Characterizing Nearby Galaxies with CIGALE

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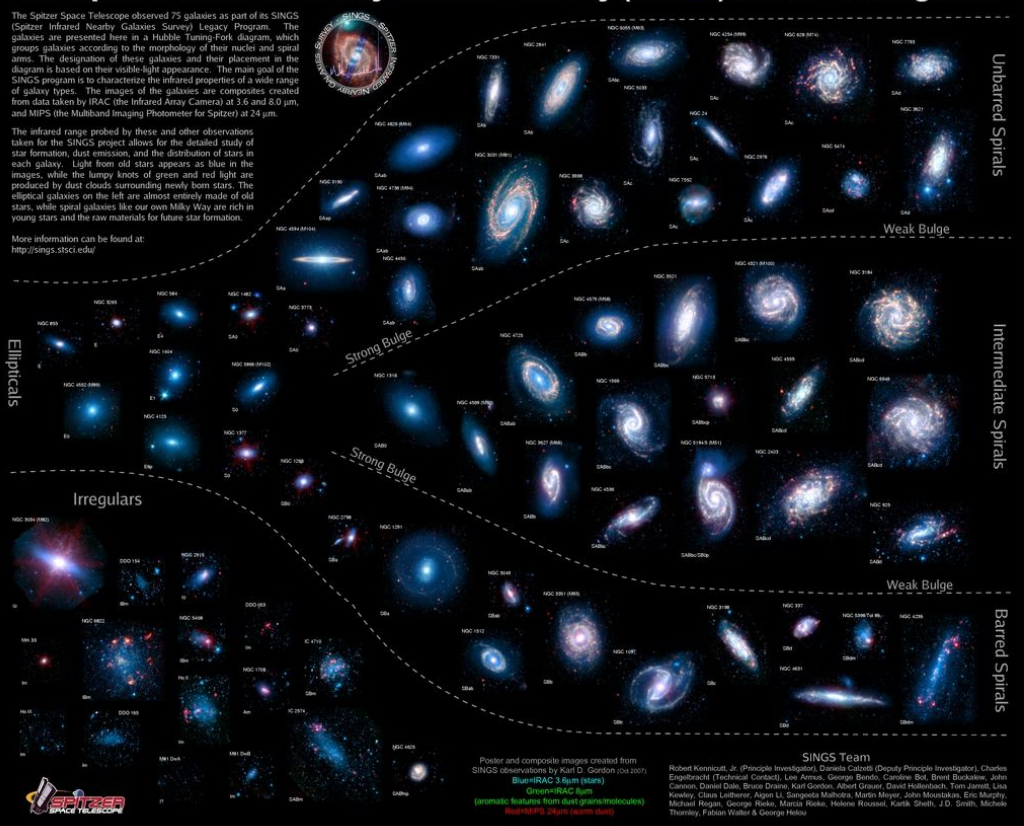
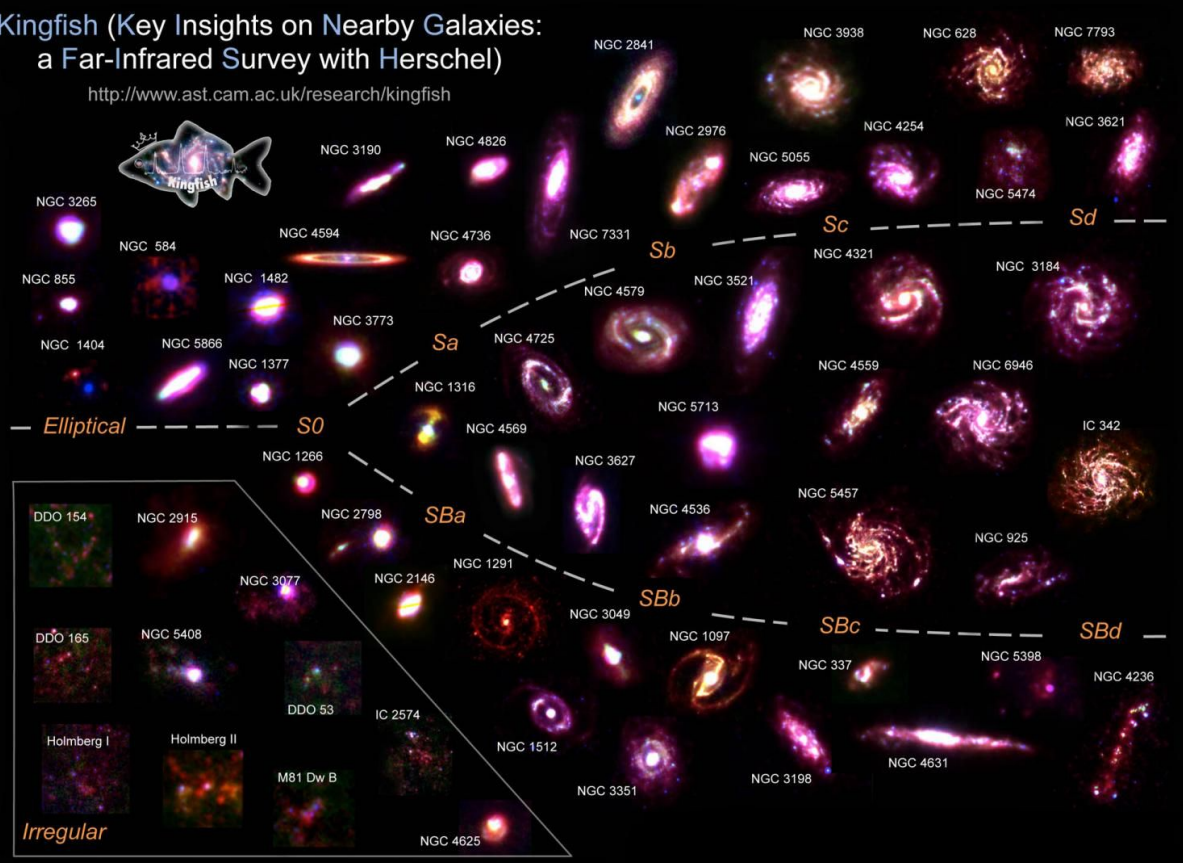
Sample: SINGS and KINGFISH





Sample: SINGS and KINGFISH

SINGS

The Spitzer Infrared Nearby Galaxies Survey

survey: Kennicutt et al. (2003)

spectra: Moustakas et al. (2010)

KINGFISH

The Key Insights on Nearby Galaxies: a Far-Infrared Survey with Herschel

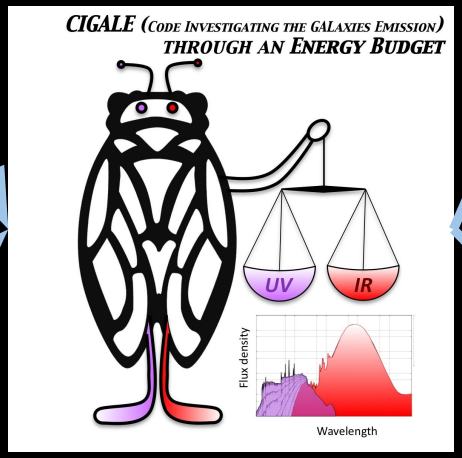
survey: Kennicutt et al. (2011)

Integrated properties and local interstellar medium (ISM) environments found in the local Universe for 61 nearby (d < 30 Mpc) galaxies

CIGALE: Code Investigating GALaxy Emission
Boquien et al 2019

Observed photometry+spectroscopy

Input Parameters:
- Redshift
- Stellar population
  - SFH and SSP
- Dust
  - Attenuation and emission
- Nebular Emission
- Metallicity
- etc



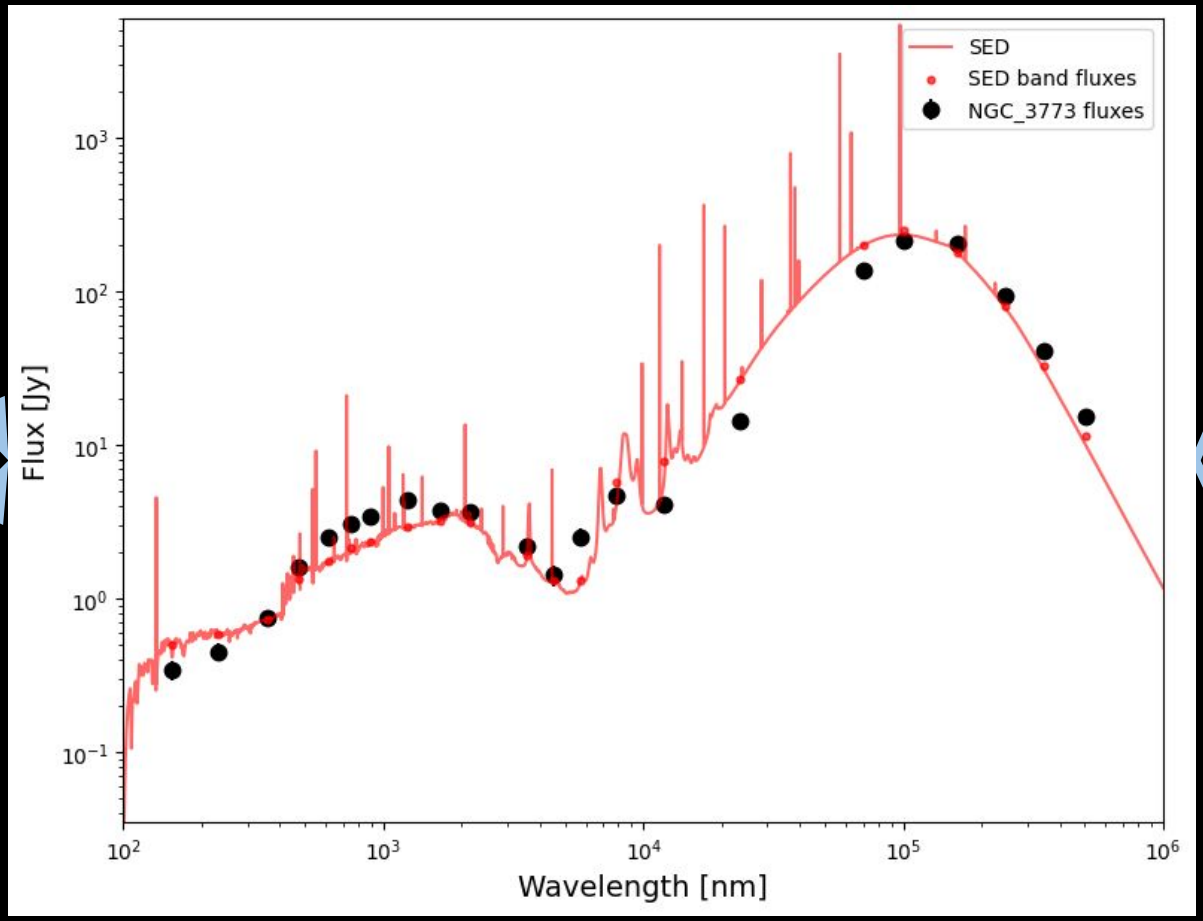
Model SED

Output Parameters:
- Best fit parameters
- Emission line flux

CIGALE: Code Investigating GALaxy Emission
Example

Observed spectrophotometry

Input Parameters



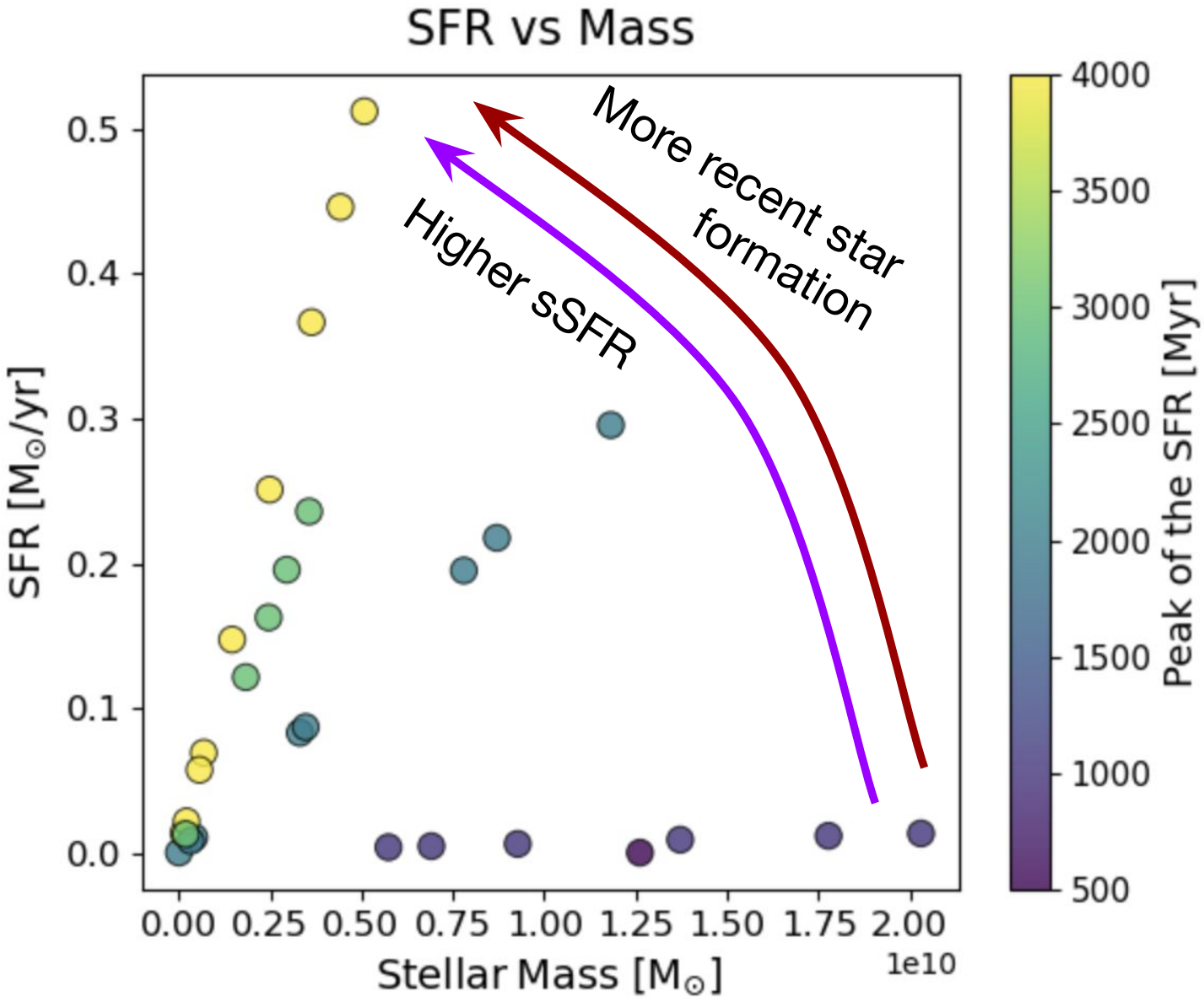
Model Spectrum

Output Parameters

Star Formation Rate vs Mass

CIGALE fits to KINGFISH/SINGS observations

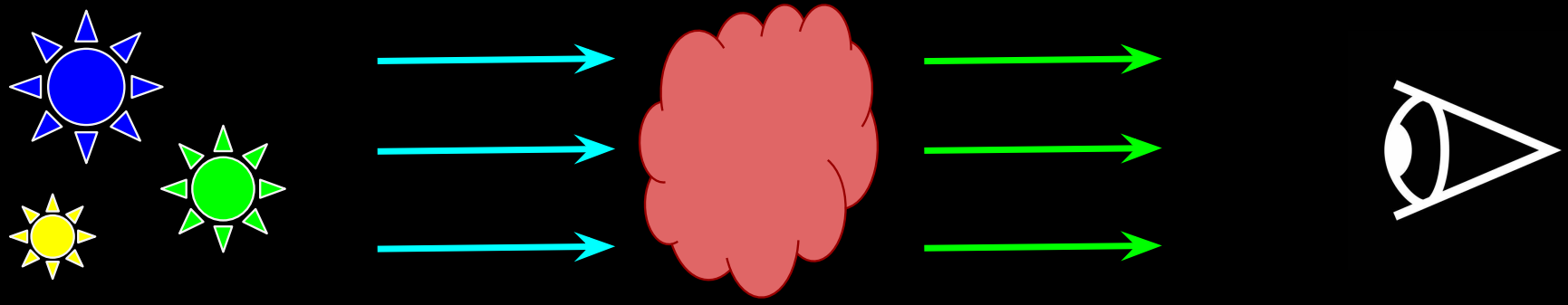
We find that there are no current starburst



Cloudy & Associates

Photoionization simulations for the discriminating astrophysicist since 1978

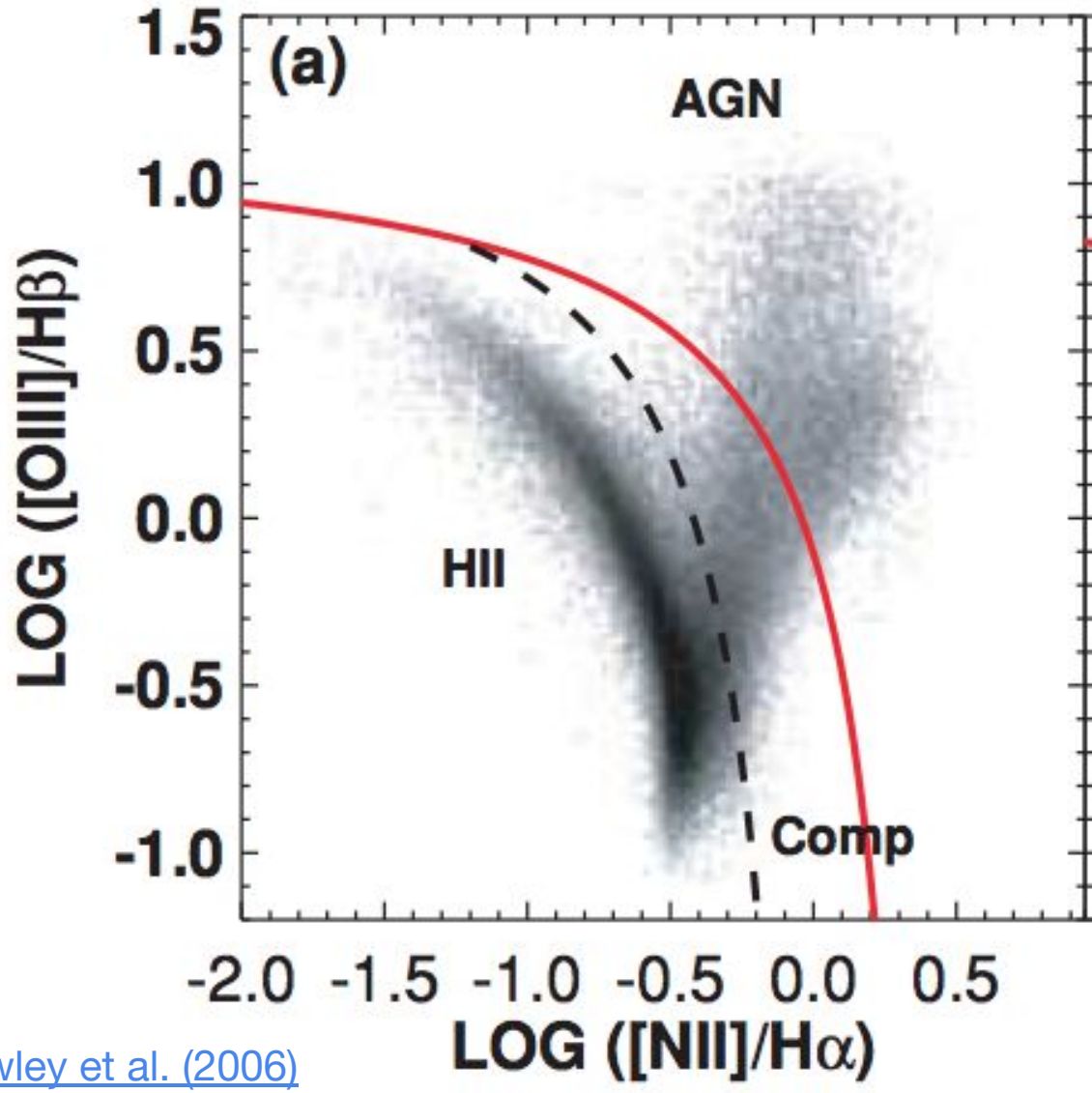
- Produces a spectrum based on input parameters (similar to CIGALE) like metallicity and ionization parameter
- Cloudy produces **emission lines** that are used in CIGALE fits



Incident SED + Nebular gas and dust = Resulting SED

BPT Diagram

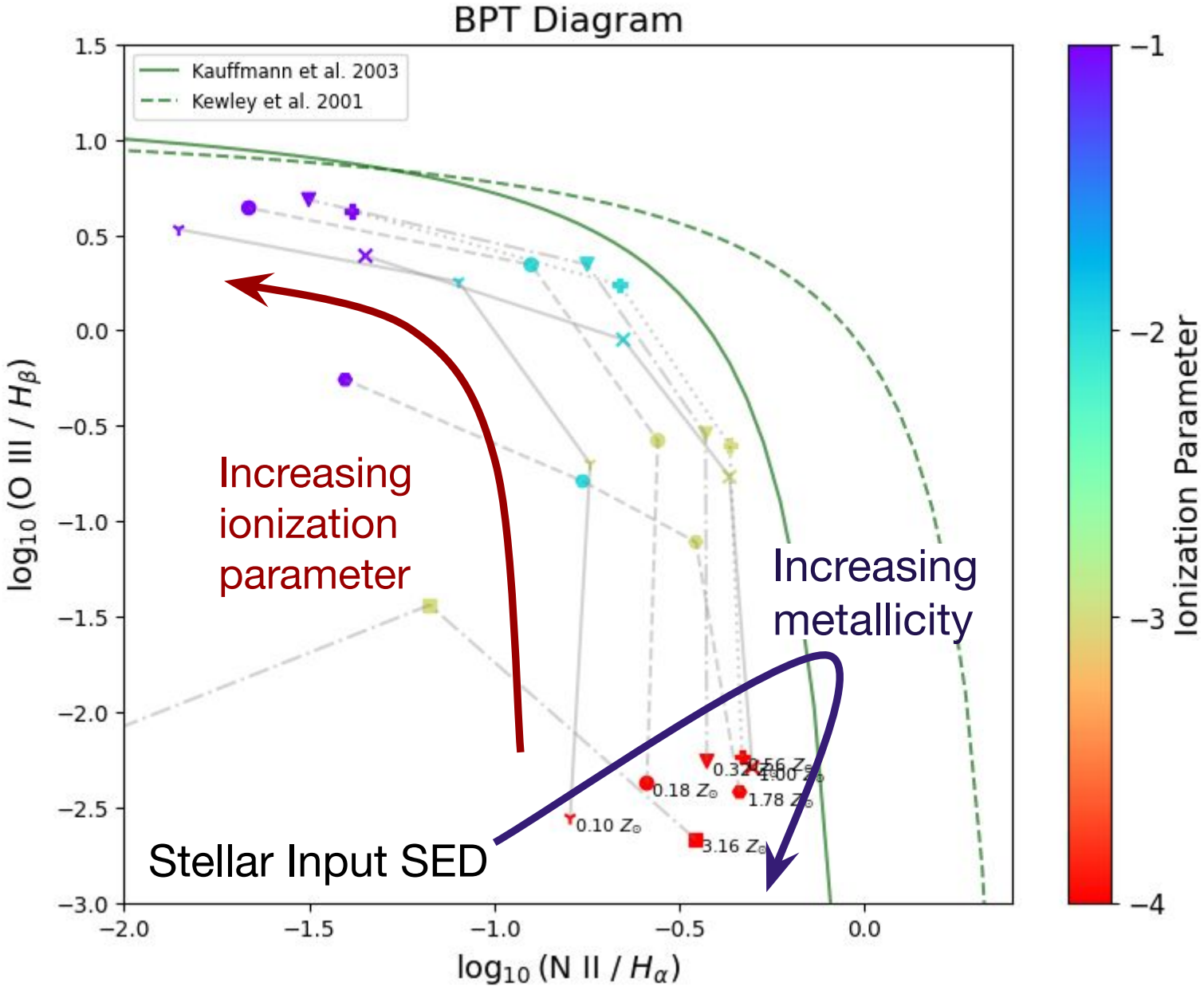
Based on placement of observations on BPT diagram, we can determine the source of ionization in nebular gas (AGN vs OB stars)



Kewley et al. (2006)

Results

We want to characterize the ionization, metallicity, density, and SED of the observations by analyzing their placement on the BPT diagram



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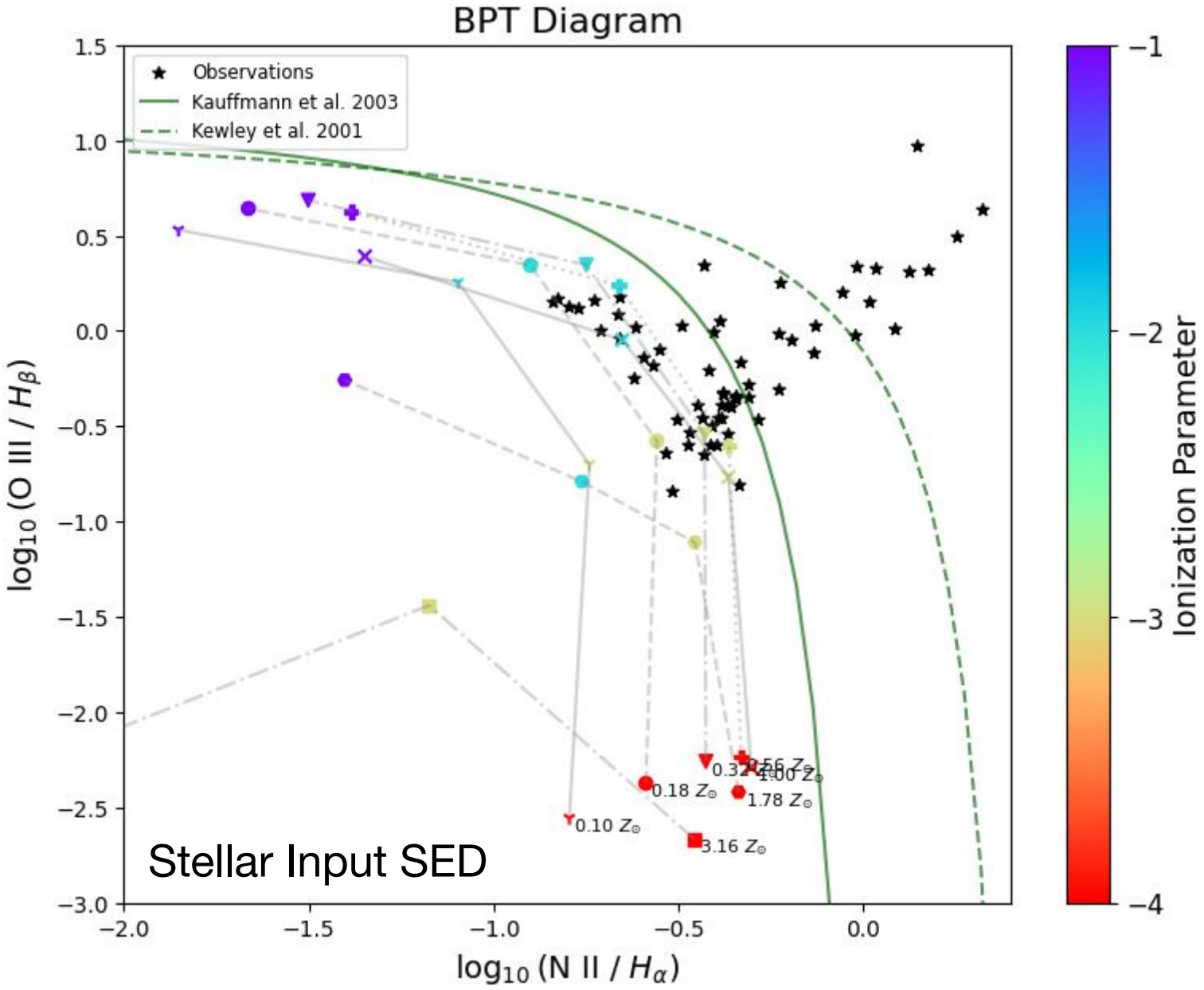
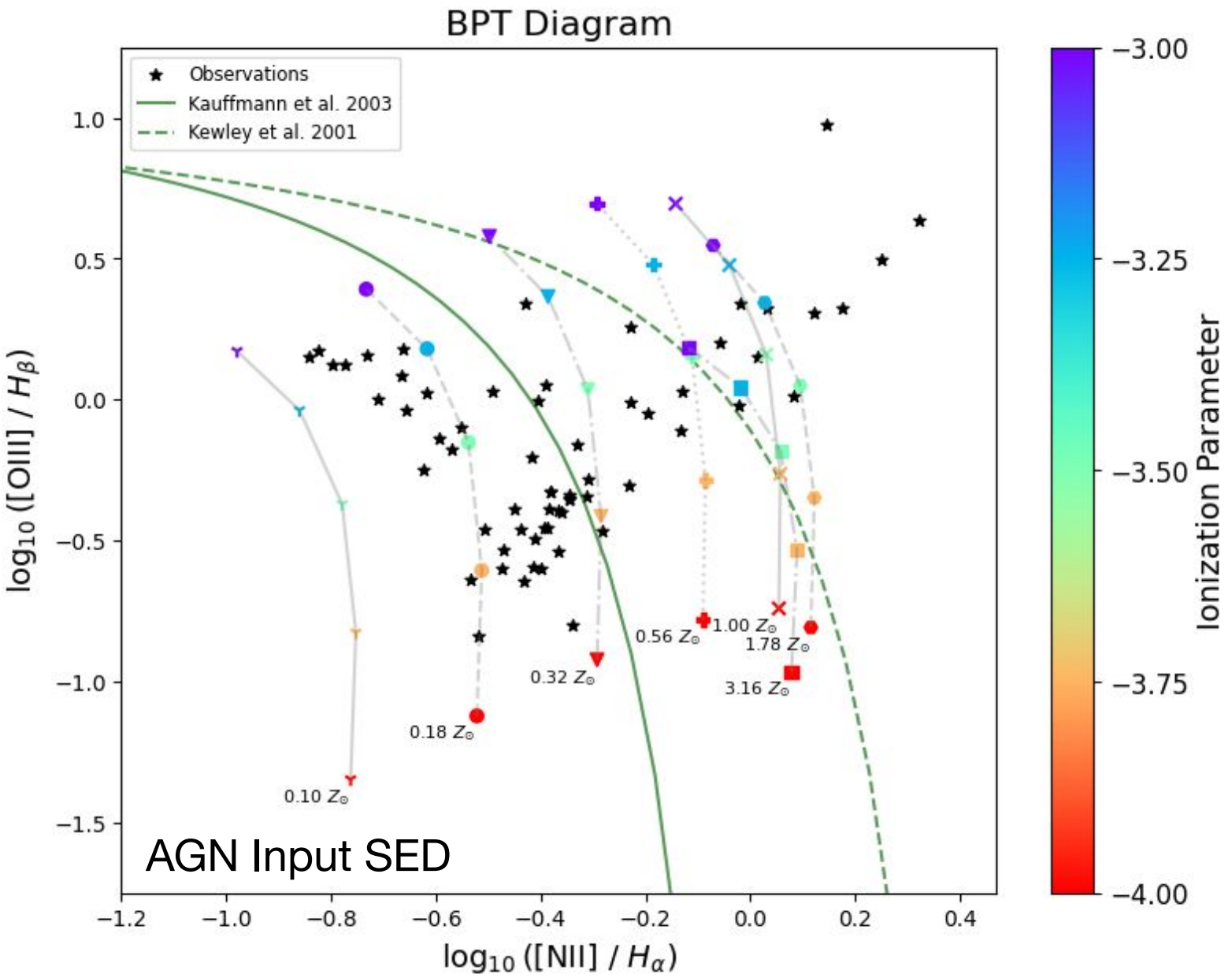


Results

We find that the KINGFISH/SINGS sample contains contributions from AGN and low (gas phase) metallicity galaxies



What have we learned?

- How to fit SEDs to spectro-photometric observations with CIGALE
- What parameters go into constructing an SED
- How to characterize nearby galaxies with SED fitting and the BPT diagram

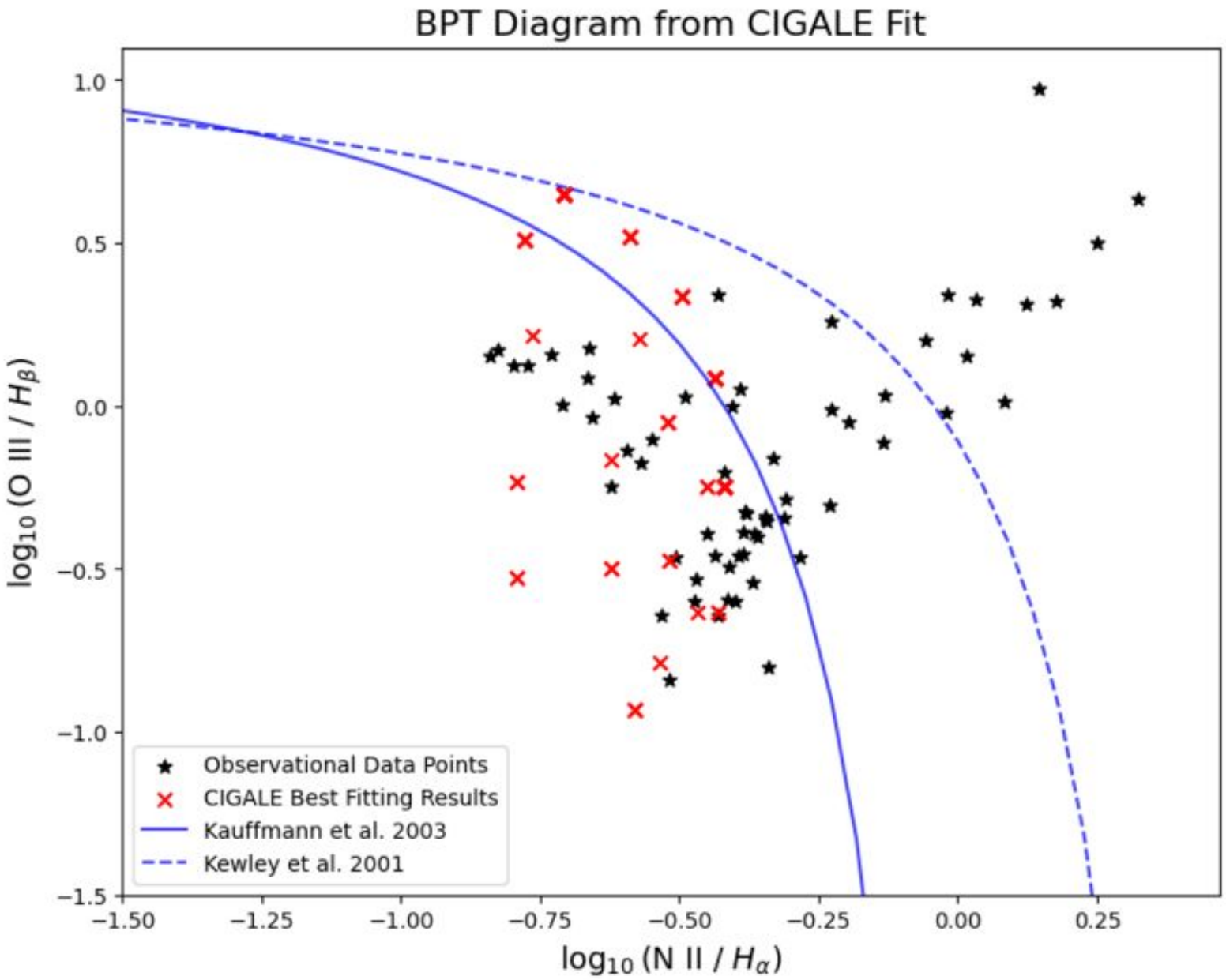
Thank you!

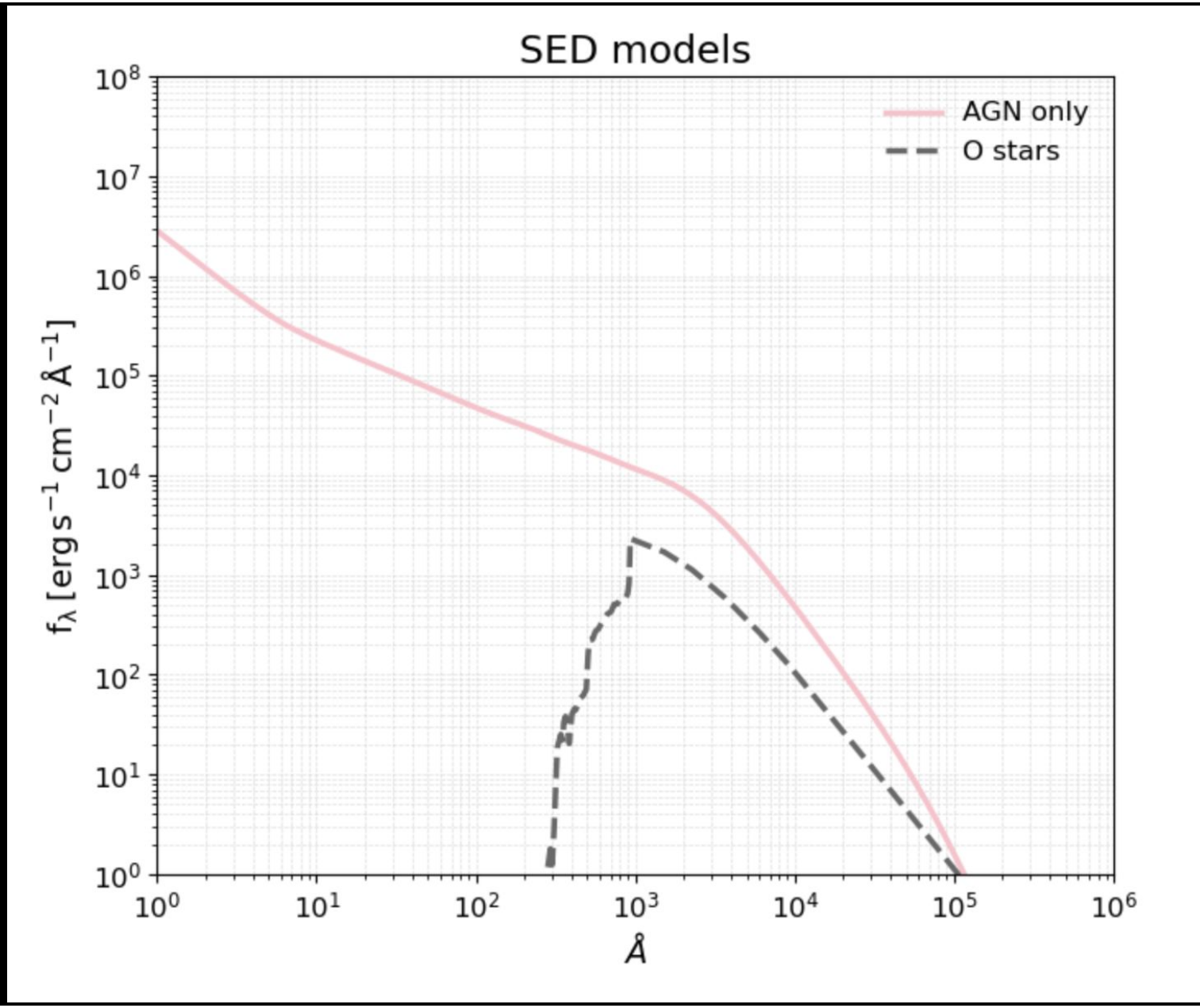
Results

Red crosses show CIGALE best fit parameters

Black stars show spectroscopic measurements

The same best fit may correspond to the multiple galaxies




SED models
AGN only
O stars
f_λ [erg s^{-1} cm^{-2} Å^{-1}]
Å
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7
10^8