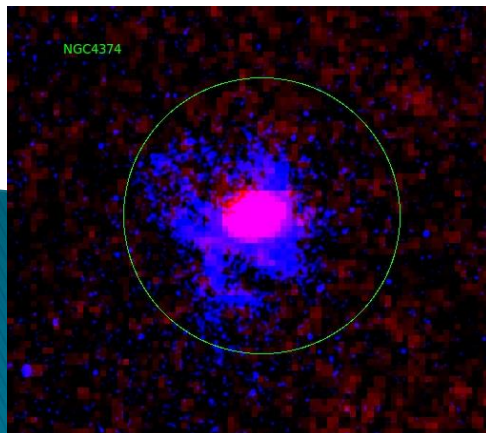


Early-type galaxies

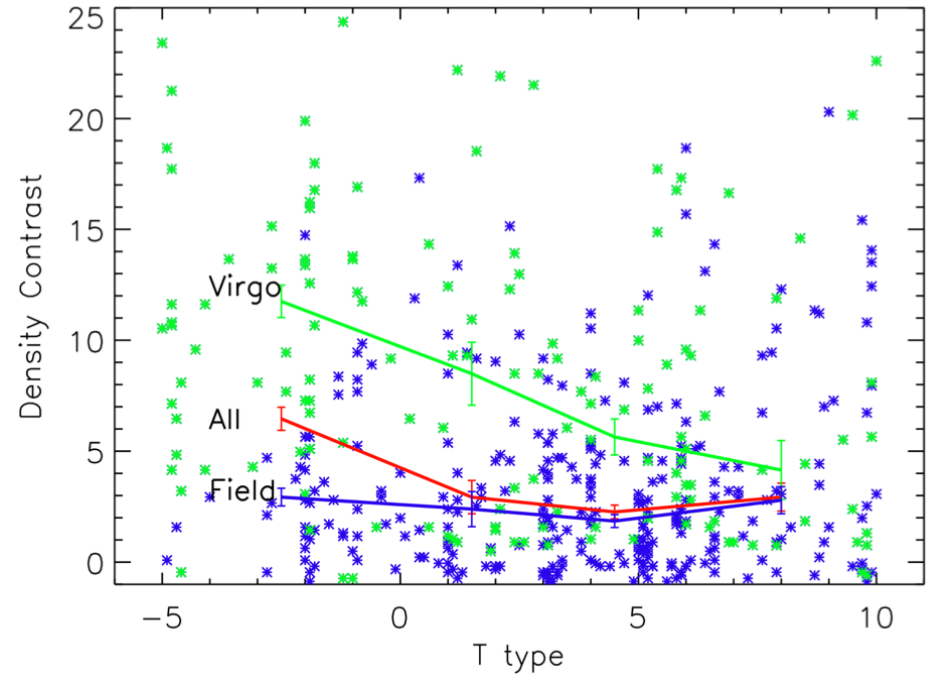
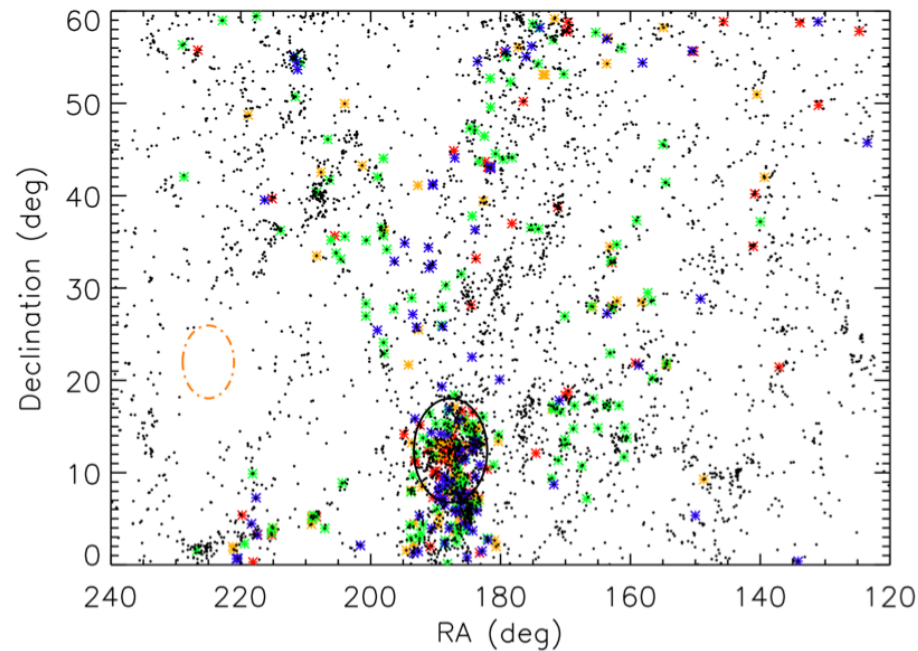


Investigate the dust lifetimes and relative contributions of photon versus electron collisional heating of dust grains and the survival of the dust grains of different sizes in these galaxies.

dust lifetime in a hot gas



Environmental effects on DustPedia galaxies

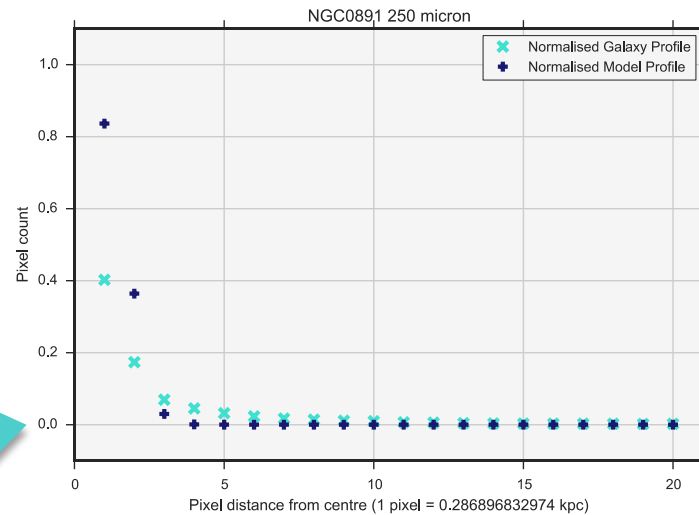


We are carrying out an investigation into how the local environment may affect the properties of DustPedia galaxies.

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



NGC 0891
SPIRE 250 μm



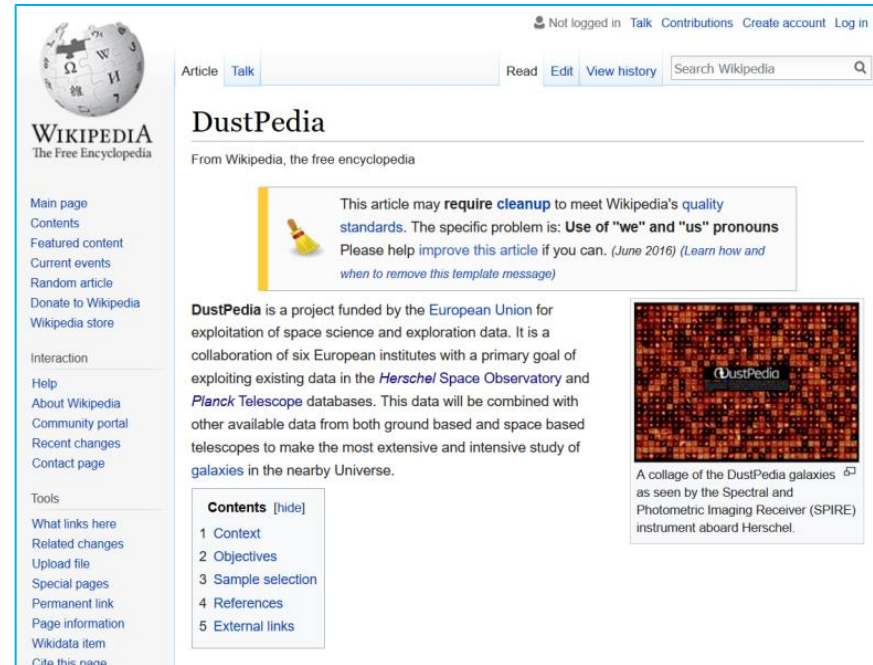
DustPedia on the web

dustpedia.com



The screenshot shows the DustPedia website homepage. At the top, there is a navigation menu with links for HOME, SCIENCE, COLLABORATION, ACKNOWLEDGE, NEWS, and OUTREACH, along with a LOGIN button. The main header features the DustPedia logo and the tagline "A Definitive Study of Cosmic Dust in the Local Universe". Below this is a "Learn more" button. The "Overview" section contains a paragraph about the project's funding and goals. Two circular images show a space telescope and a galaxy. The "Objectives" section lists four key goals: SED Fitting, Radiative Transfer Modelling, Dust Evolution, and Cosmological Implications, each with a small icon and a brief description.

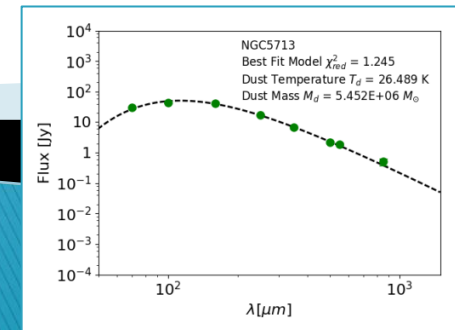
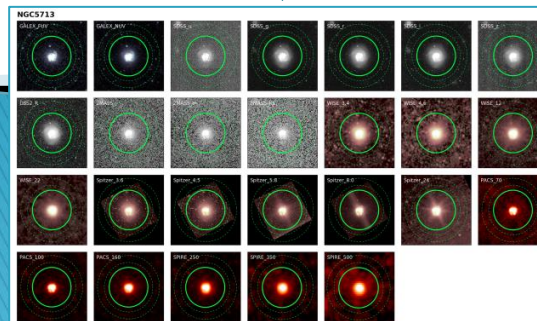
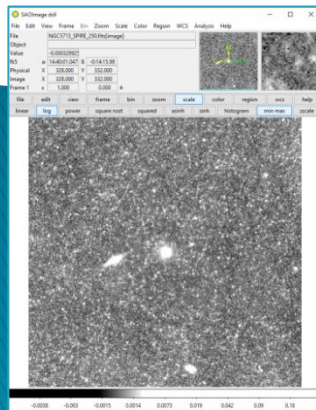
DustPedia on Wikipedia



The screenshot shows the DustPedia article on Wikipedia. The page header includes the Wikipedia logo and the text "WIKIPEDIA The Free Encyclopedia". The article title is "DustPedia" and it is categorized as "From Wikipedia, the free encyclopedia". A yellow banner at the top right indicates that the article may require cleanup to meet Wikipedia's quality standards, specifically mentioning the use of "we" and "us" pronouns. The main text of the article describes DustPedia as a project funded by the European Union for the exploitation of space science and exploration data. A "Contents" box on the right side of the article lists the following sections: 1 Context, 2 Objectives, 3 Sample selection, 4 References, and 5 External links. A small image of a galaxy collage is visible on the right side of the article.

The DustPedia database

dustpedia.astro.noa.gr





DustPedia



This image displays all 647 DustPedia galaxies; every galaxy within 140 million light-years of us that has an angular size over 1/160th a degree) that was observed by the Hubble Space Telescope. In each RGB image, red is far-infrared Herschel data showing emission from cold interstellar dust, green is near-infrared 3.6 μm data showing light from populations of older stars, and blue is ultraviolet GALEX data showing emission from newborn stars. Each image is scaled to the optical size of galaxy (down to a minimum of 1/20th a degree). Images with "speckled" red data are where foreground dust or background galaxies obscure the target galaxy.

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