08 – Dust Properties of Galaxies from the DustPedia Sample

Participants:

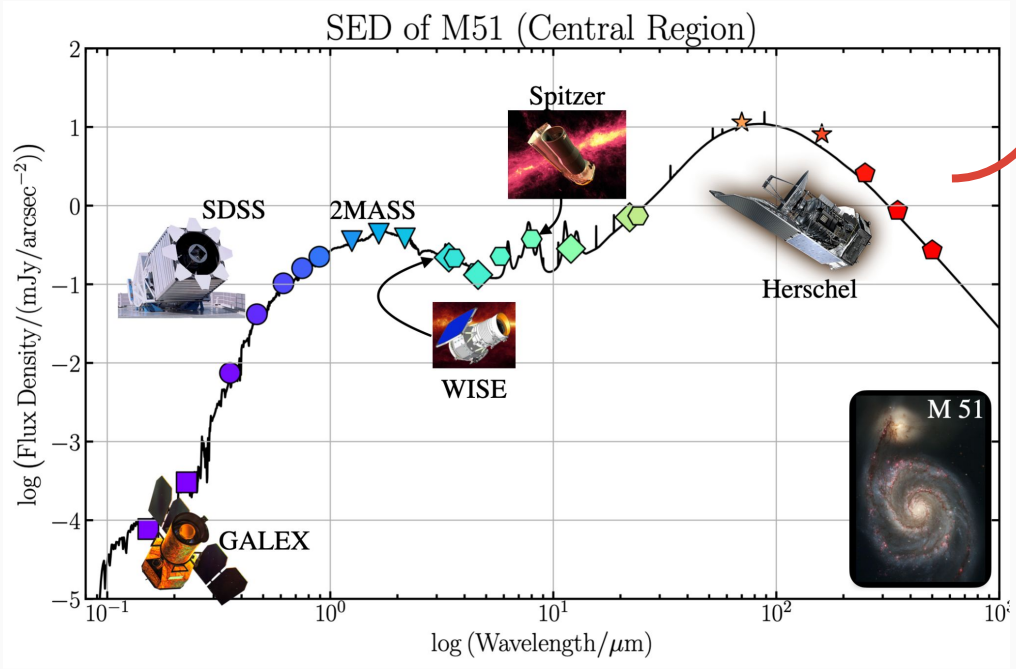
- **Jakob den Brok**
- Wilfried Mercier
- **Amy Ralston**
- Dr. Rosemary Coogan
- Soboh Al-Qeeq
- Sabrina Mordini
- Daysi Quinatoa
- Dr. Petia Yanchulova

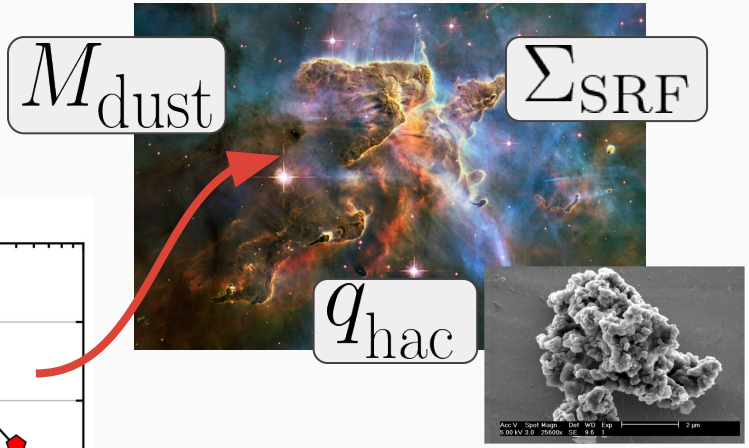
Supervisors:
Frédéric Galliano and Angelos Nersesian

DustPedia

Introduction

http://dustpedia.astro.noa.gr/

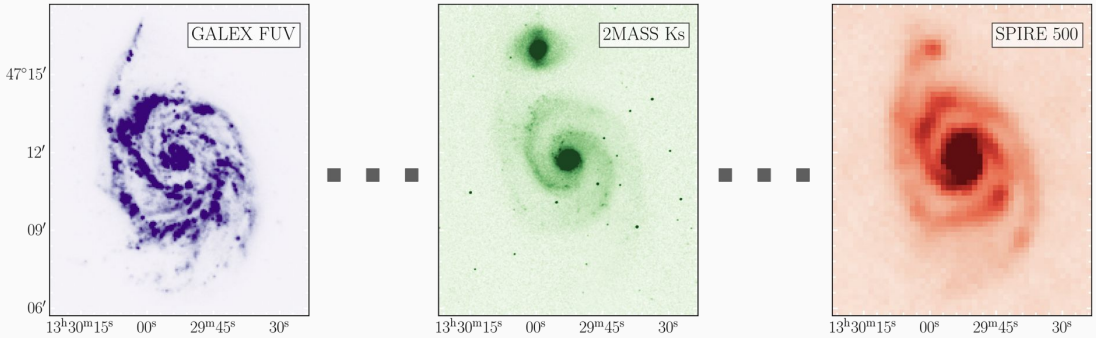




Objectives and Goals:

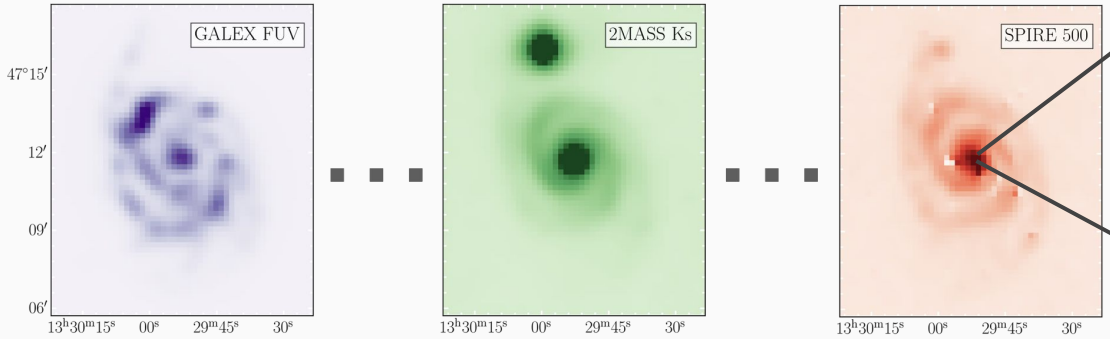
- Homogenize a heterogeneous, multi-wavelength dataset (from DustPedia)
- Perform basic SED fitting with CIGALE
- What can we infer from the resulting SED fit in terms of ISM and galactic properties?

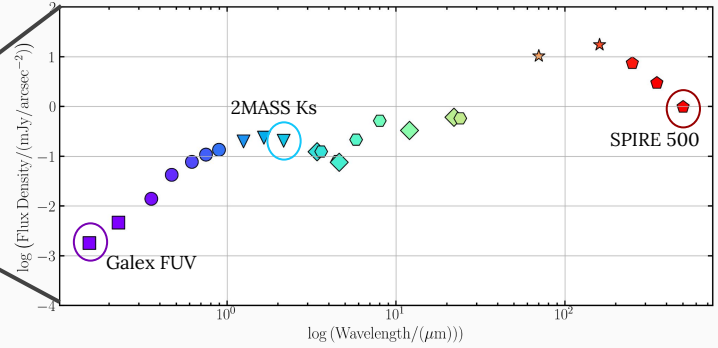
Data Preparation: Homogenize the Dataset



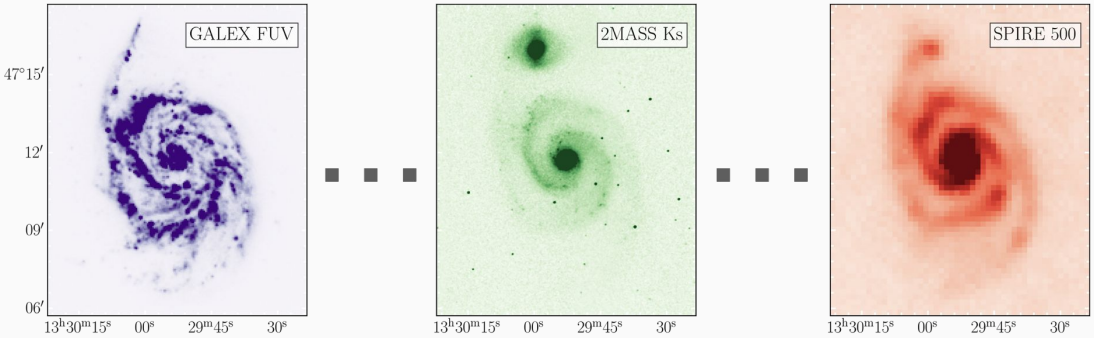
Example M51:
→ 24 observations from FUV to IR

→ Remove Background Emission
→ Mask Foreground Stars
→ Convolve to same Resolution
→ Regrid onto same Rectangular Lattice



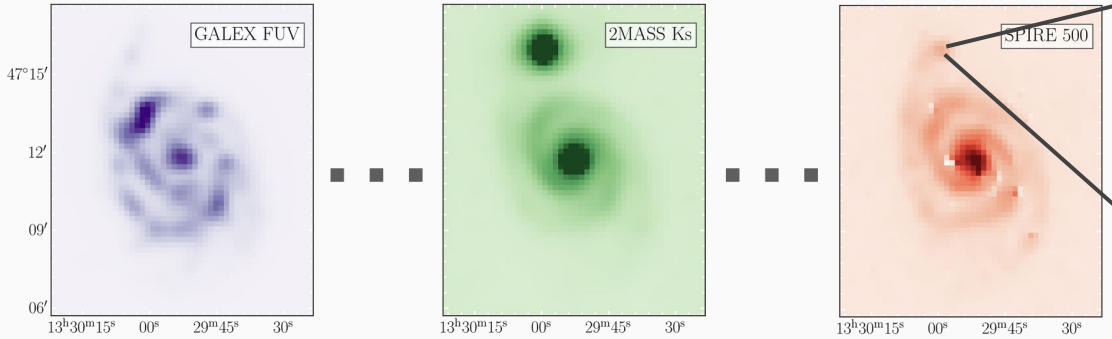


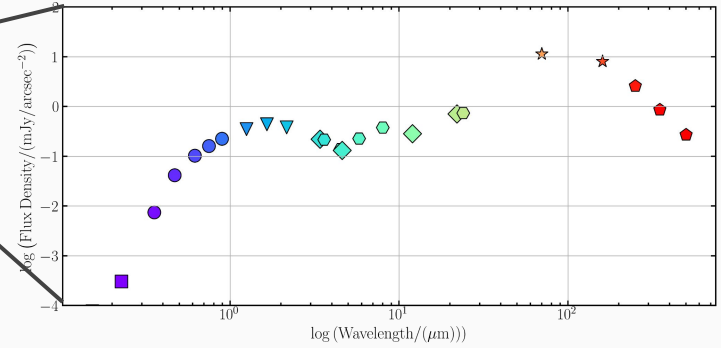
Data Preparation: Homogenize the Dataset



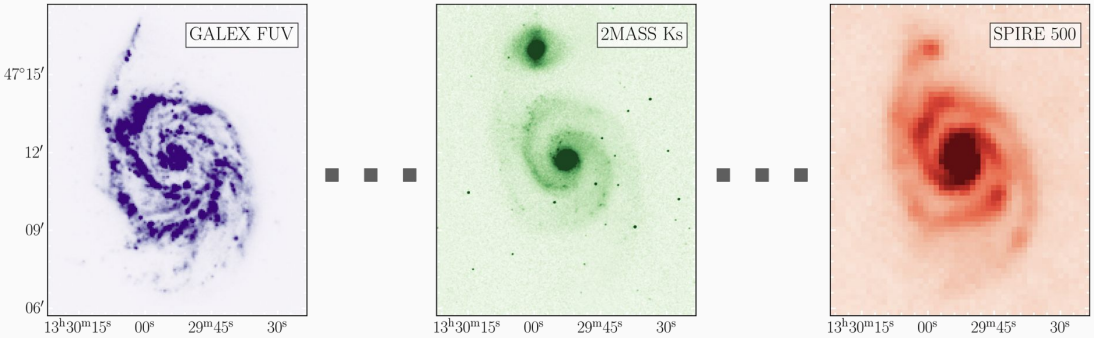
Example M51:
→ 24 observations from FUV to IR

→ Remove Background Emission
→ Mask Foreground Stars
→ Convolve to same Resolution
→ Regrid onto same Rectangular Lattice



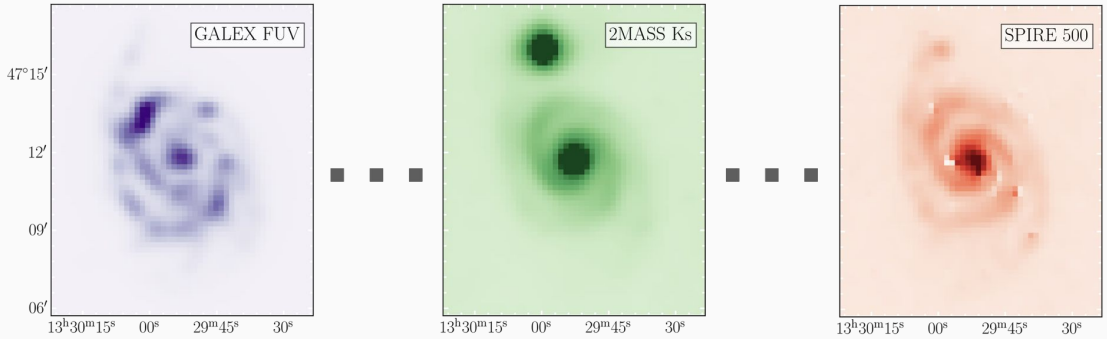


Data Preparation: Homogenize the Dataset



Example M51:
→ 24 observations from FUV to IR

→ Remove Background Emission
→ Mask Foreground Stars
→ Convolve to same Resolution
→ Regrid onto same Rectangular Lattice



Data Preparation Pipeline:
→ Pipeline for preparation of the data available on GitHub:
https://github.com/jdenbrok/DustP_Data_Prep

CIGALE† SED Fitting

# id	redshift	herschel.spire.PSW	herschel.spire.PSW_err	herschel.pacs.160	herschel.pacs.160_err	WISE2	WISE2_err	sdss.rp
7	0	-0.0642283673721308	0.22360498706434595	-0.01466351171721105	0.24143189396842538	0.027858760182973605	0.0009915818097688887	0.043243567505079857
8	0	-1.044671141214087	0.25994889972806323	-0.18877028644407207	0.257295556540211	0.029816024329646657	0.0010777899955251467	0.05494362013831894
9	0	-1.1187191081251573	0.23637251162918874	0.17210641438834182	0.219546564887928	0.03409814806501616	0.0013086028579682998	0.06620909575649135
10	0	-0.030472161952243396	0.21610620675933687	1.072887442098914	0.240222082512084	0.042135396080834116	0.0016303466867248753	0.07302507610844816
11	0	1.6779650706578466	0.2797652744336913	3.5014762172446954	0.29259145120573216	0.05133607210283393	0.0018770063845047718	0.0746350377710682
12	0	2.8473263531848034	0.3162304914512995	5.84898563669031	0.43020415148906704	0.05655243621053367	0.0019623949992851586	0.07248288417394613
13	0	2.6121508799990525	0.311272176428814	6.2142090253190165	0.5482800365594693	0.05309176318666936	0.0018193200668210707	0.06687792866014516
14	0	1.2057262353572091	0.2642214841169735	4.448442068055052	0.5481367230558747	0.04253790045104528	0.0014592915303126676	0.05810649470739182
				2.9600820023192638	0.4570148942712467	0.03217276426983114	0.0011220191221795902	0.04836781050779694
				2.807796066619655	0.34986397085182375	0.026220474806004417	0.0009248931575017622	0.0396240494866817
				2.789971750337297	0.3861339929323407	0.02289817804404877	0.0008263726773990152	0.03219610703784284
				1.9675217356318488	0.4693779635044269	0.020180743329299908	0.0007724744418416276	0.026329023608496406

`pcigale-filters list` to show available filter names

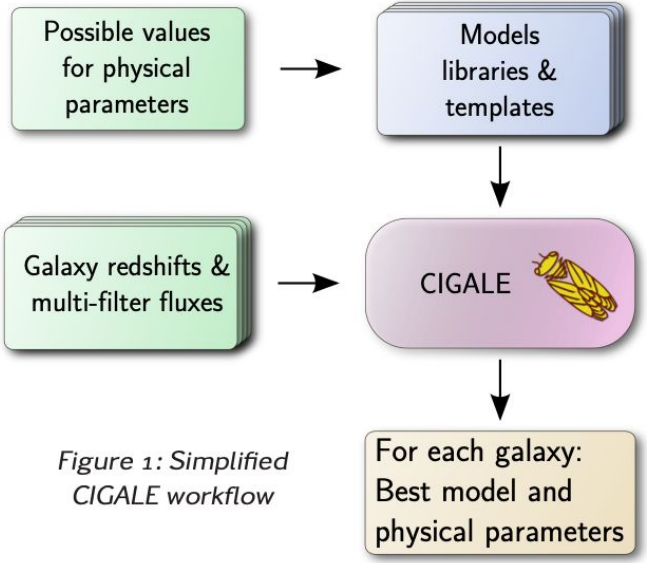


Figure 1: Simplified CIGALE workflow

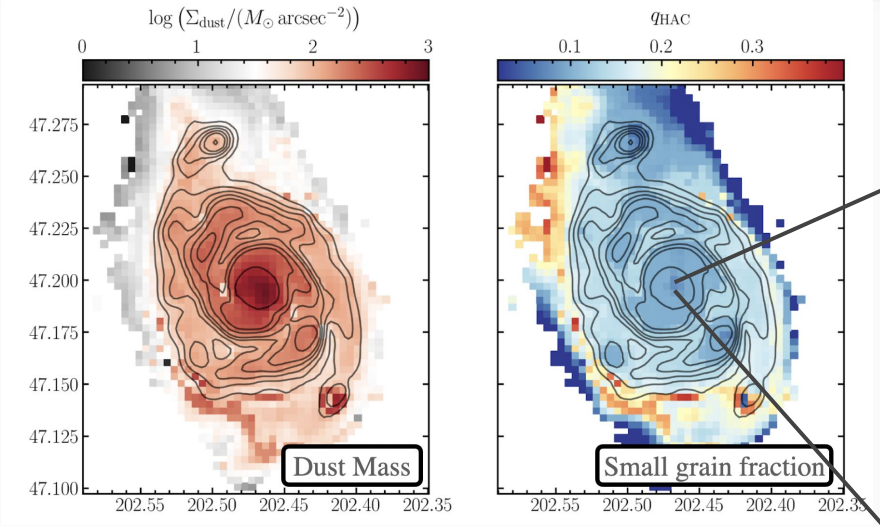
Roehlly Y., Burgarella D., Buat V. et al. ADASS XXI, 2011

Main commands:

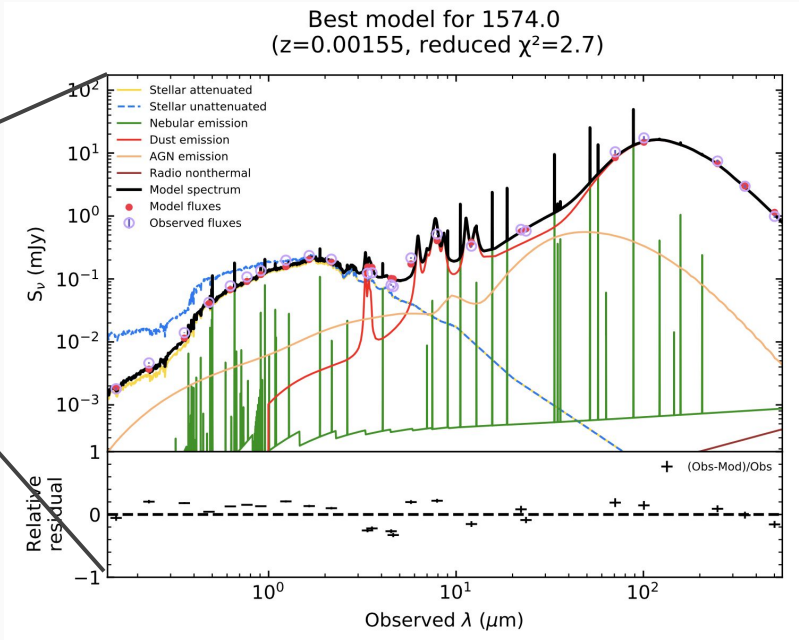
1. **`pcigale init`** : *generate an init file*
   - Fill it in by hand, provide modules, flux file, etc.
2. **`pcigale genconf`** : *transform the init file into a CIGALE conf file*
   - Provide grid values for each module
3. **`pcigale check`** : *checks validity of conf file, prints number of models*
4. **`pcigale run`** : *launches cigale (~100-300 models/s/thread)*

†https://cigale.lam.fr/ [Boquien et al. 2019]

Results



Central Region of M51

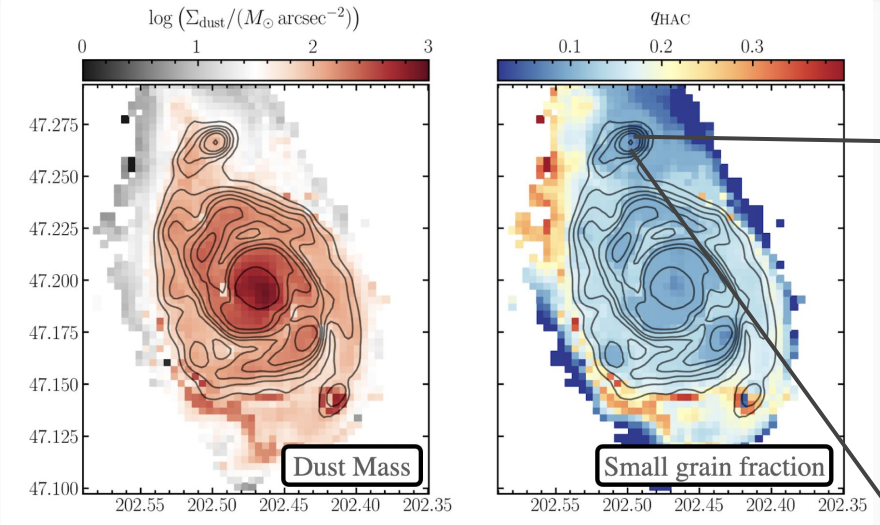


Result:

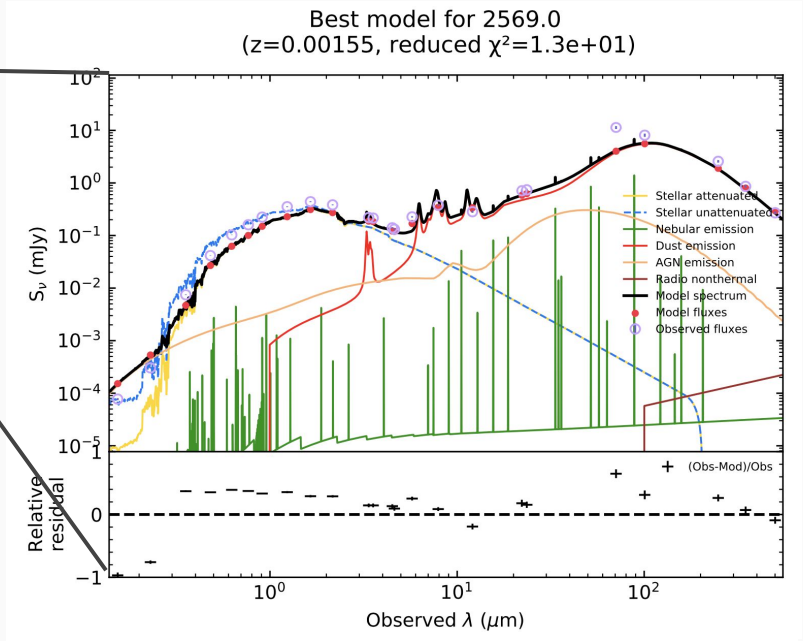
→ Get SED fit for every single pixel

→ Can study spatial variation of dust properties across the galaxy.

Results



Central Region of Companion

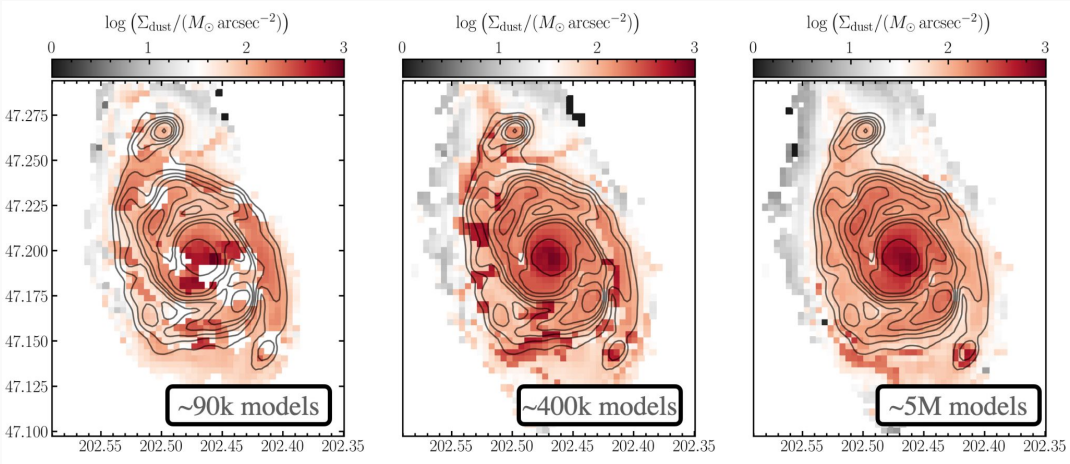


Result:

→ Get SED fit for every single pixel

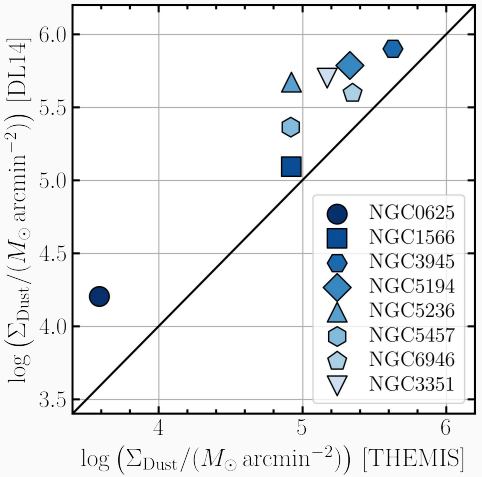
→ Can study spatial variation of dust properties across the galaxy.

Results: *Impact of Model Resolution and Model Selection*



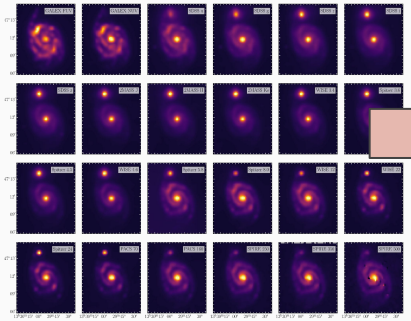
Different Model Resolution:
→ Increasing the number of SED models fitted has an effect on the resulting inferred galactic properties

Dust Model Selection:
→ Choice of dust model affects the resulting inferred galactic properties

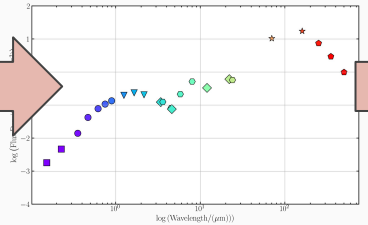


Summary

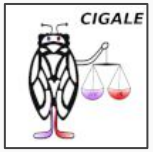
1) Process Data



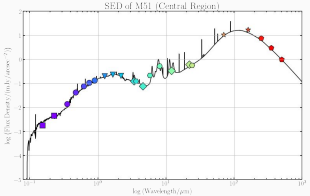
2) Combine Dataset

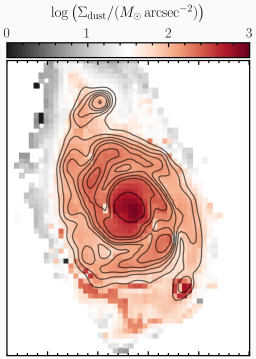


3) Run Cigale



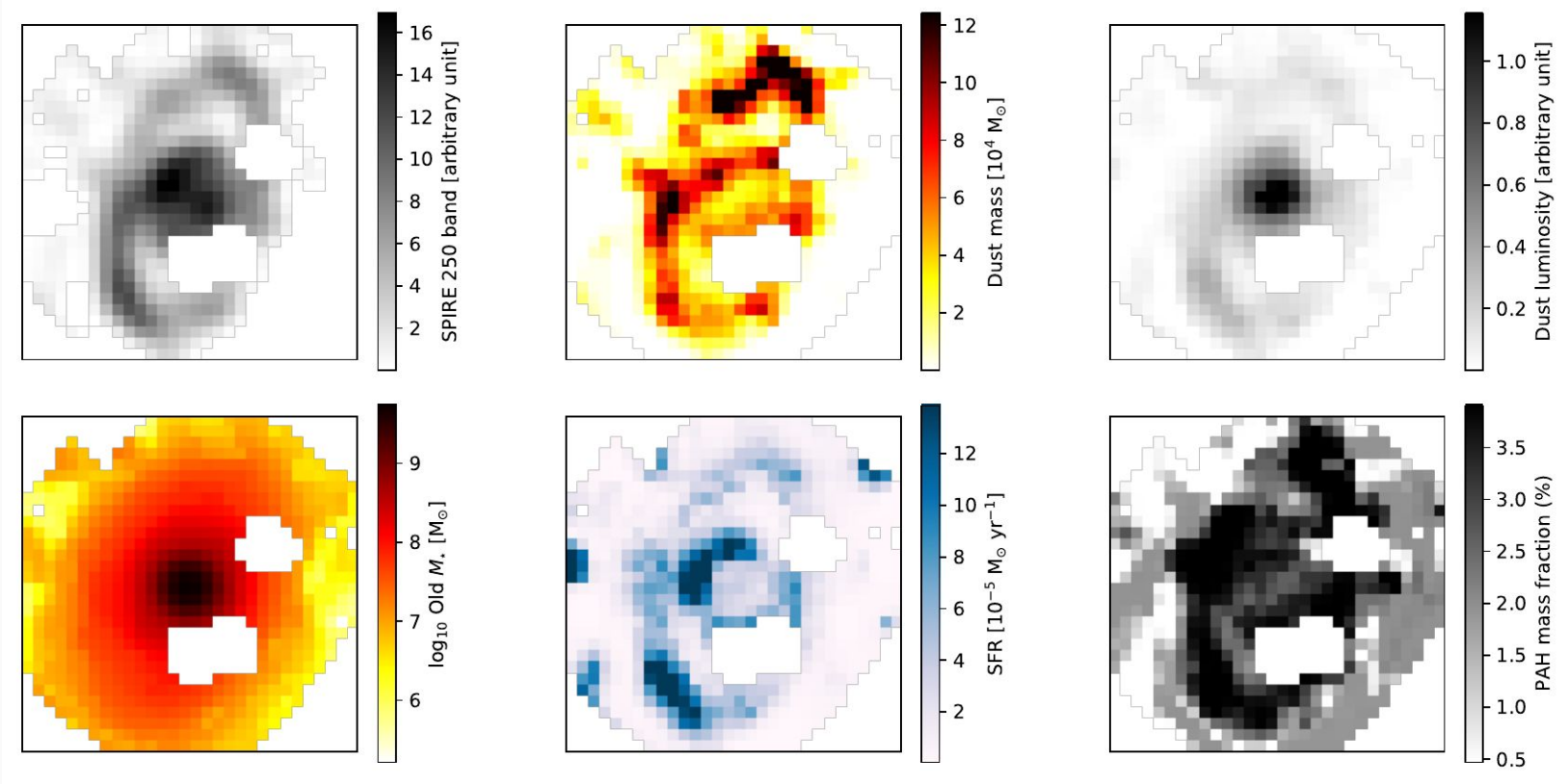
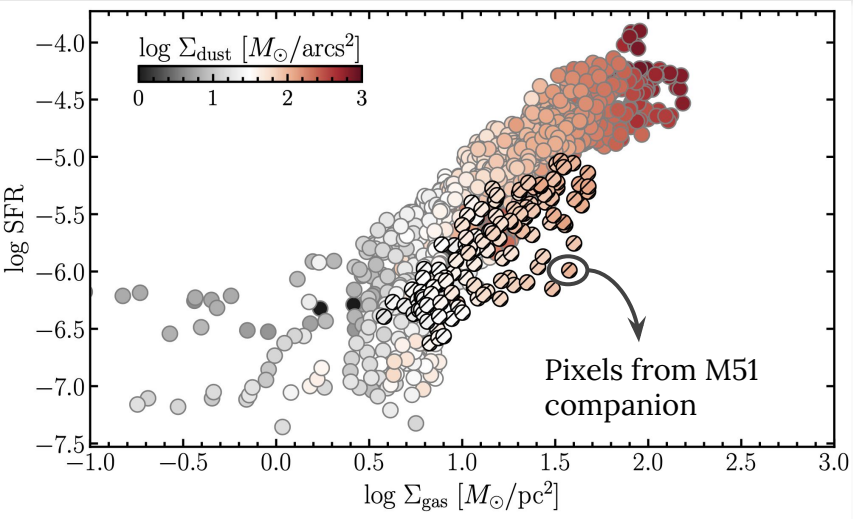
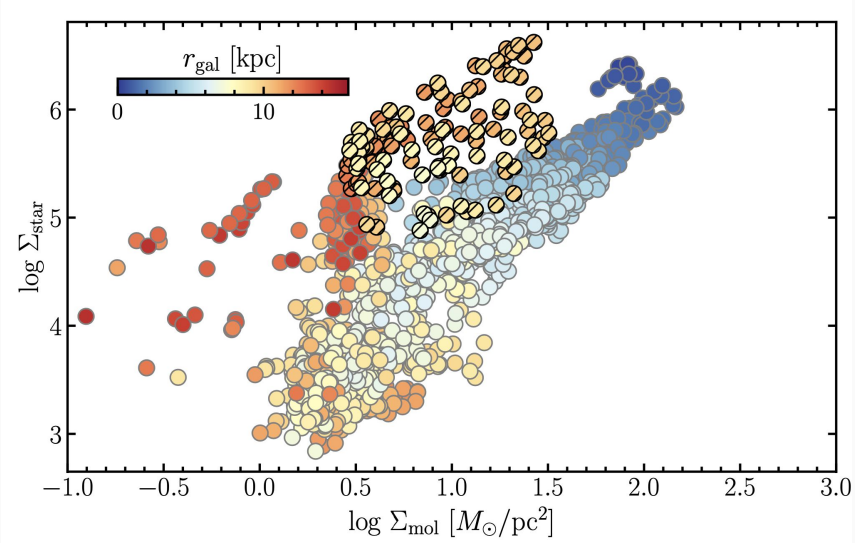
Result: SED fit and inferred values





- Pipeline for Data-processing provided on GitHub: https://github.com/jdenbrok/DustP_Data_Prep
- By fitting individual pixel → Can study spatial variation of galactic properties.
- Model selection and the resolution of the model can have non-trivial impact on the inferred quantities.

Appendix: Resolved properties for NGC3945



Appendix: Scaling Relations in M51 (NGC 5194)