

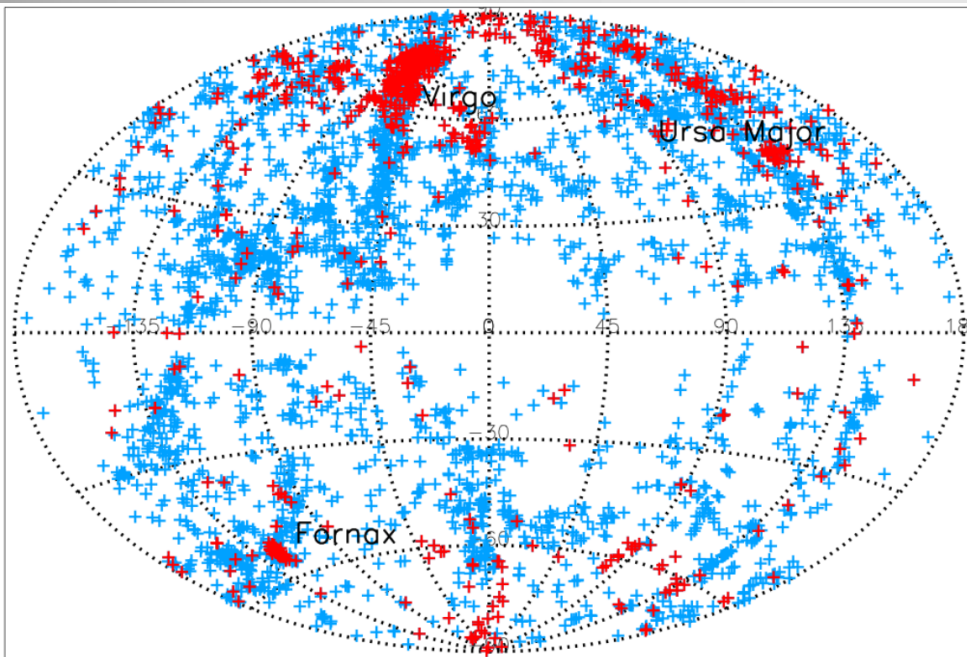
High-resolution, 3D radiative transfer modeling of barred galaxies

Angelos Nersesian

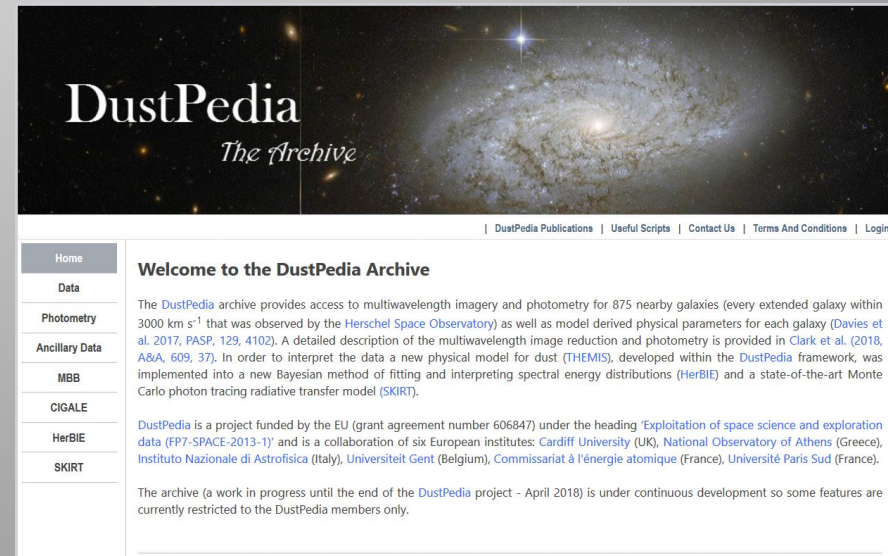
Sam Verstocken, Sébastien Viaene & Maarten Baes

DustPedia

A Definitive Study of the Cosmic Dust in the Local Universe



Davies et al. 2017



DustPedia
The Archive

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Welcome to the DustPedia Archive

The DustPedia archive provides access to multiwavelength imagery and photometry for 875 nearby galaxies (every extended galaxy within 3000 km s^{-1} that was observed by the [Herschel Space Observatory](#)) as well as model derived physical parameters for each galaxy (Davies et al. 2017, *PASP*, 129, 4102). A detailed description of the multiwavelength image reduction and photometry is provided in Clark et al. (2018, *A&A*, 609, 37). In order to interpret the data a new physical model for dust (THEMIS), developed within the DustPedia framework, was implemented into a new Bayesian method of fitting and interpreting spectral energy distributions (HerBIE) and a state-of-the-art Monte Carlo photon tracing radiative transfer model (SKIRT).

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).

The archive (a work in progress until the end of the DustPedia project - April 2018) is under continuous development so some features are currently restricted to the DustPedia members only.

Team Ghent

Goals

- Derive the 3D distribution and the spectral properties of the stellar populations and the interstellar dust in face-on galaxies.
- Study the dust heating mechanisms in galaxies of different types.

Method/Application on
face-on spiral galaxy

Verstocken et al.



M81

Application on face-
on barred galaxies

Nersesian et al.



NGC1365, M83 & M95

Application on face-
on AGN

Viaene et al.



NGC1068

Meet the galaxies



NGC1365

Distance: 17.3 Mpc

Apparent Size : 11.2' x 6.2'

Morphology: SB(s)

AGN: Sy 1.8

M83

Distance: 4.9 Mpc

Apparent Size: 12.9' x 11.5'

Morphology: SAB(s)

M95

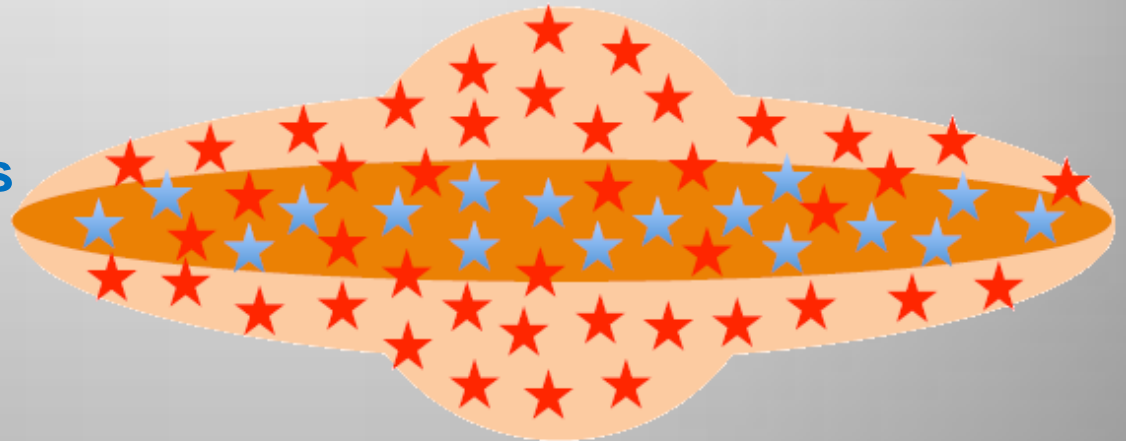
Distance: 9.9 Mpc

Apparent Size: 3.07' x 2.86'

Morphology: SB(r)

Model Construction

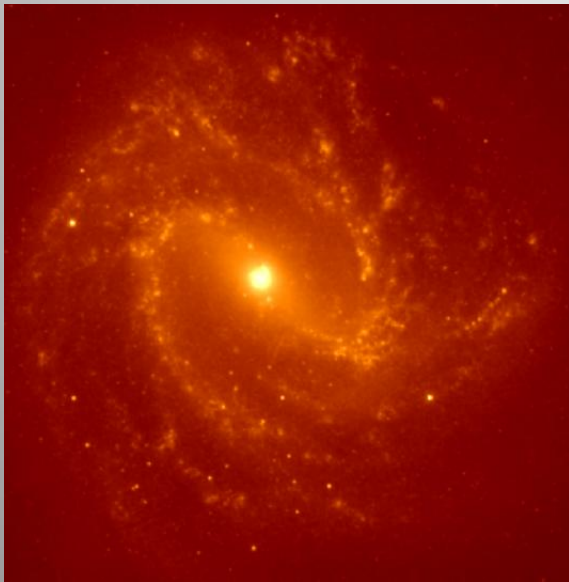
- **Old Stellar Population**
- **Young non-ionizing stars**
- **Young ionizing stars**
- **Dust component**



De Looze et al. 2014

Decomposition

M83



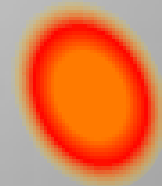
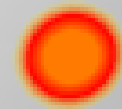
IRAC I1

S4G database

Decomposition



Bulge



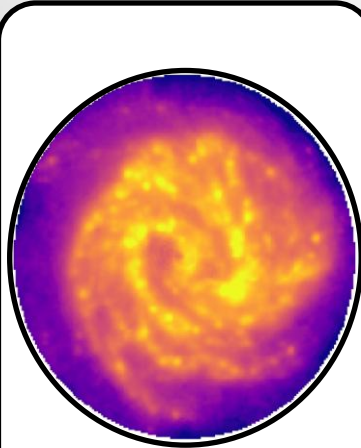
Disk

We assume that the bar is part of the galactic disk!

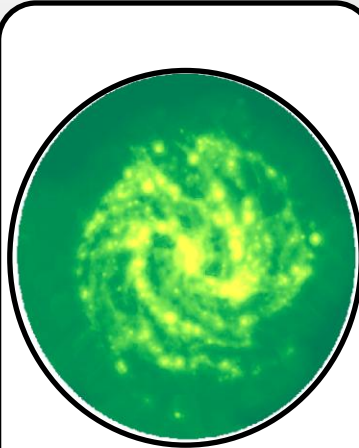
Map Making



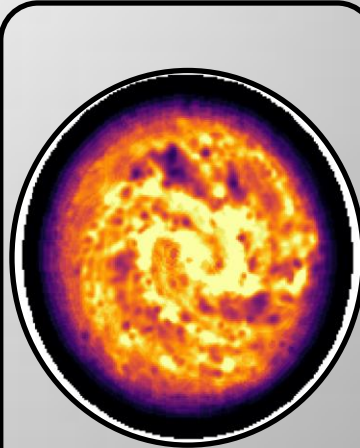
Evolved
stars



Young
stars



Ionizing
stars



Dust



Unevolved stars

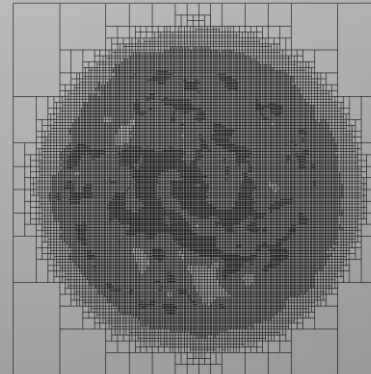
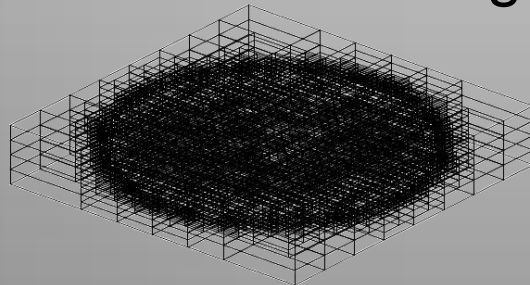
Radiative transfer model

- ❖ De-projection & adding an exponential vertical scale height to create 3D geometries.

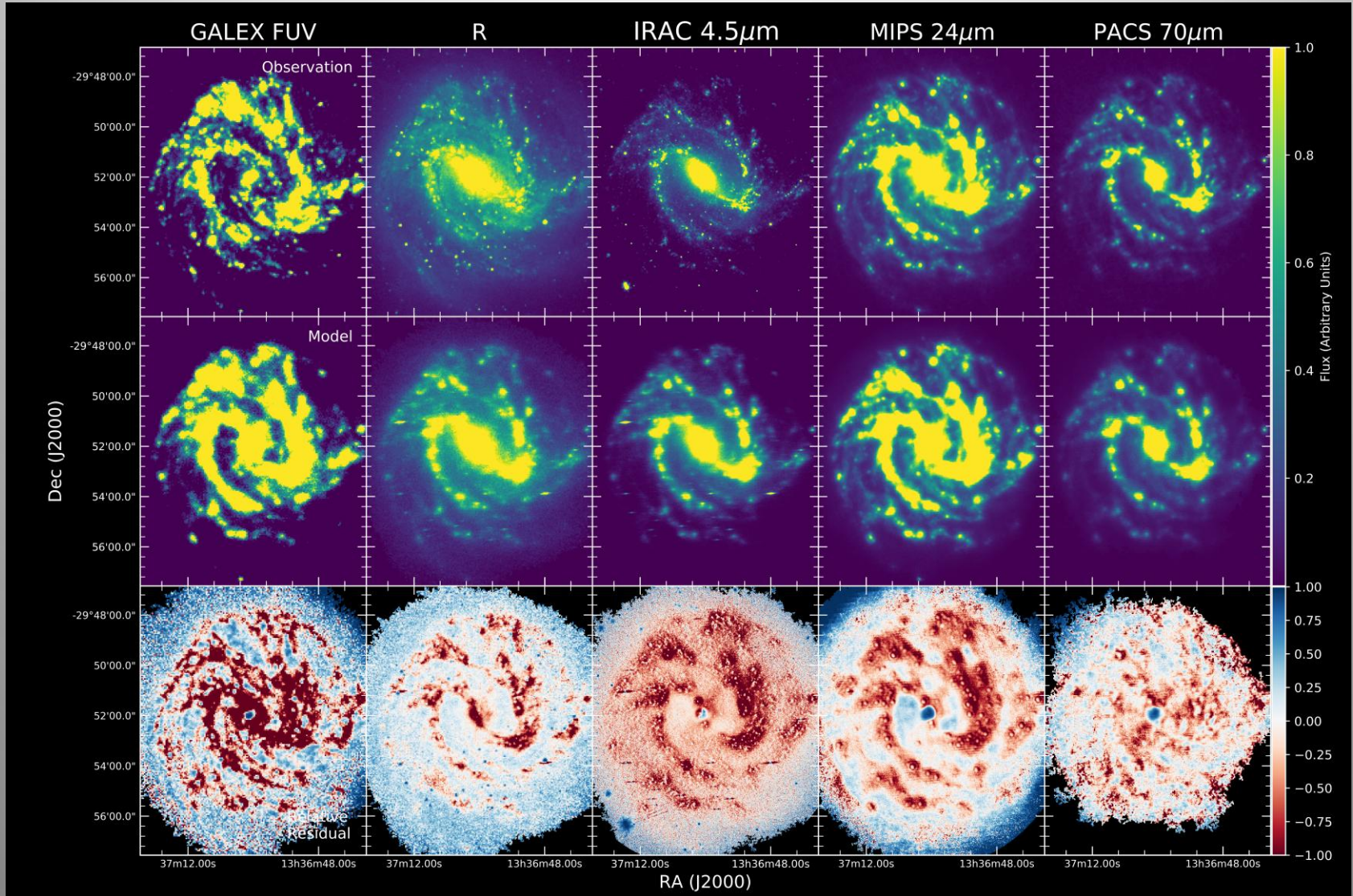
3D Monte Carlo radiative transfer code designed to model dusty systems

- Absorption
- Scattering
- Thermal re-emission

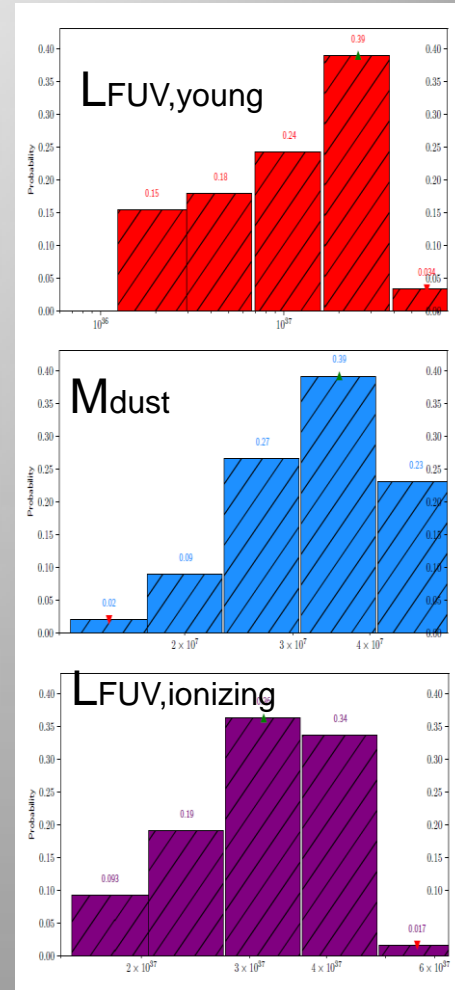
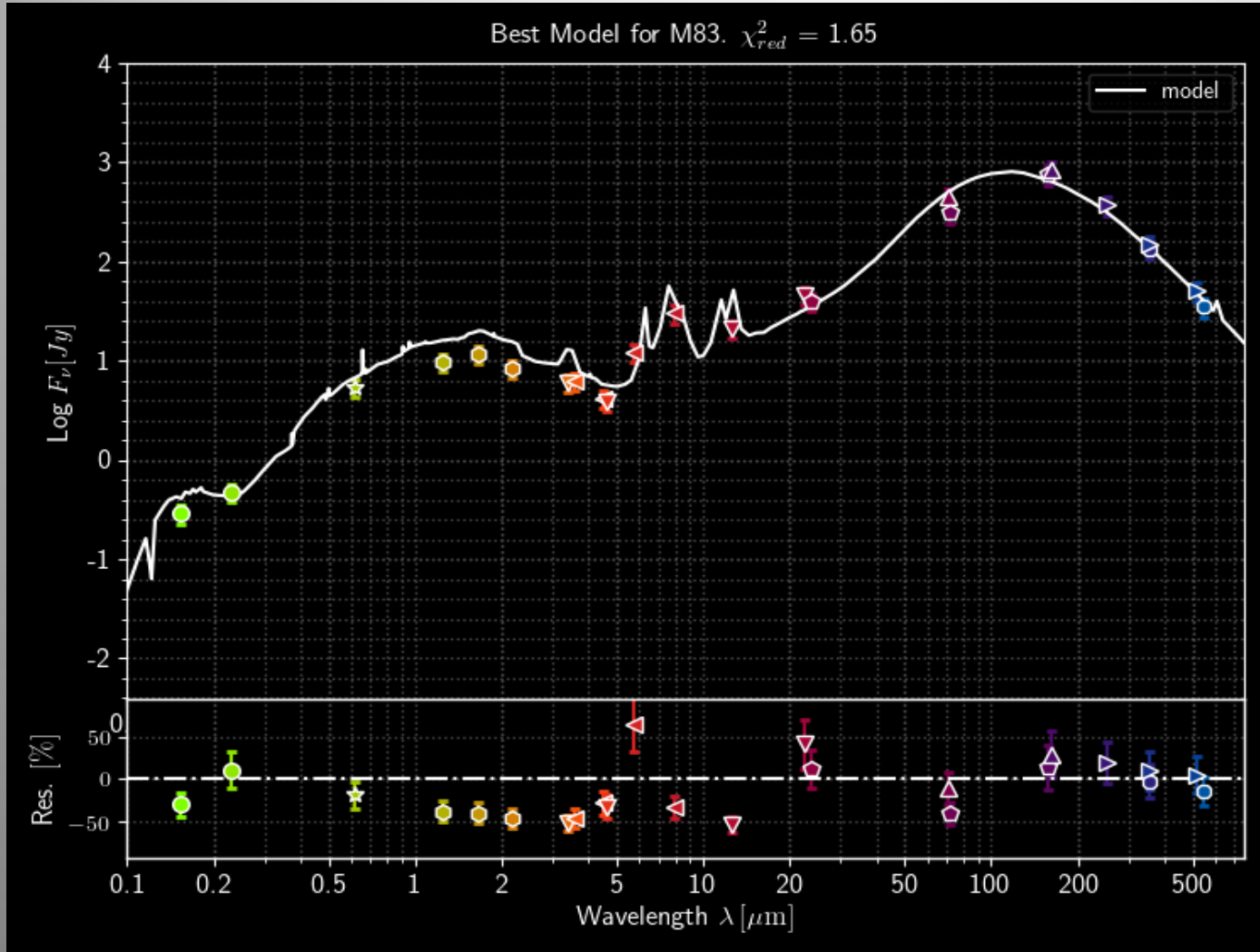
Use of adaptive grid structures to increase the resolution in the dust grid



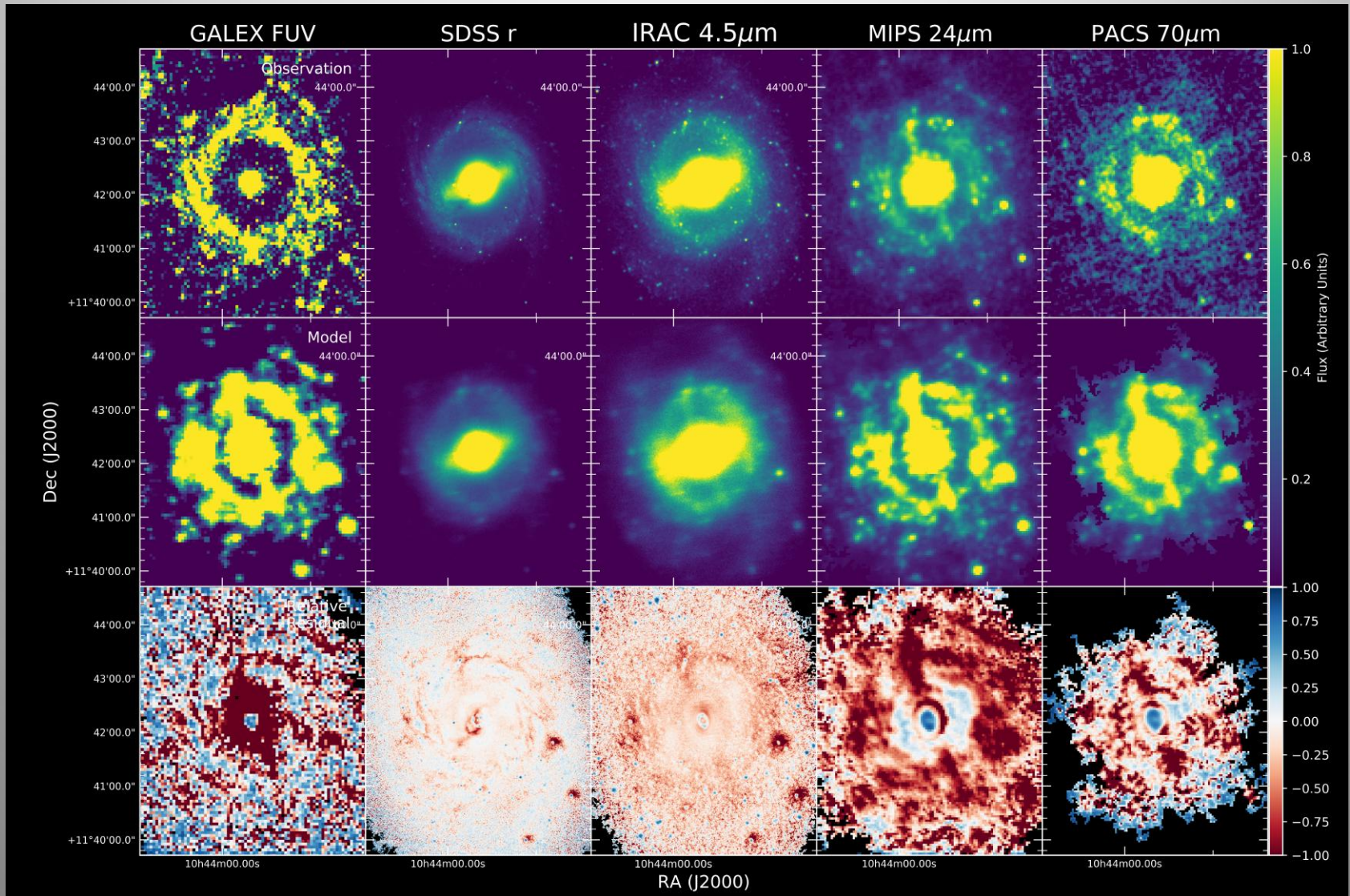
Results/NGC5236 (M83)



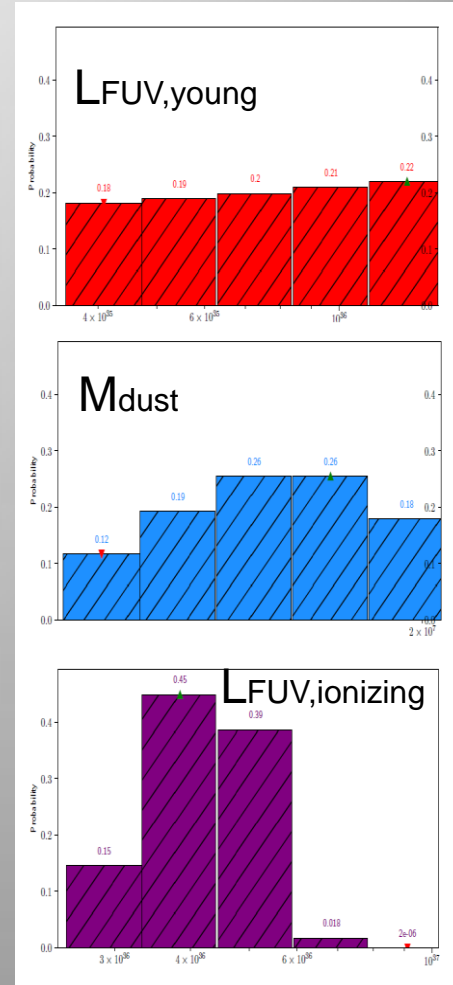
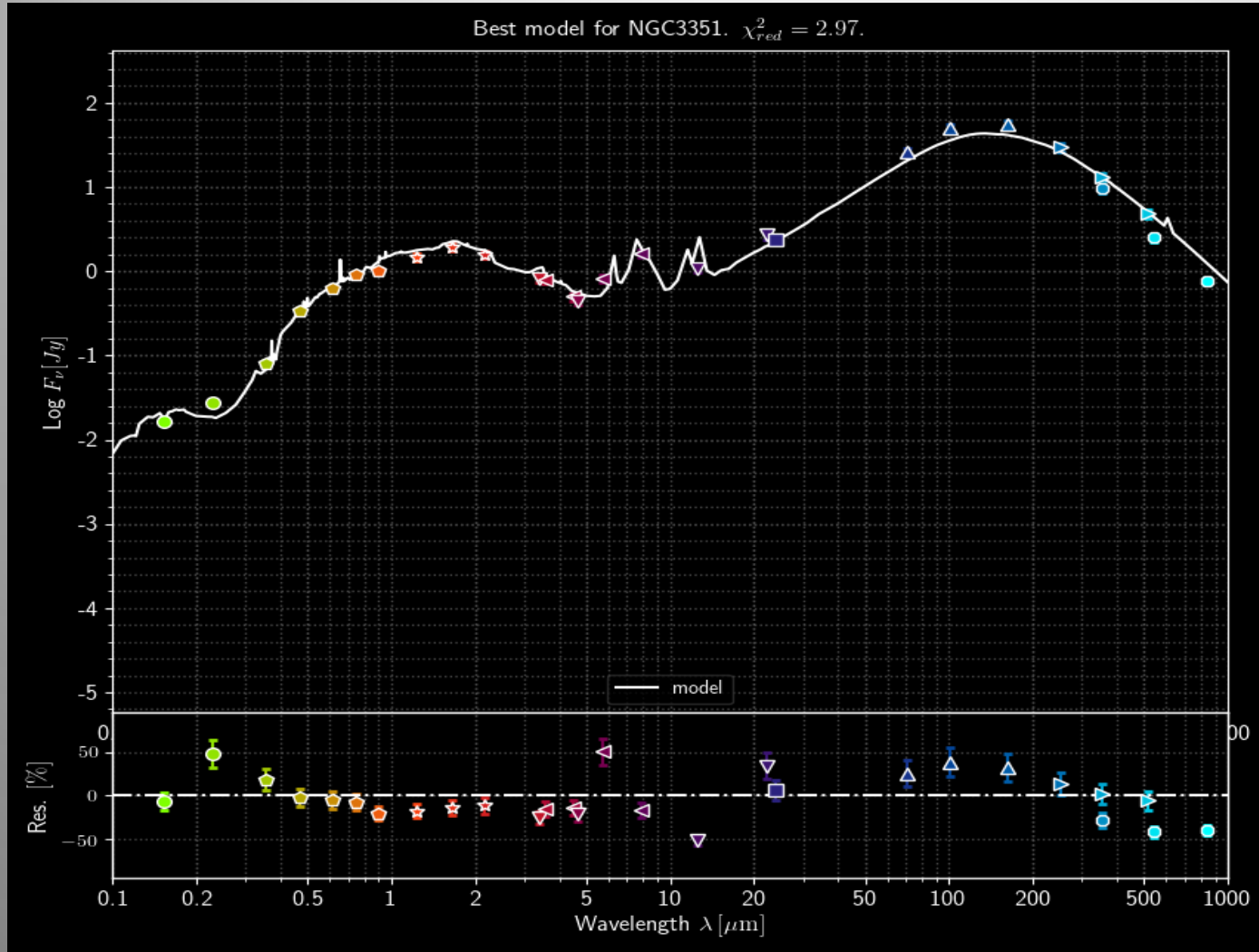
Results/NGC5236 (M83)



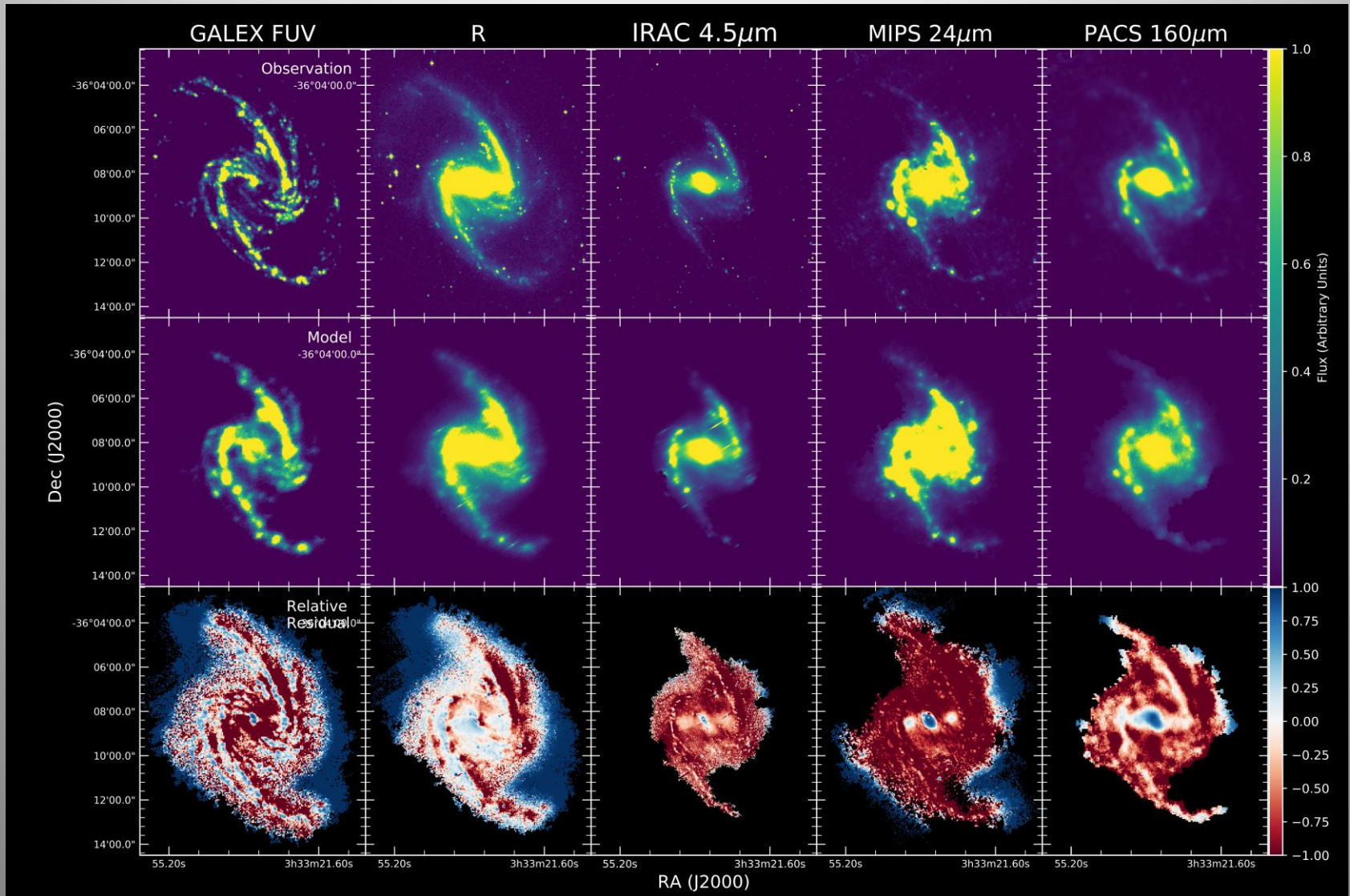
Results/NGC3351 (M95)



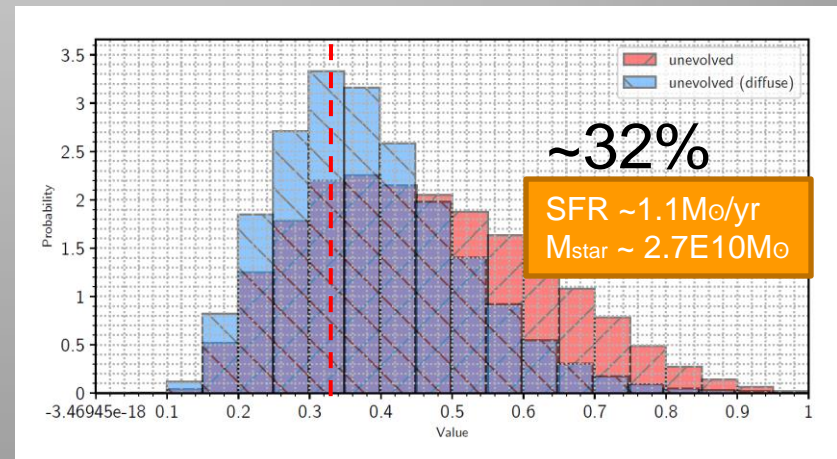
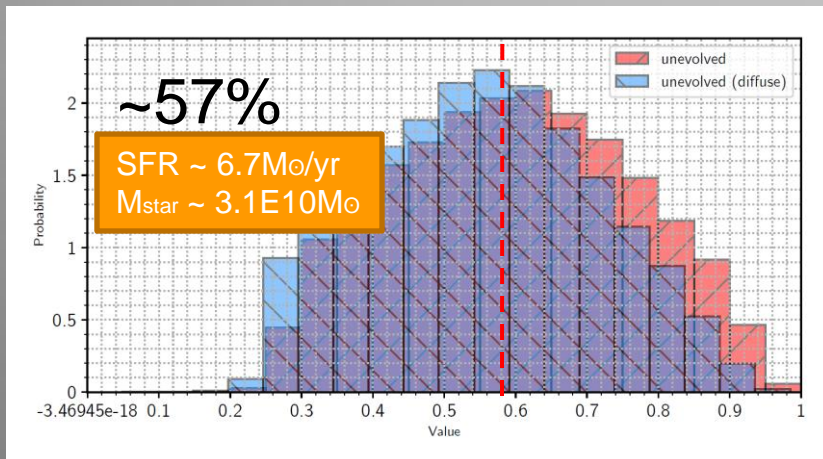
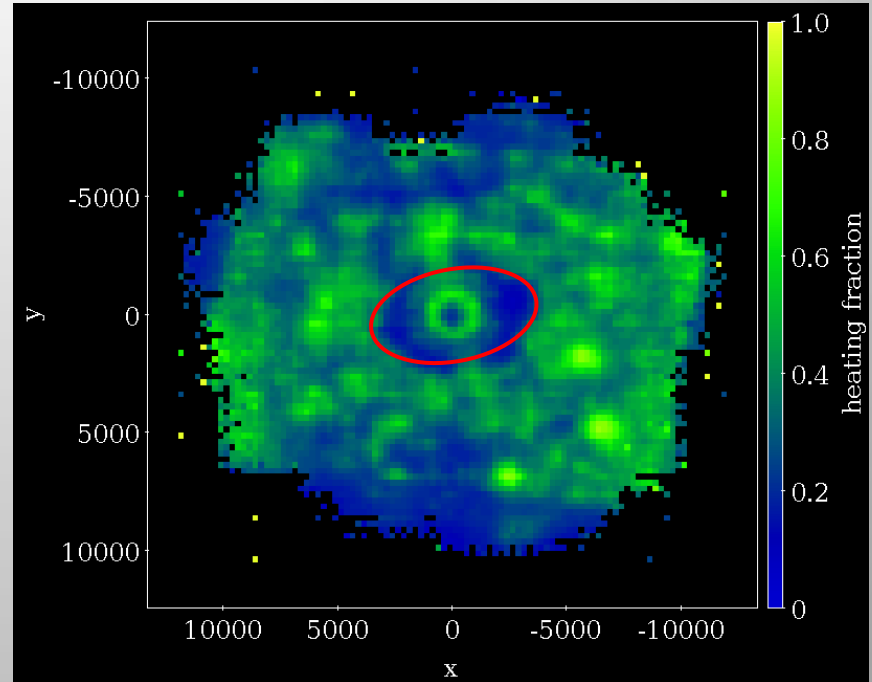
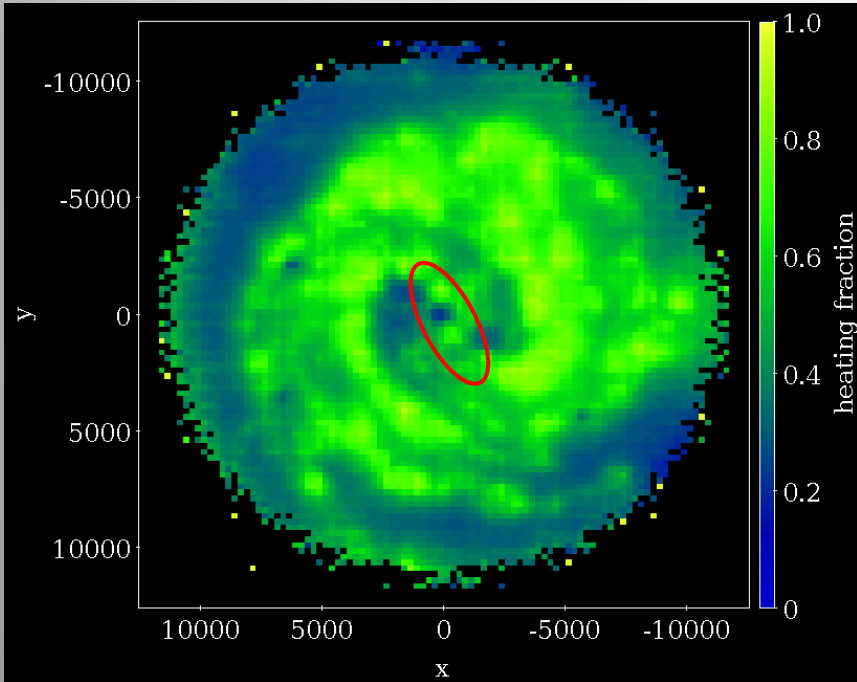
Results/NGC3351 (M95)



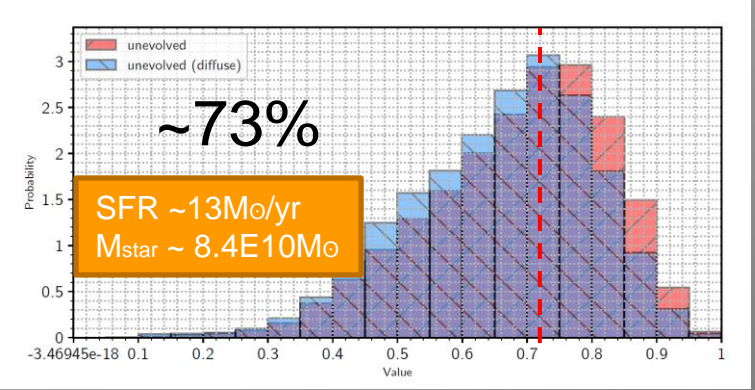
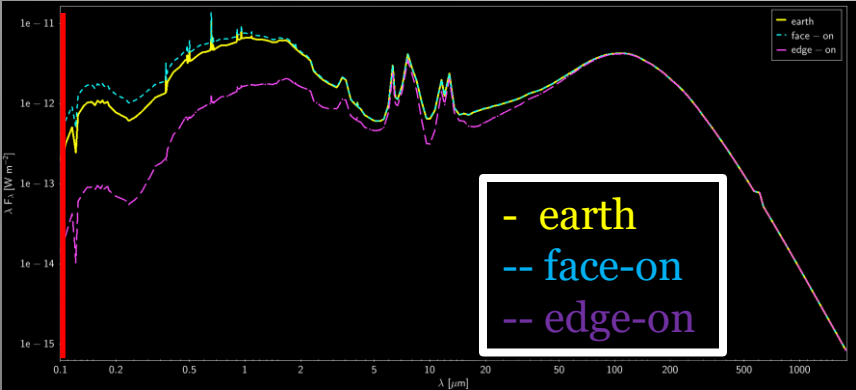
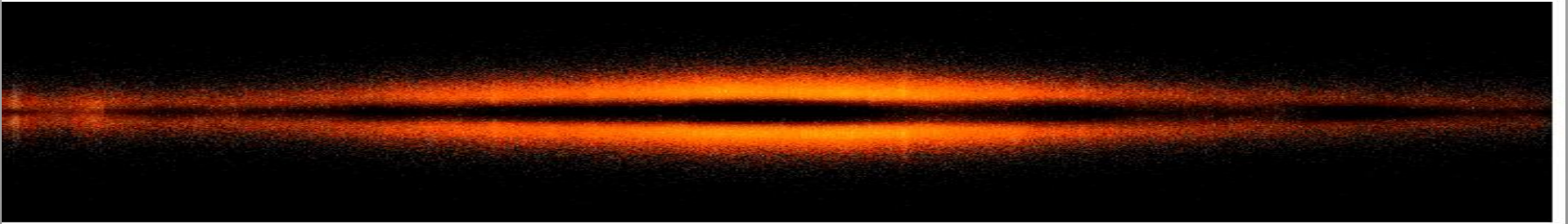
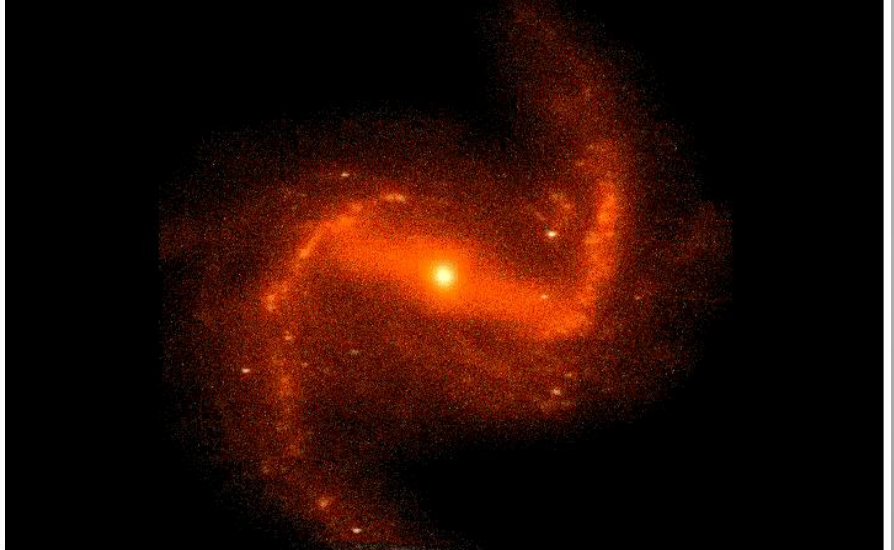
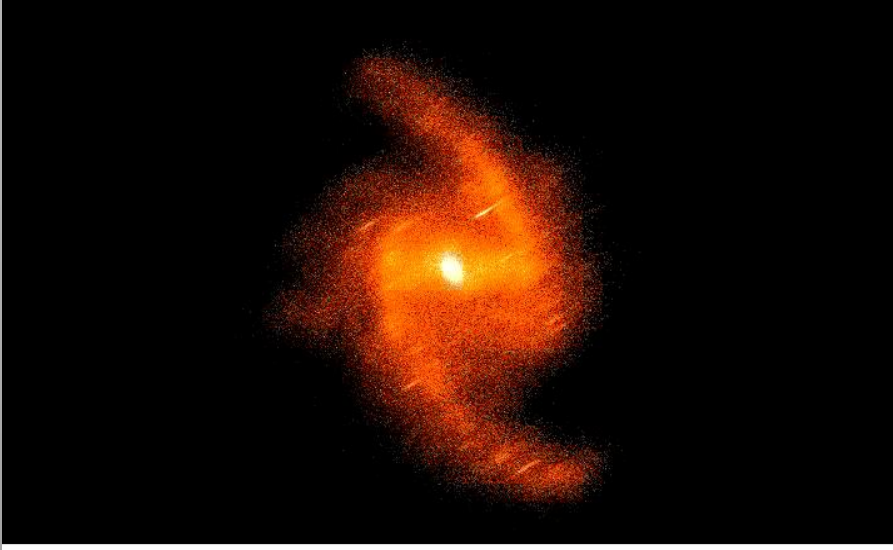
Results/NGC1365



Dust Heating



FIR



Conclusions

We have constructed highly detailed models for 3 barred galaxies to investigate the dust heating mechanisms.

- ✓ The integrated SEDs of all galaxies are fitted well.
- ✓ Our model is able to reproduce the observed morphologies of each galaxy reasonably well.
- ✓ Our study reveals the importance of evolved stars contributing to the dust emission at IR bands.



Thank You!