

DustPedia

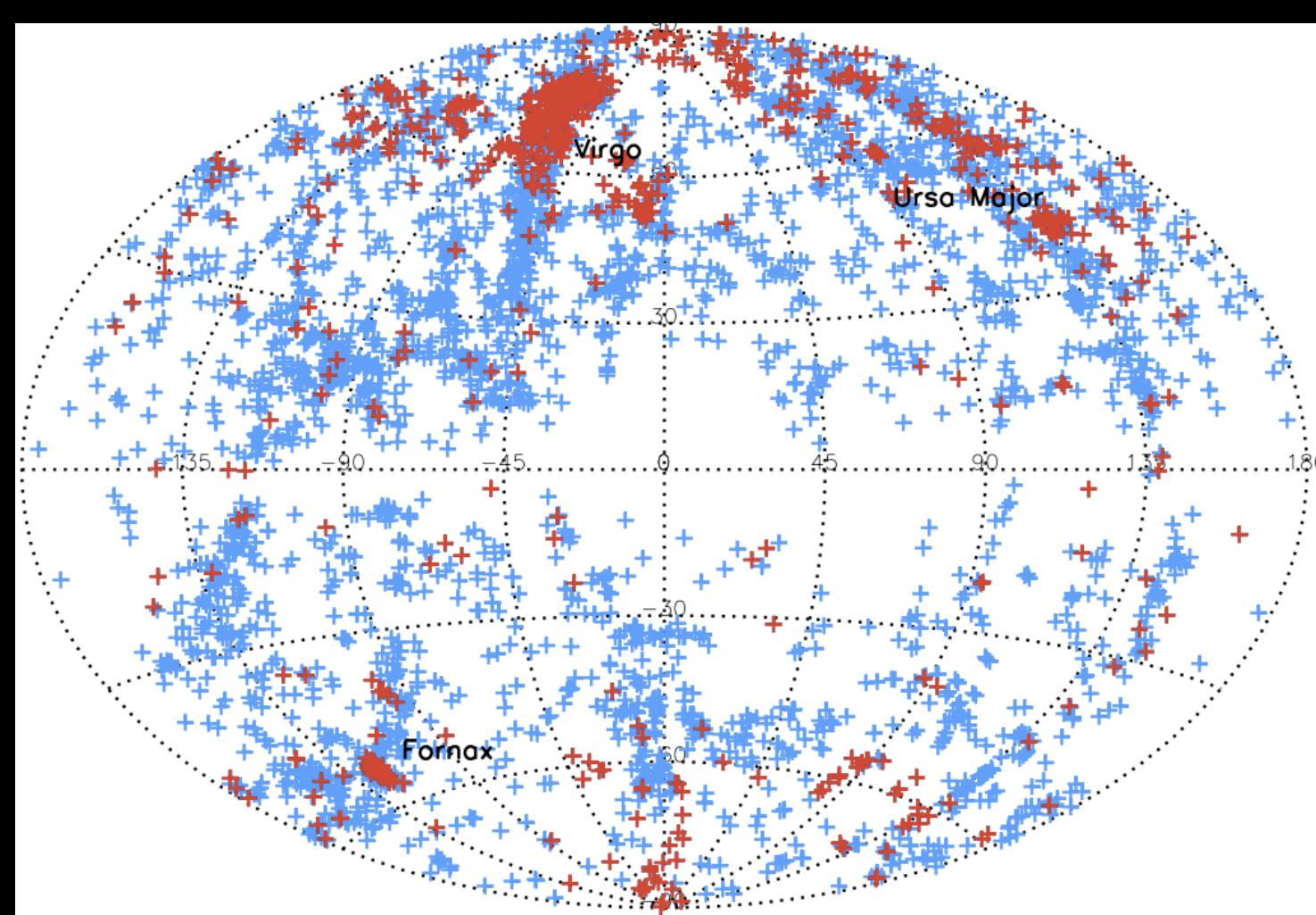
www.dustpedia.com

Overview

DustPedia is an international collaboration working towards a definitive understanding of dust in the local Universe, taking advantage of the wealth of data provided by *Herschel* and other recent missions. We have created a database of all *Herschel* observations of extended nearby galaxies, complimented by ancillary imaging data in 30 photometric bands. We are using this unrivalled dataset to model galaxy SEDs using the THEMIS model, perform spatial analyses of dust properties, conduct radiative transfer modelling, derive dust mass and luminosity functions, and explore cosmological implications of local studies of dust. All of this data, including the multiwavelength imagery, the models/code developed, the derived galaxy properties, and full aperture-matched photometry, will be made available to the community.

Sample

The DustPedia sample consists of all 867 nearby galaxies imaged by *Herschel* that have recessional velocities <3000 km/s, optical diameters >1 arcminute ($1/60^{\text{th}}$ of a degree), and a detected stellar component. The vast majority (93%) of the sample has been observed by both of *Herschel*'s cameras, PACS & SPIRE. The figure below shows the distribution of DustPedia galaxies (red) compared to the 3454 other nearby galaxies that lack *Herschel* coverage, but which otherwise meet the selection criteria (blue). Most DustPedia galaxies are group/field, whilst $\sim 30\%$ are in the Virgo & Fornax clusters. Late type morphologies make up $\sim 65\%$ of the sample.



Public Availability

Our full database, including the standardised multiwavelength imagery, the models/code developed, the derived galaxy properties, and full aperture-matched photometry, will be made available to the community as the project develops.



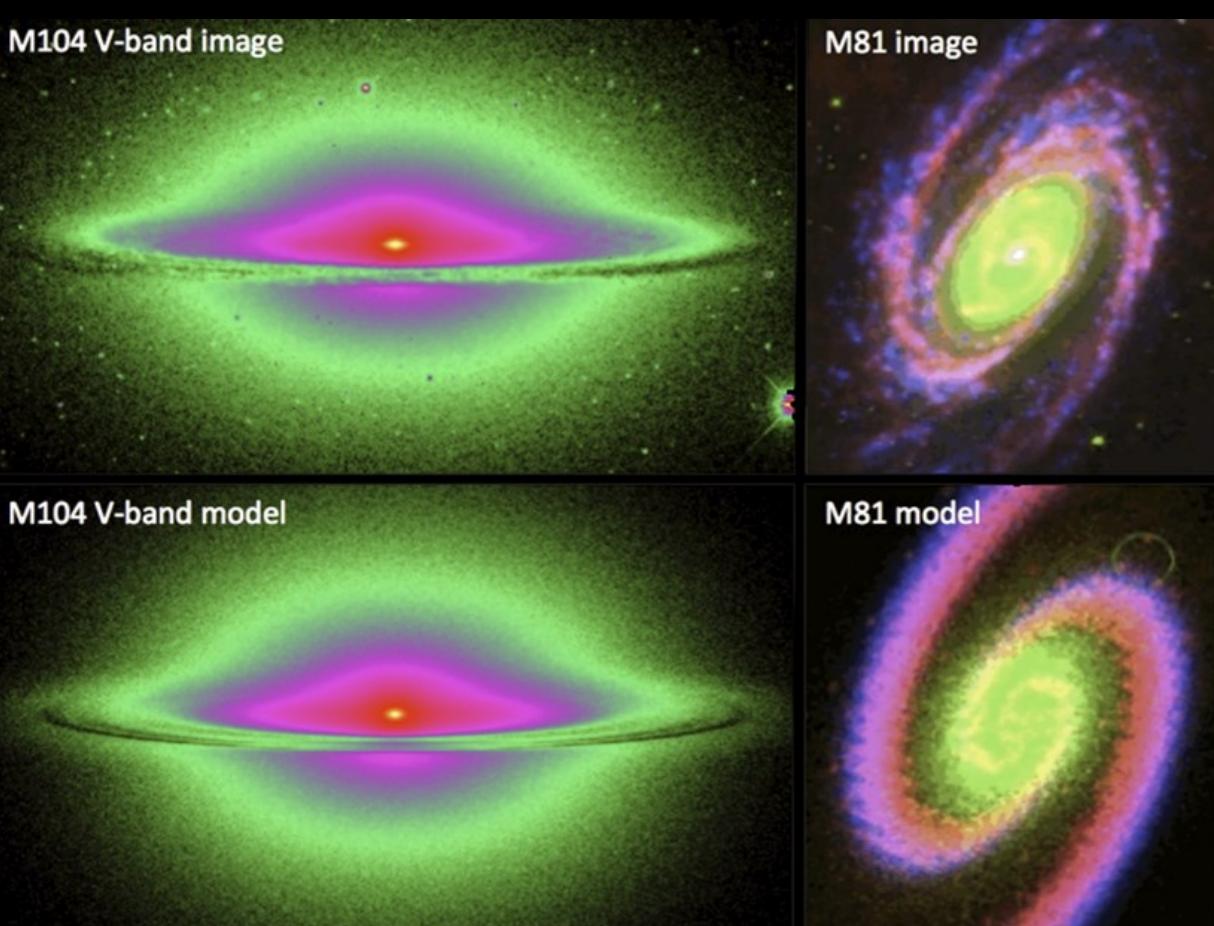
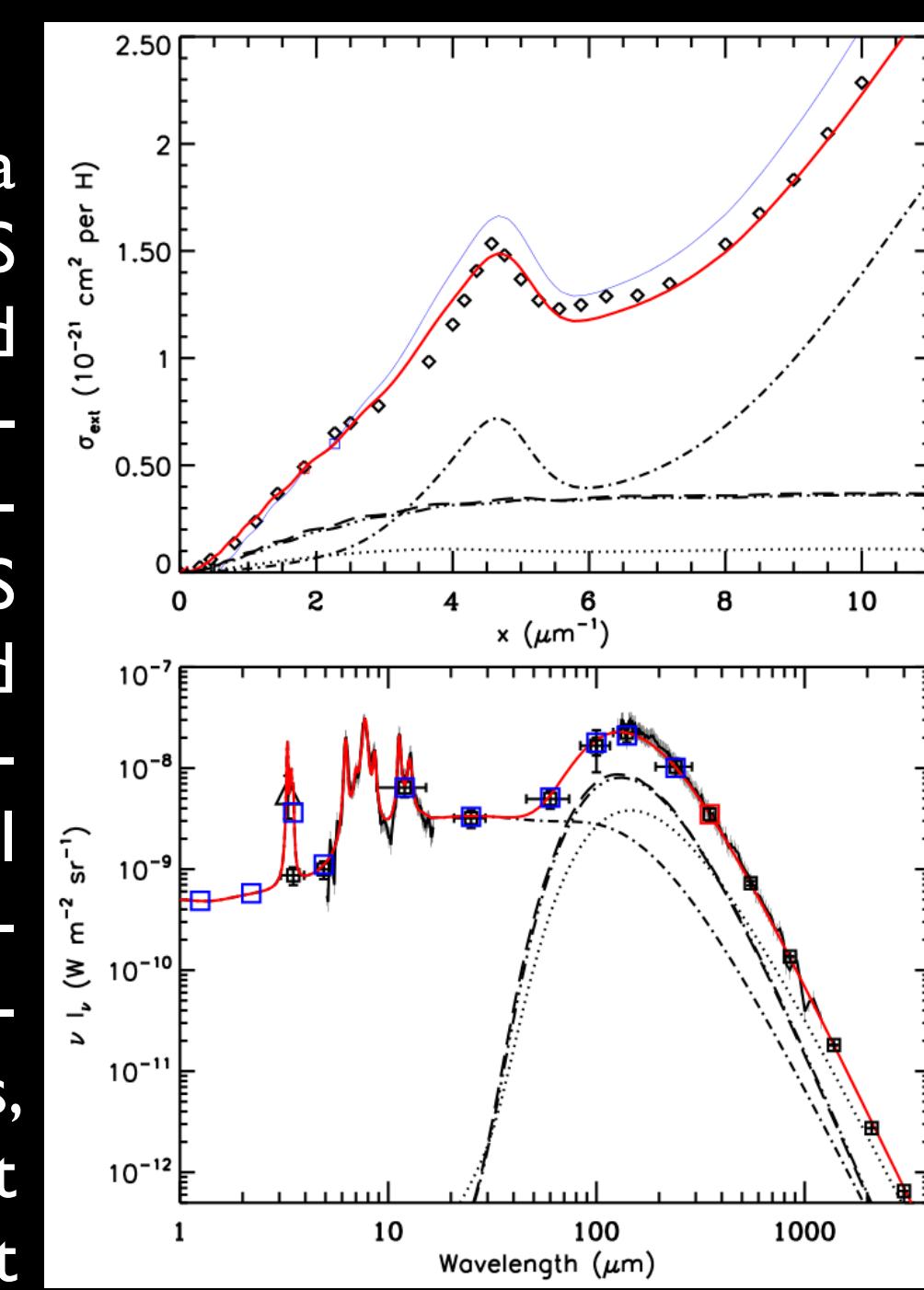
This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement № 606874.



For our database, we have produced our own consistent reductions of the *Herschel* PACS & SPIRE observations of the DustPedia targets; all appropriate observations have been combined, creating the deepest ever *Herschel* maps of many galaxies. We are complimenting the *Herschel* data with standardised ancillary UV—radio imaging data, from GALEX, SDSS, DSS, 2MASS, WISE, Spitzer, and Planck, providing coverage in up to 30 photometric bands. Other imaging is being acquired as needed on a galaxy-by-galaxy basis. Additionally IRAS photometry is also available for all of our targets. Metallicity data and atomic gas observations are available for the vast majority of the sample.

Global Dust Model

To study dust and interstellar conditions in DustPedia galaxies, we are continuing development of THEMIS (Jones 2012abc; Jones et al 2013; Köhler, Jones, and Ysard 2014). THEMIS is a physically-motivated dust model, using lab constraints (not tuning the model to observations) within a physical theoretical framework. THEMIS is based on (hydrogenated) amorphous carbons and amorphous silicates with metallic iron and/or iron sulphide nano-inclusions. THEMIS is being used to model the SEDs of the DustPedia galaxies, exploiting our excellent multiwavelength dataset. The figure to the right illustrates (top) THEMIS diffuse extinction cross-sections, and (bottom) an example spectral energy distribution fit (dotted: a-C coated a-C:H; long-dash: a-Sil_{olivine}; triple dot-dash: a-Sil_{pyroxene} grains; dot-dash: small a-C grains; solid red: model total; solid blue: band-normalised B & V; see Jones 2015 for further details).



Radiative Transfer Modelling

To understand the distribution, optical properties, heating mechanisms, and general characteristics of the dust in these galaxies (along with other galaxy properties), we are taking advantage of recent improvements in the SKIRT radiative transfer modelling suite (Camps & Baes 2015, De Geyter, Baes, Fritz, and Camps 2013). With SKIRT, we are fitting radiative transfer models to our multiwavelength imagery, to see how light propagates through these galaxies, exploiting the fact we have assembled the largest-possible database of observations of extended galaxies made by *Herschel*. We are modelling galaxies across the full range of morphologies and inclinations; see figure to the left.

Border Image

The border displays all 867 DustPedia galaxies, in reverse order of right ascension, top-to-bottom. In each RGB image: Red is FIR *Herschel* 250 μm data showing dust emission (else *Herschel* 160 μm if no 250 μm coverage); Green is NIR SDSS z-band data showing light from evolved stellar populations (else 2MASS J-band if no SDSS coverage); Blue is FUV GALEX data showing emission from star formation (else SDSS u-band if no GALEX coverage, else DSS B-band if neither). Images scaled to optical size of galaxy (down to min 2'). Images with 'speckled' FIR emission are where foreground dust or background galaxies outshine the target galaxy.