

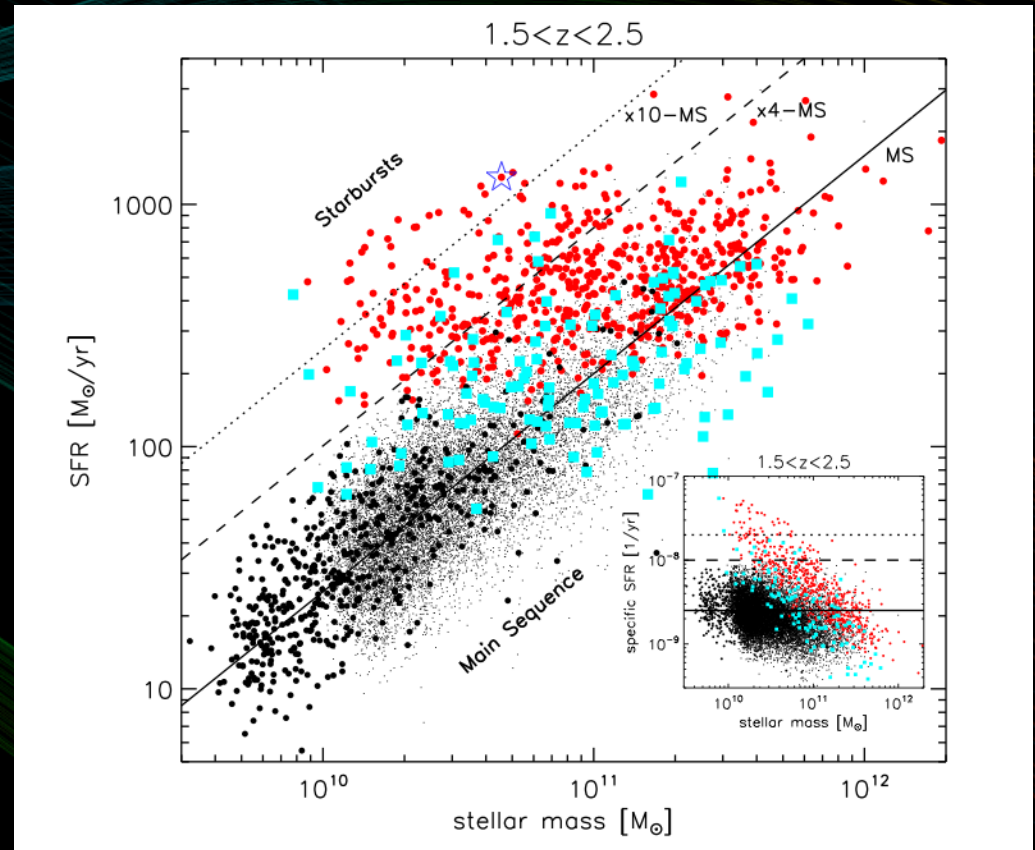
Probing the AGN - Star formation connection through the Lens of the Star Formation Reference Survey (SFRS)

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- **Fundamental galaxy properties:**
 - **Star formation rate (SFR)**
 - **Stellar mass**
- **Variety of results depending on the methods used to derive them.**
- **Where is the locus of the AGN–host galaxies in the MS plane ?**
- **Importance to set constraints and measure accurately those properties.**

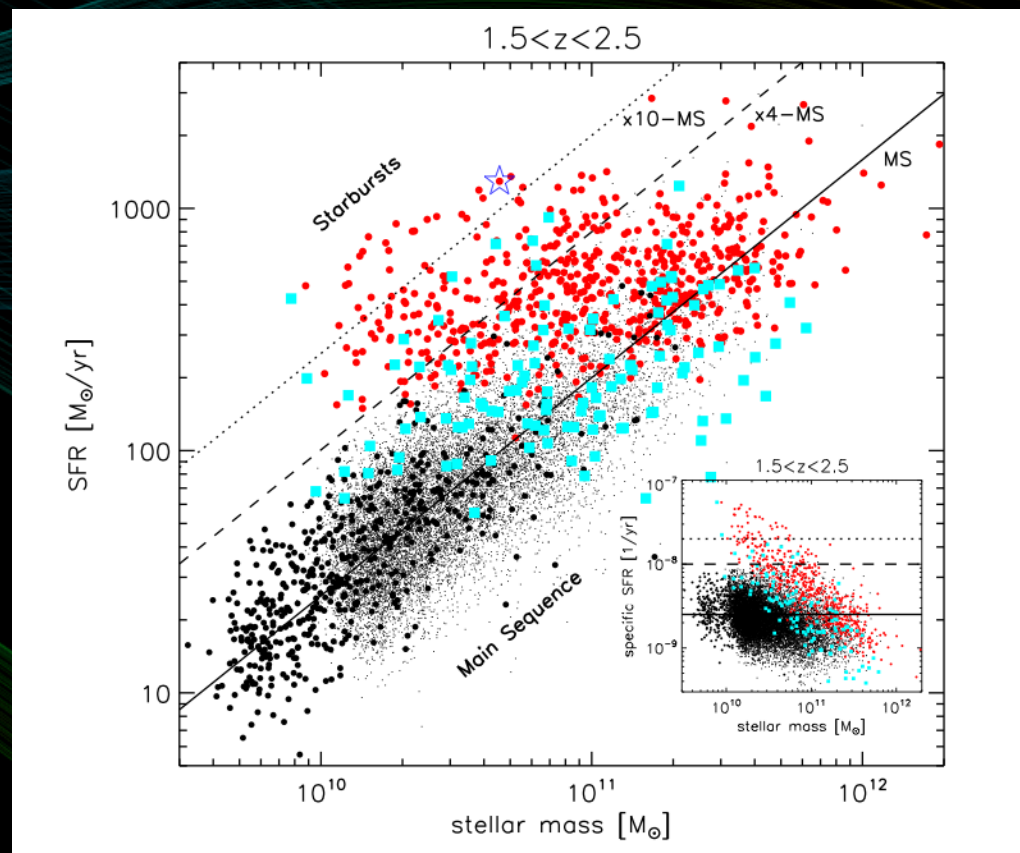
Main Sequence of Galaxies



G. Rodighiero et al. 2011

What we need:

- A well-defined sample of galaxies.
- Precise methods to identify activity types.
- Constrains on the galaxy properties.

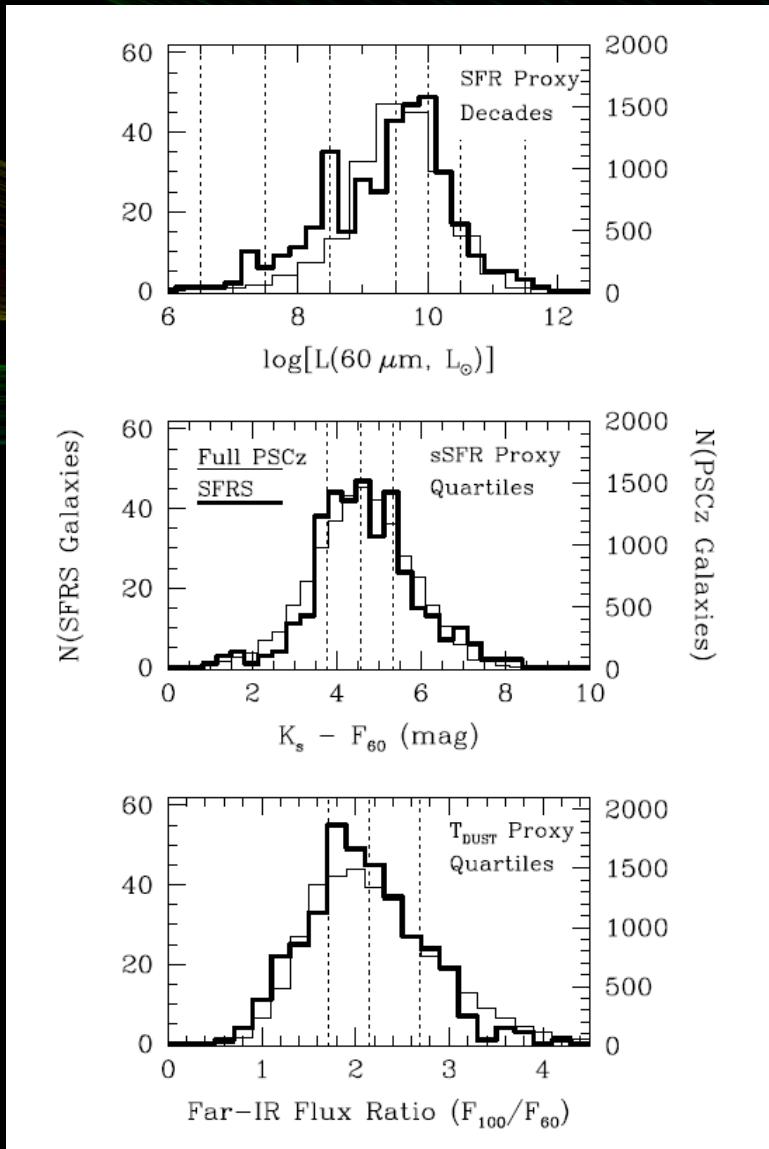


G. Rodighiero et al. 2011

The Star Formation Reference Survey (SFRS)

(Ashby et al. 2011)

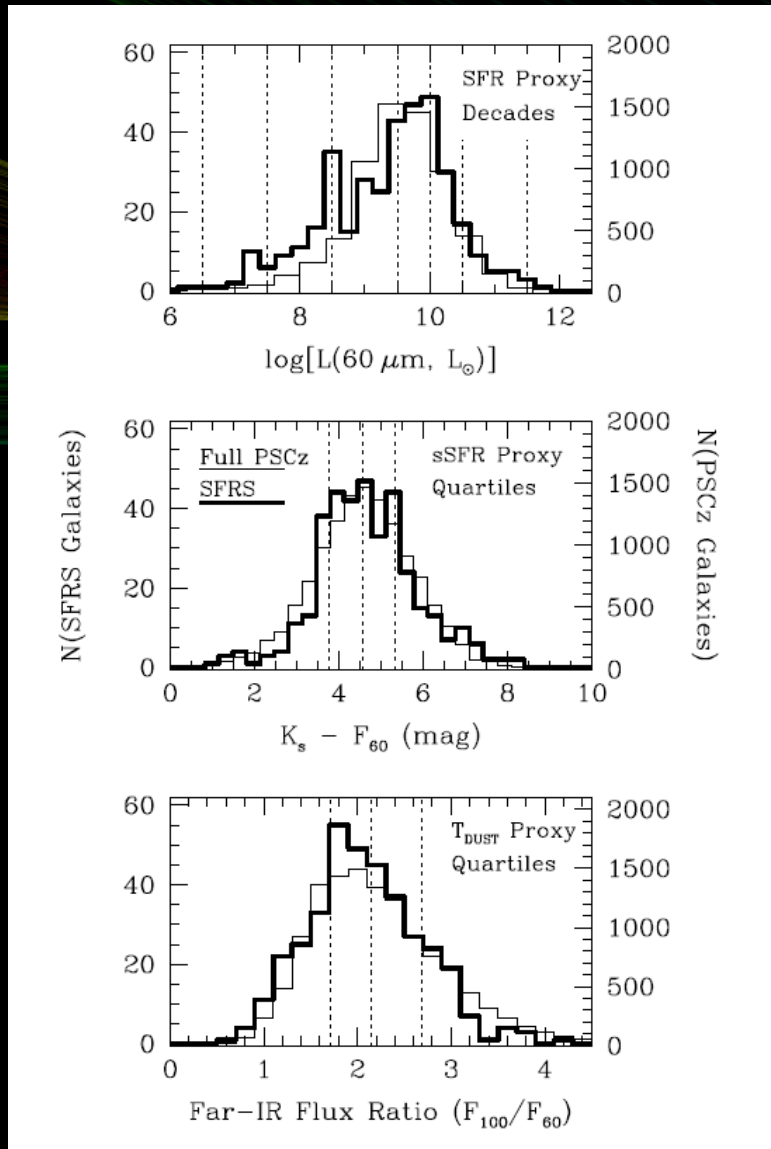
- 369 Infrared selected nearby galaxies representative of the 3D-space:
 - Star Formation Rate (SFR)
 - Specific SFR (sSFR)
 - Interstellar dust temperature



The Star Formation Reference Survey (SFRS)

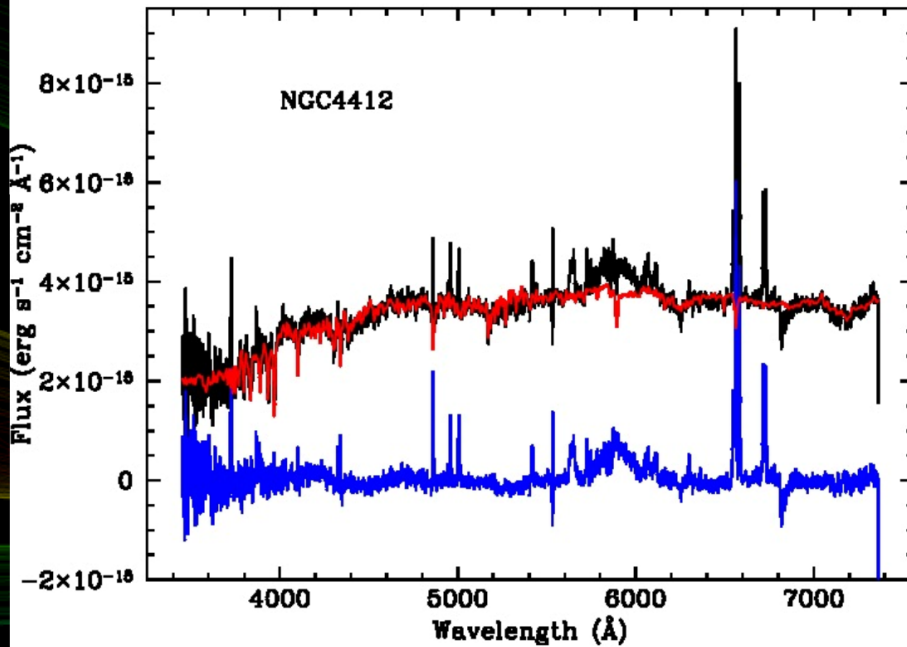
(Ashby et al. 2011)

- 369 Infrared selected nearby galaxies representative of the 3D-space:
 - Star Formation Rate (SFR)
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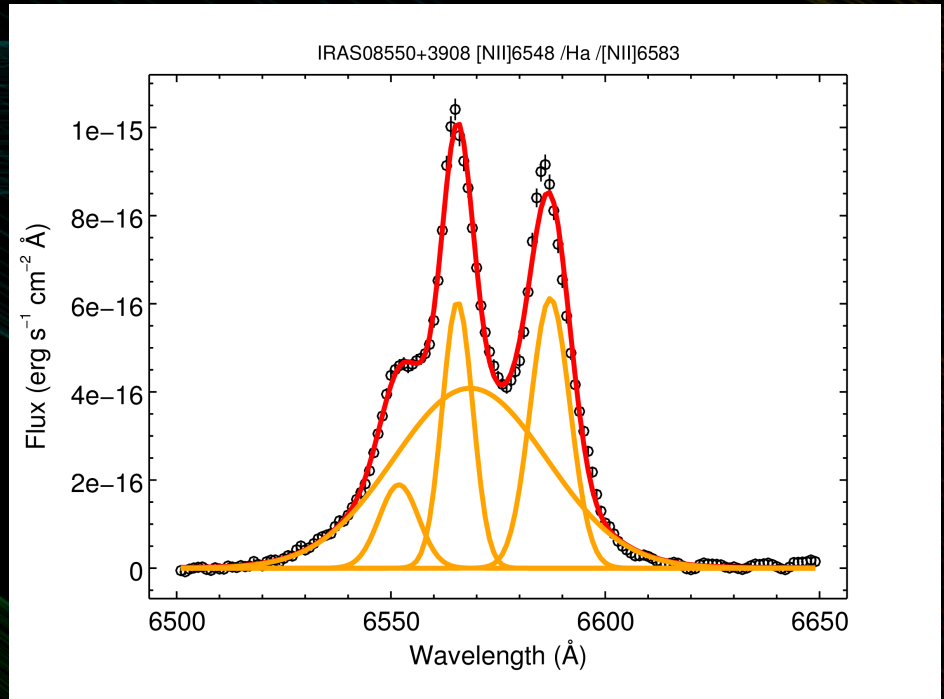
| Waveband | Observatory | Sample Coverage |
|----------------------------------|--------------|-----------------|
| 1.4 Ghz | VLA/NVSS | 100% |
| 12, 25, 60, 10 μm | IRAS | 100% |
| 24 μm | Spitzer/MIPS | 70% |
| 3.6, 4.5, 5.8, 8.0 μm | Spitzer/MIPS | 100% |
| JHKs | 2MASS | 100% |
| ugriz | SDSS | 100% |
| Optical Spectra | SDSS/FLWO | 100% |
| Ha imaging | NAOC | 30% (on-going) |
| 0.13-0.28 μm | GALEX | 90% |

Star-light Subtracted Integrated & Nuclear Spectra



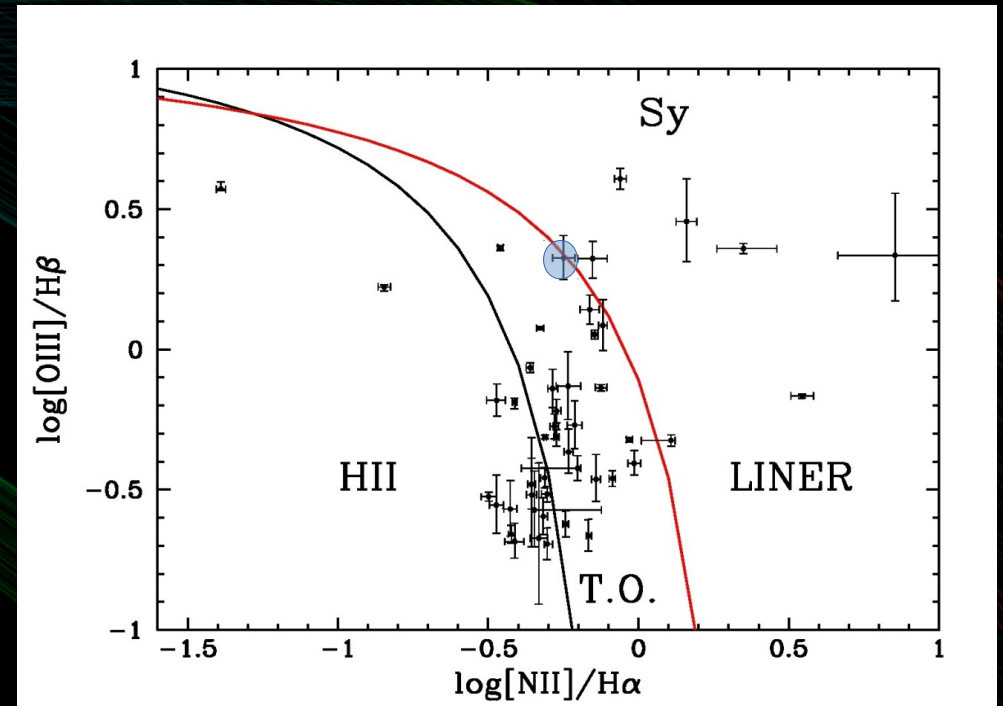
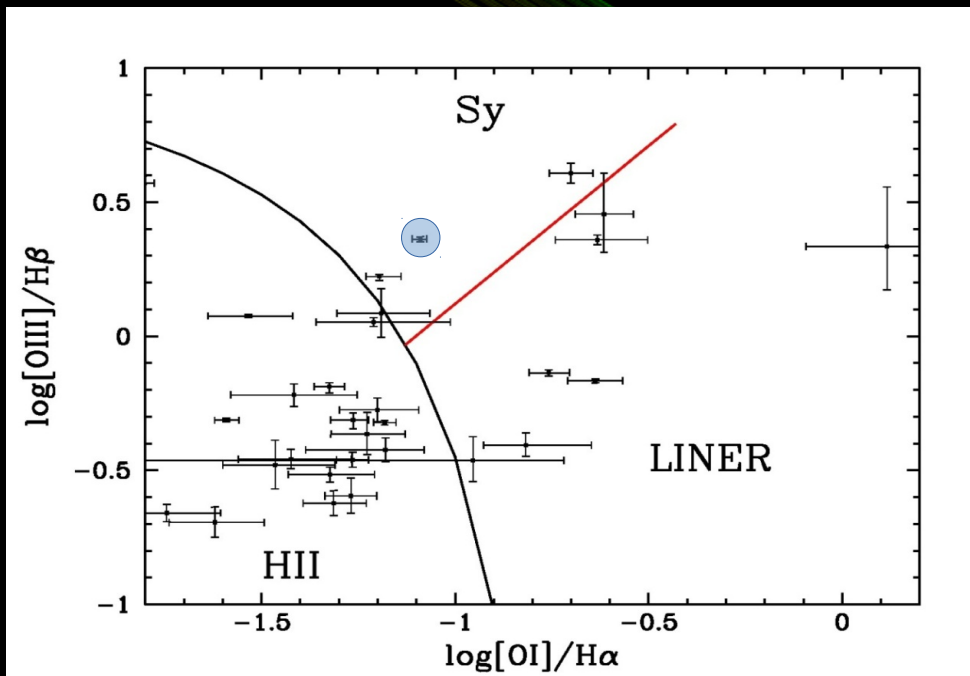
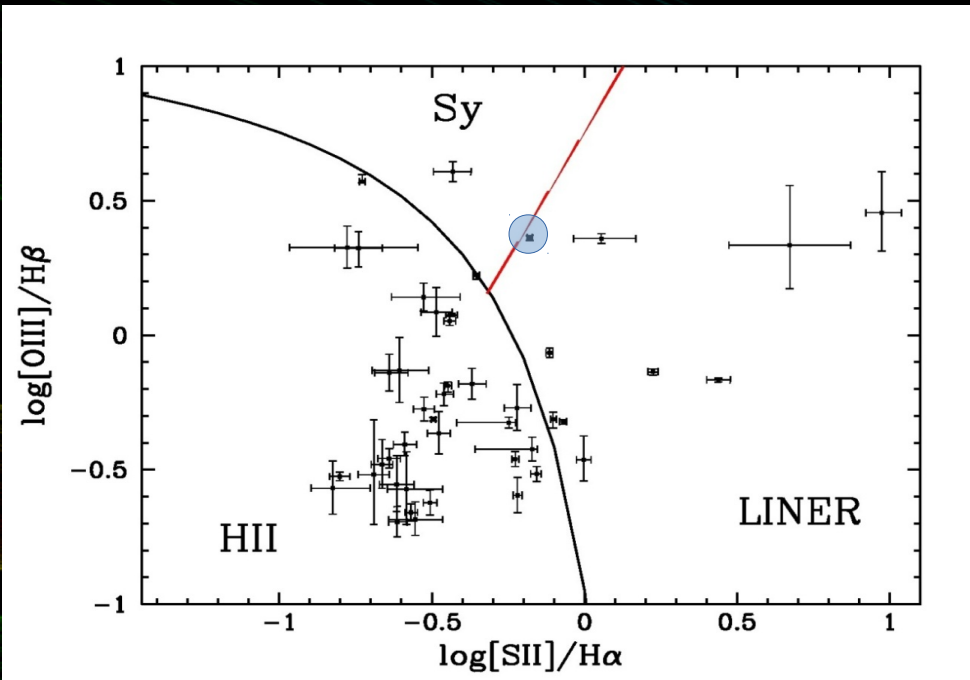
STARLIGHT code (Cid
Fernandes et al. 2005)

- Bruzual & Charlot (2003) SPS libraries
- 23 ages between 1Myr – 13Gyr
- 6 metallicities between 0.005 – $2.5 Z_{\odot}$



Multi-component fitting with
SHERPA (Freeman et al. 2001)

- Spectroscopic Activity Classification Diagnostics
- Introducing a Probabilistic Classification Scheme



Maragkoudakis et al. (in prep.)

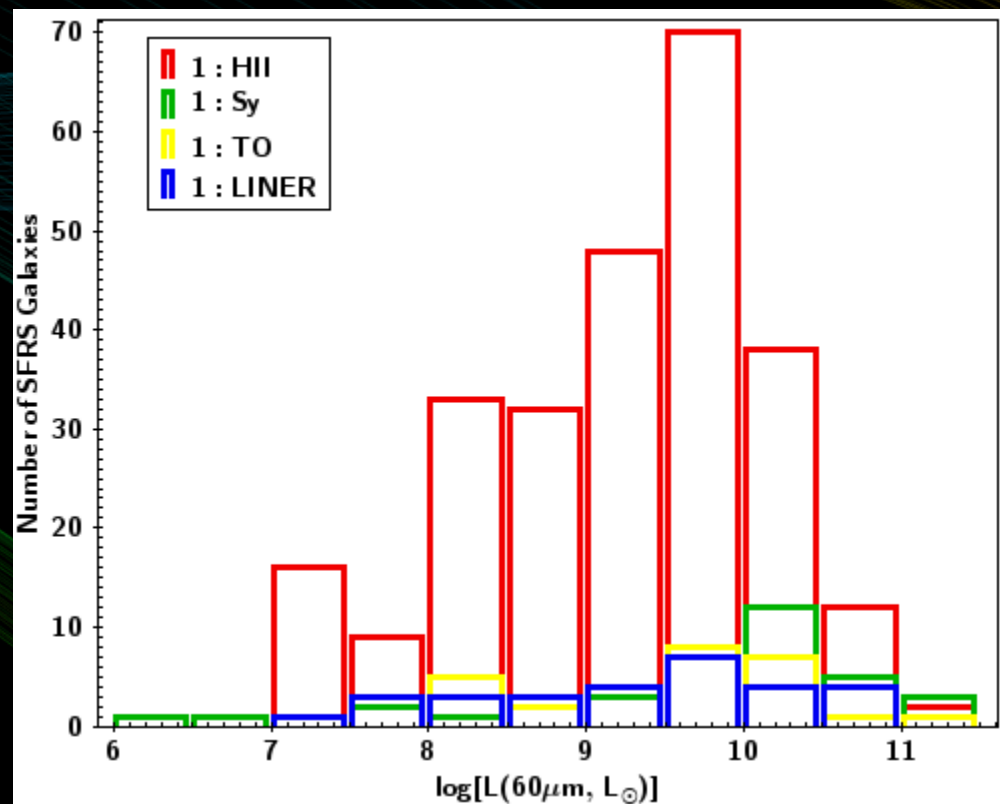
Spectroscopic Activity Classification

264 Starforming (71% of the total SFRS sample)

43 Seyfert (Sy) (12%)

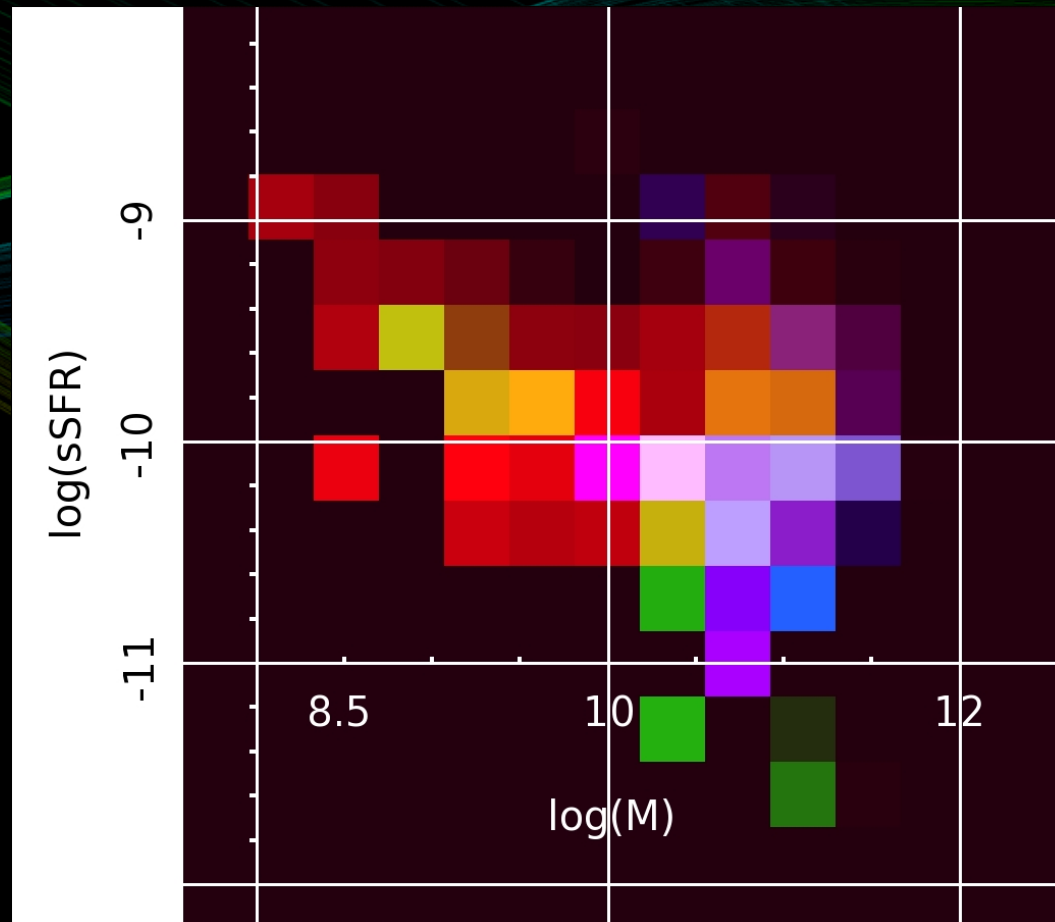
37 Transition Objects (TO) (10%)

25 LINER (7%)



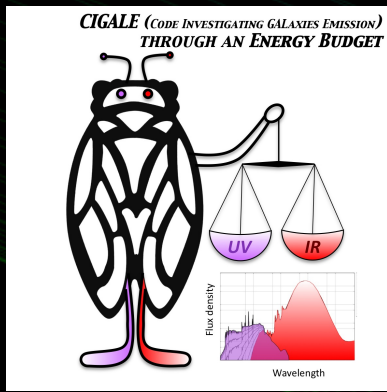
The Bi-variate sSFR – M_* Function

- Star-forming
- AGN – TO
- LINER



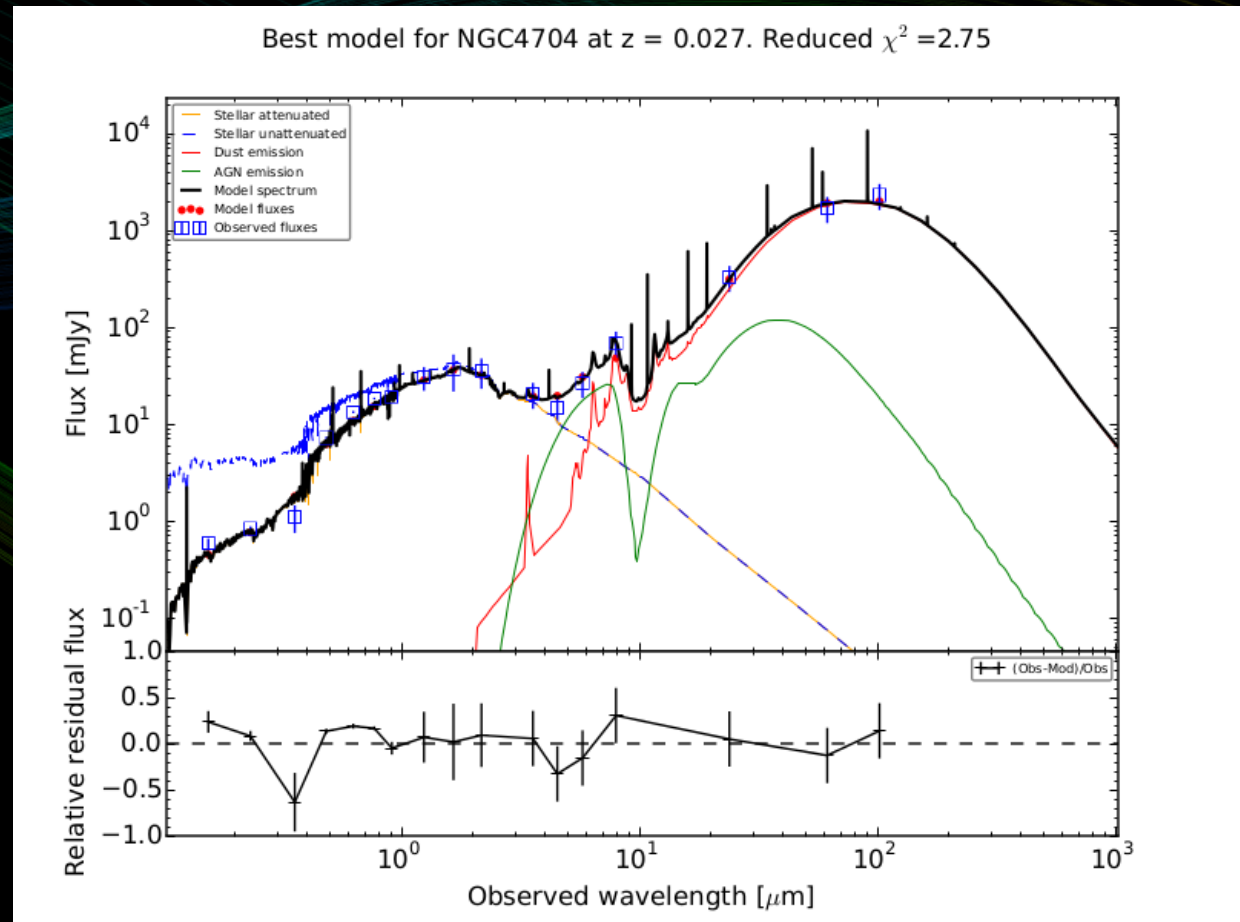
Bonfini et al. (in prep.)

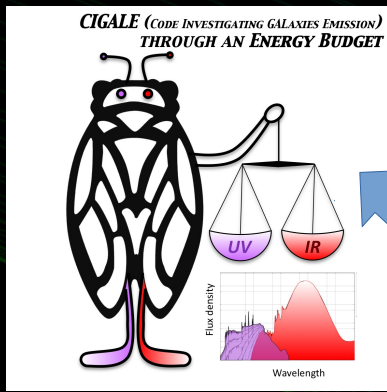
Maragkoudakis et al. (in prep.)



Using SED Fitting to Derive the AGN Fraction

- Double-exp / delayed SFH
- Bruzual and Charlot (2003) SPS libraries
- Dale et al. (2014) two component IR models
- Fritz et al. (2006) AGN models

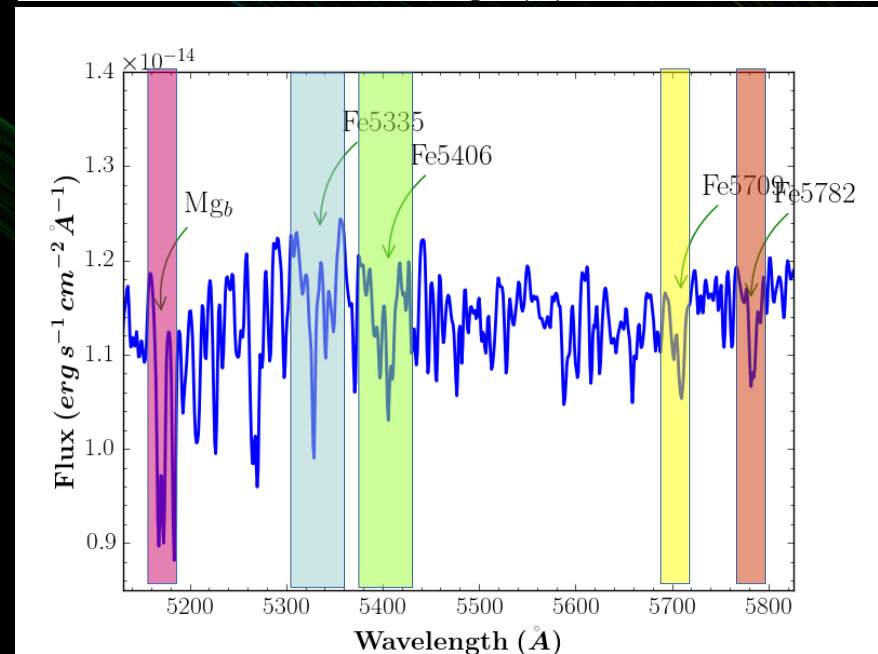
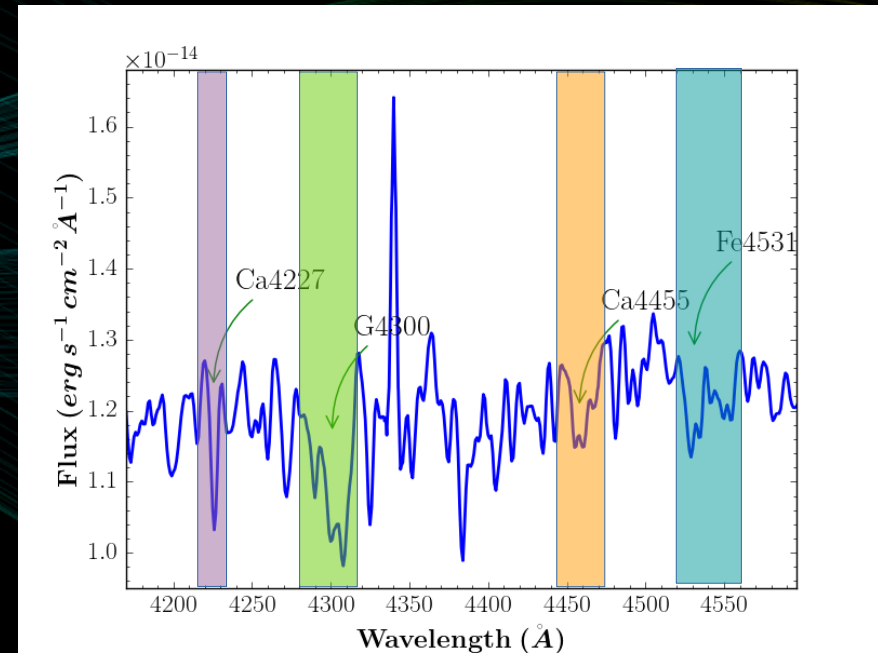




Using Spectro – Photometric SED Fitting (S – P SED)

Modified

- Using spectroscopic information in the SED fitting process to set constraints on the derived galaxy properties.
- Creating *spectral filters* from spectral lines / regions to use in the SED fitting.
- High Resolution Bruzual and Charlot (2003) SPS libraries

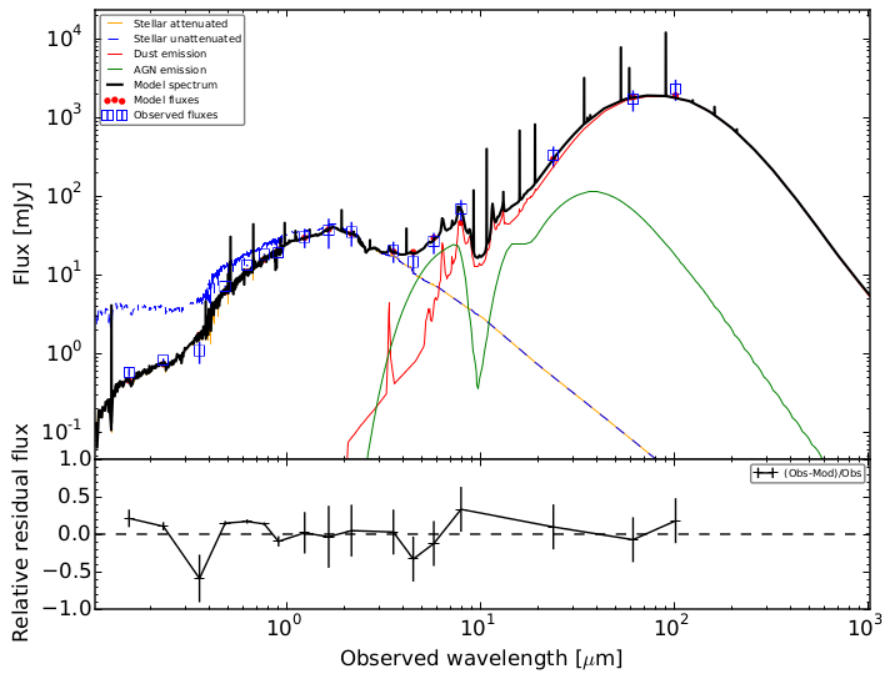


Standard SED Method

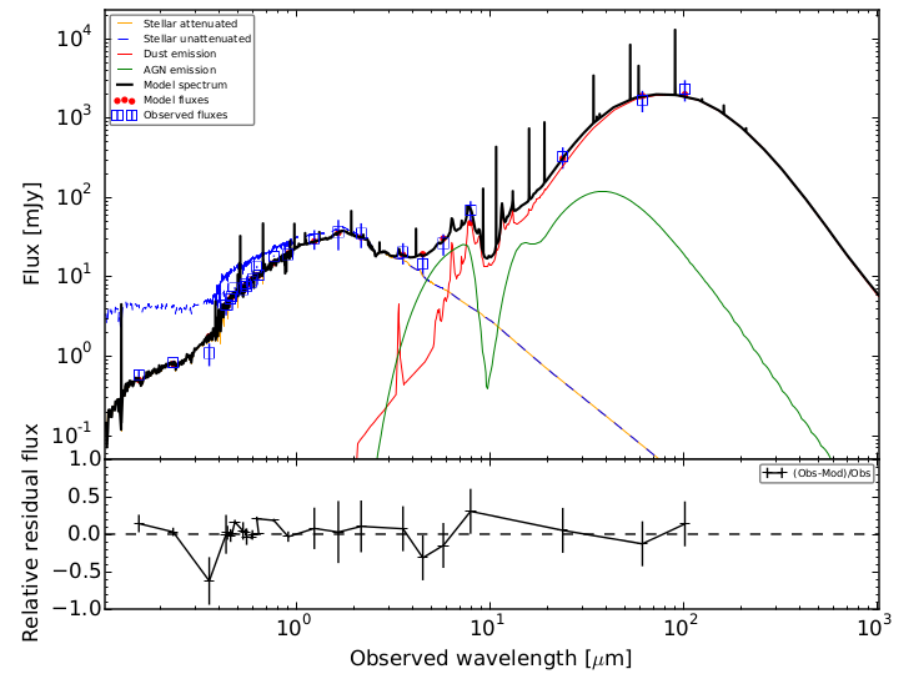
VS

S - P SED Method

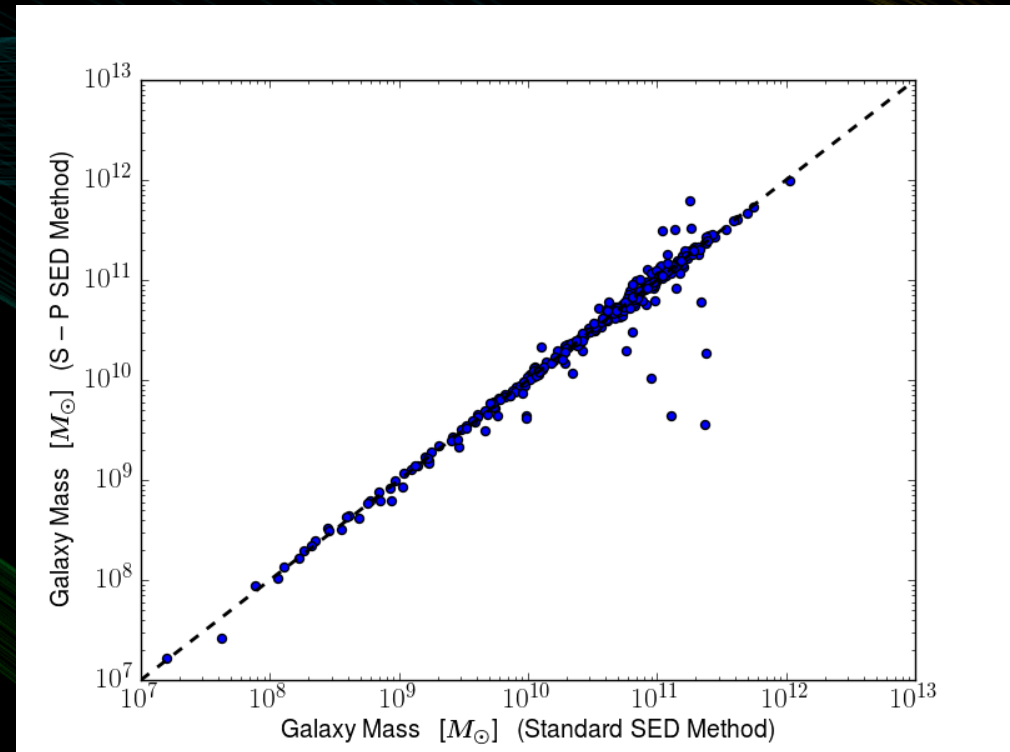
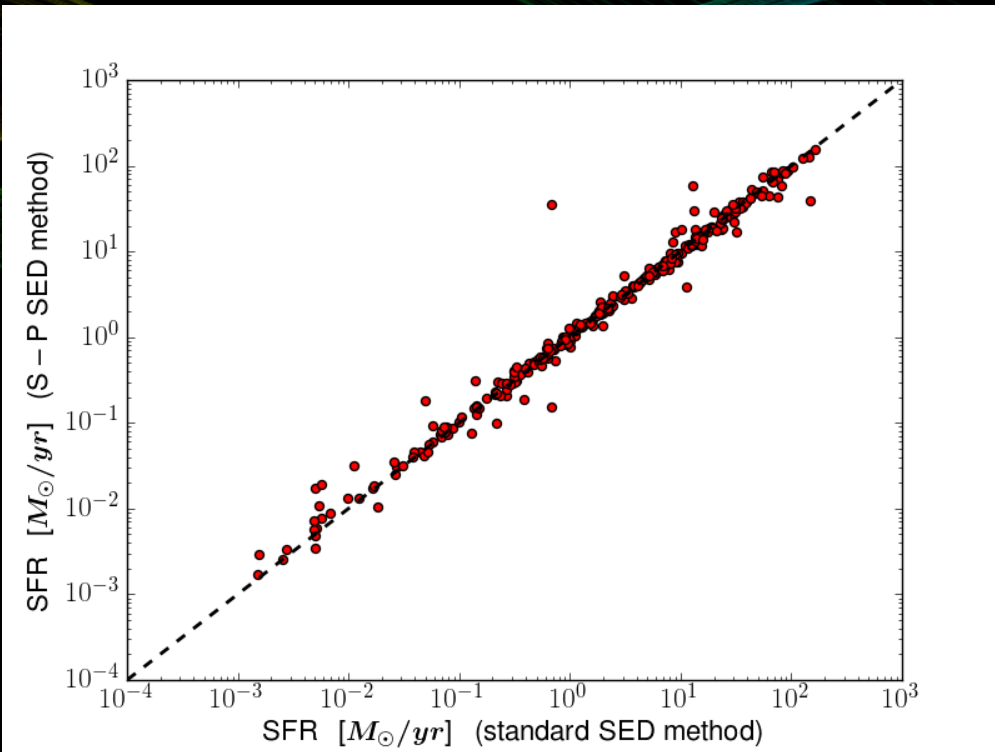
Best model for NGC4704 at $z = 0.027$. Reduced $\chi^2 = 2.56$



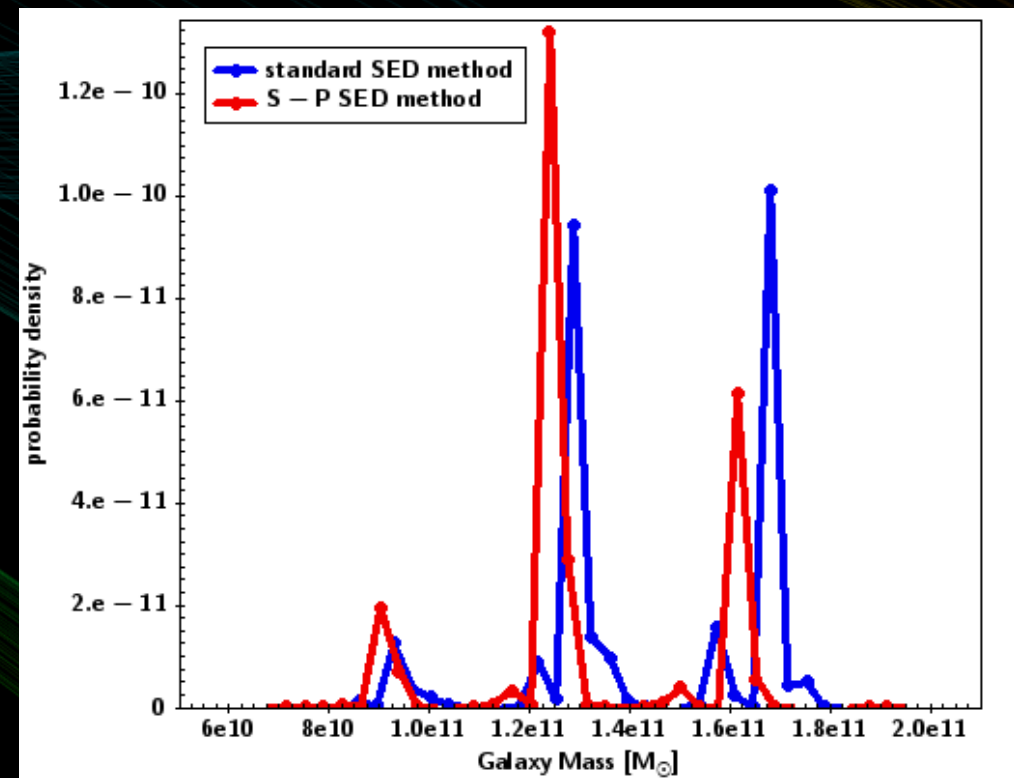
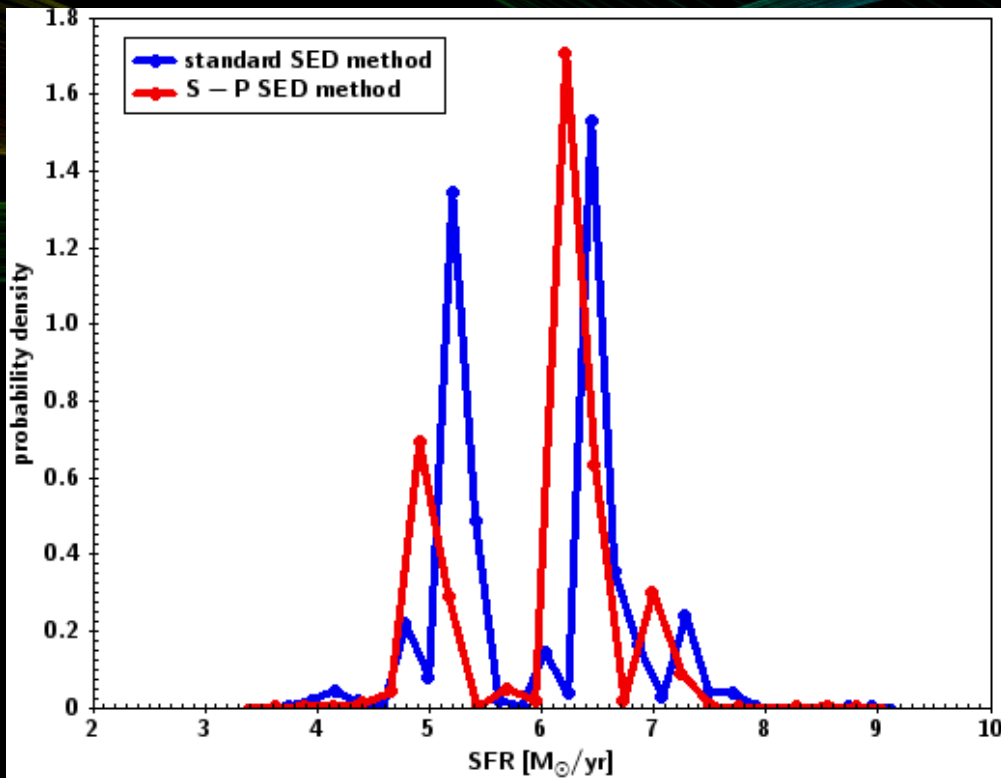
Best model for NGC4704_1 at $z = 0.027$. Reduced $\chi^2 = 1.67$



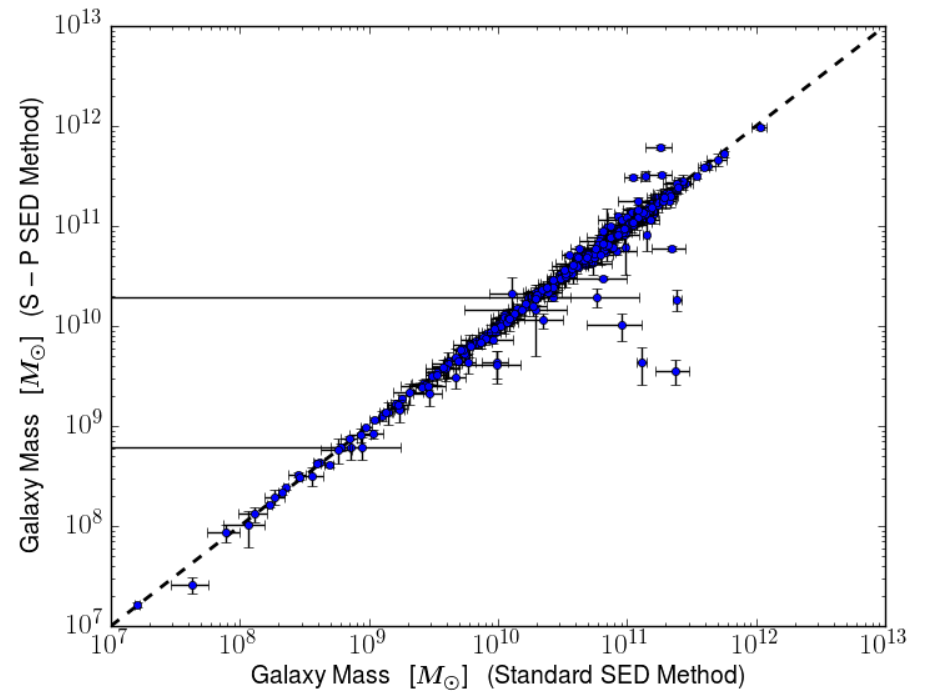
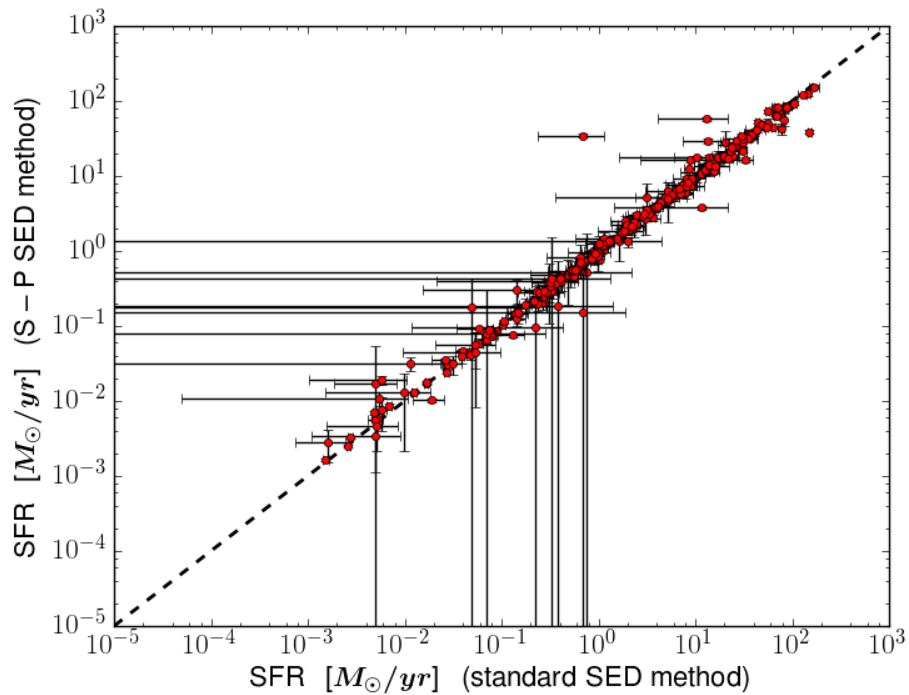
Consistency



Improvement

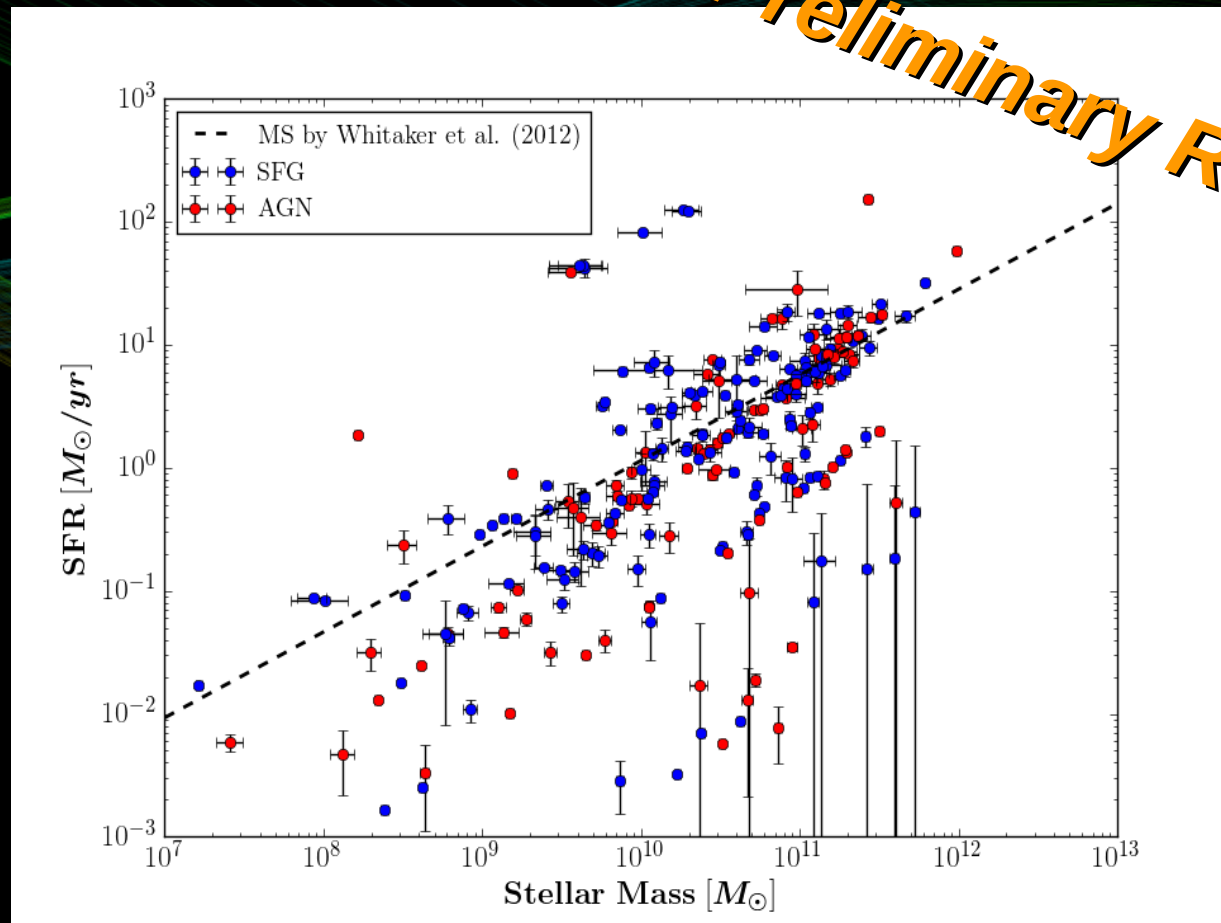


Precision



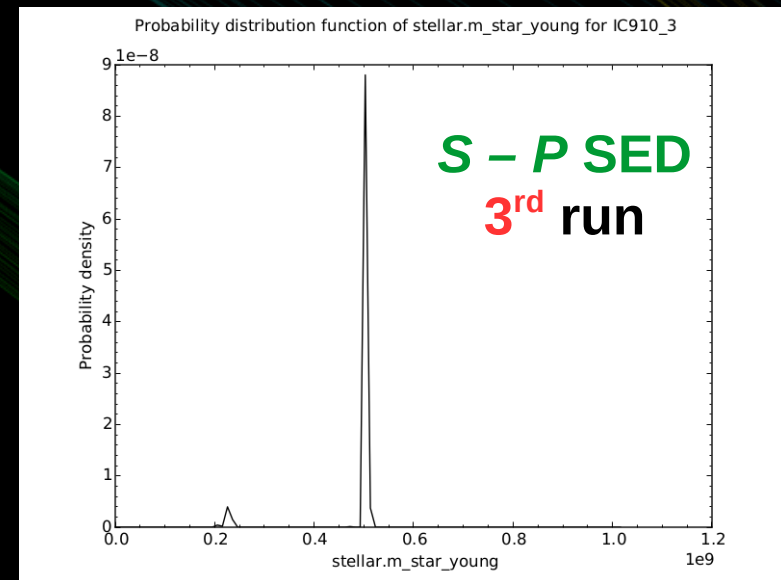
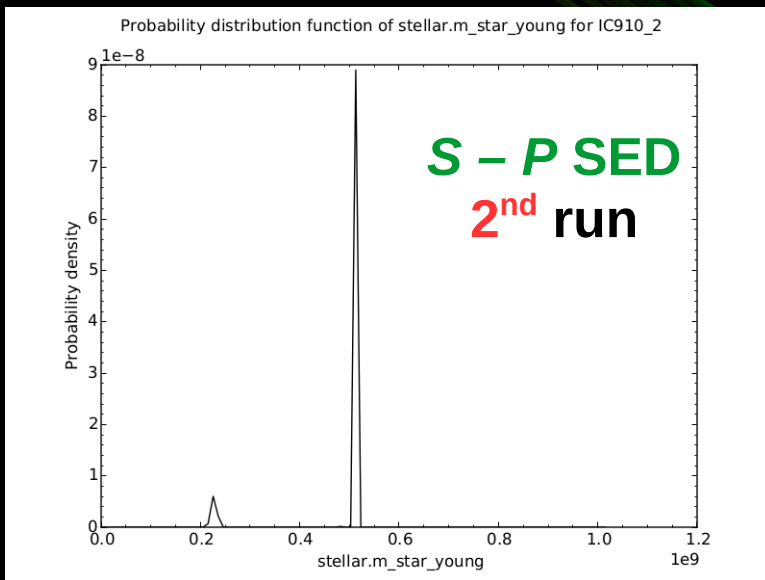
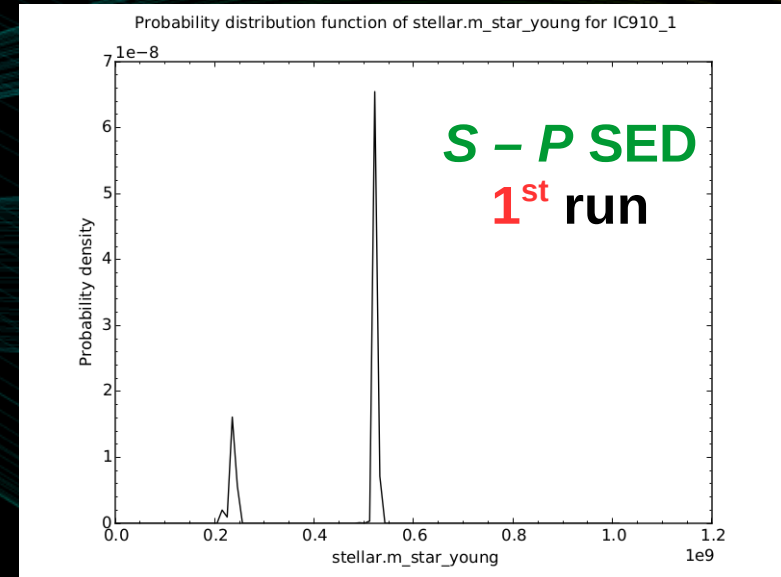
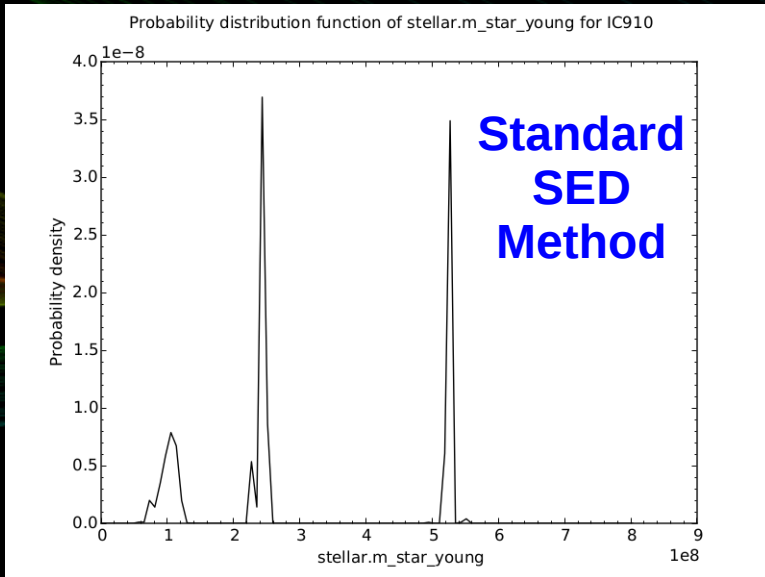
MS of SFRS galaxies at $z \sim 0.024$

Preliminary Results



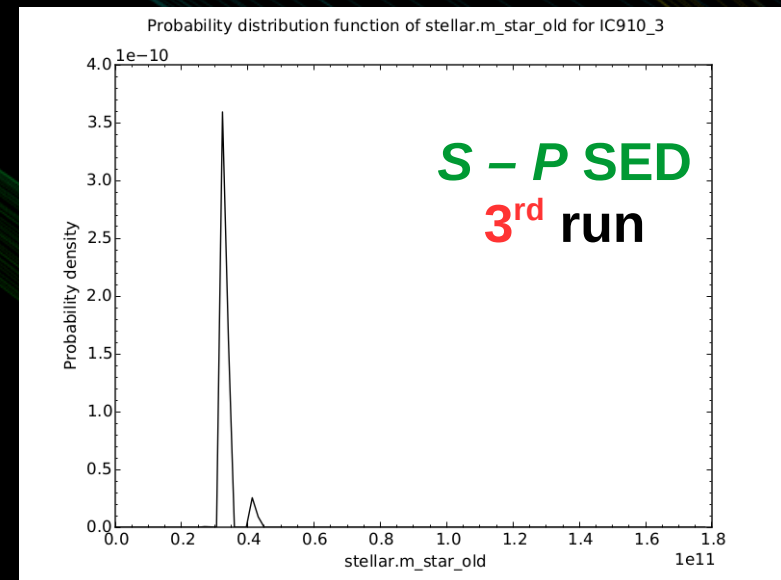
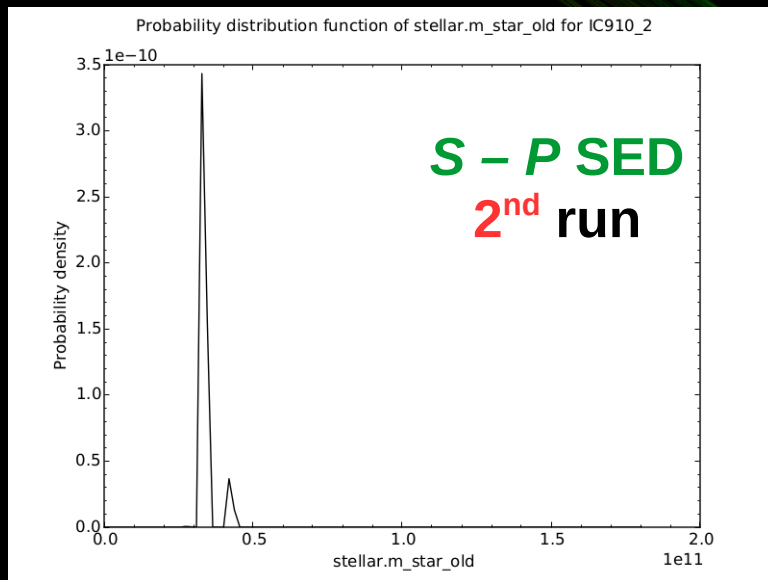
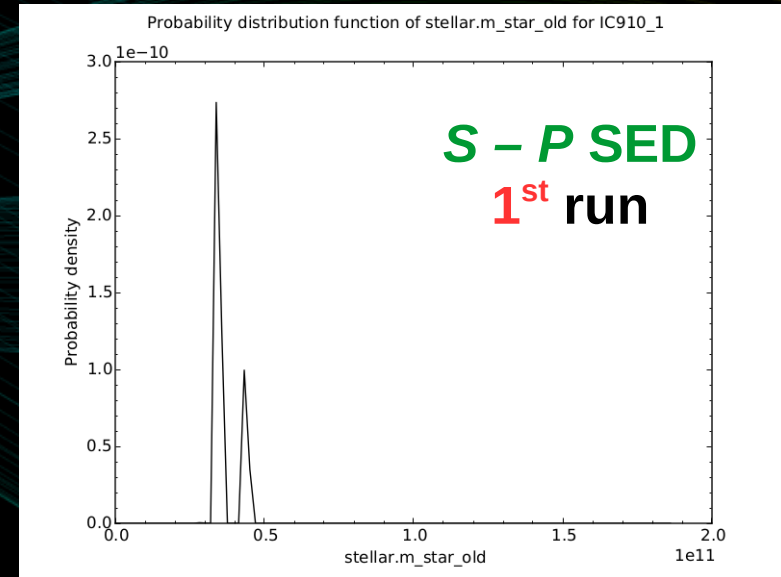
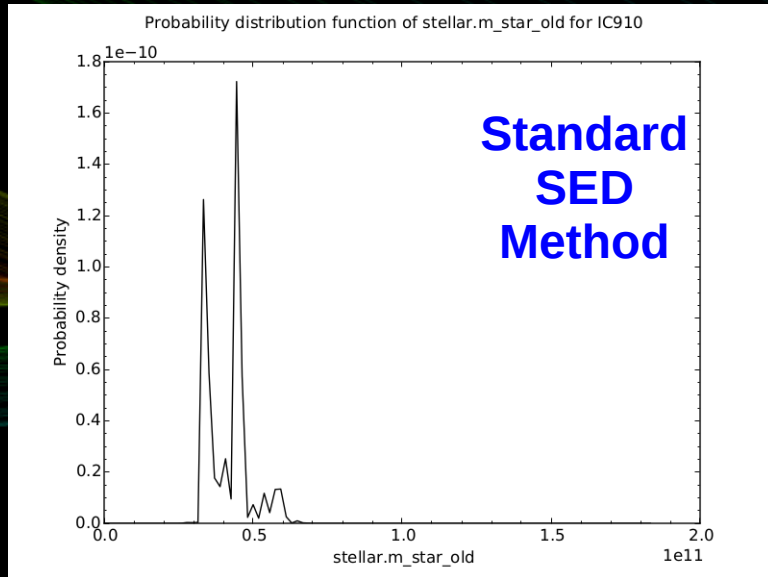
Other Parameters Improved

Stellar Mass of Young CSP



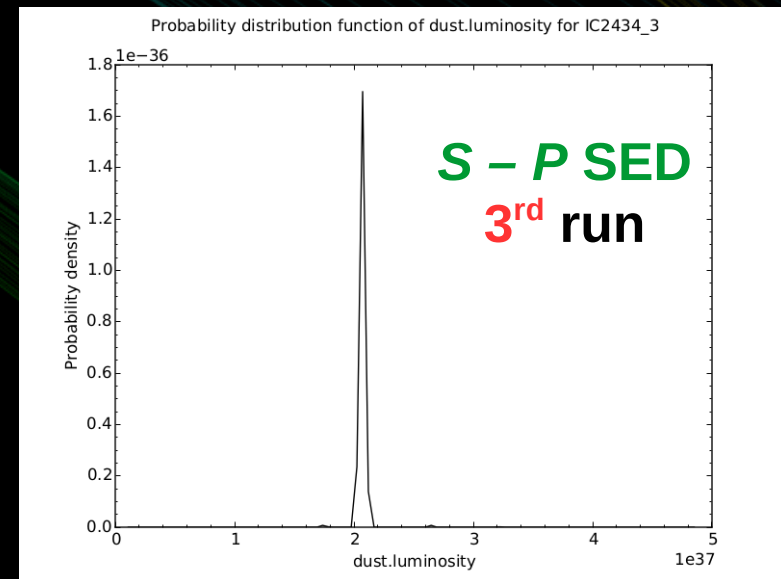
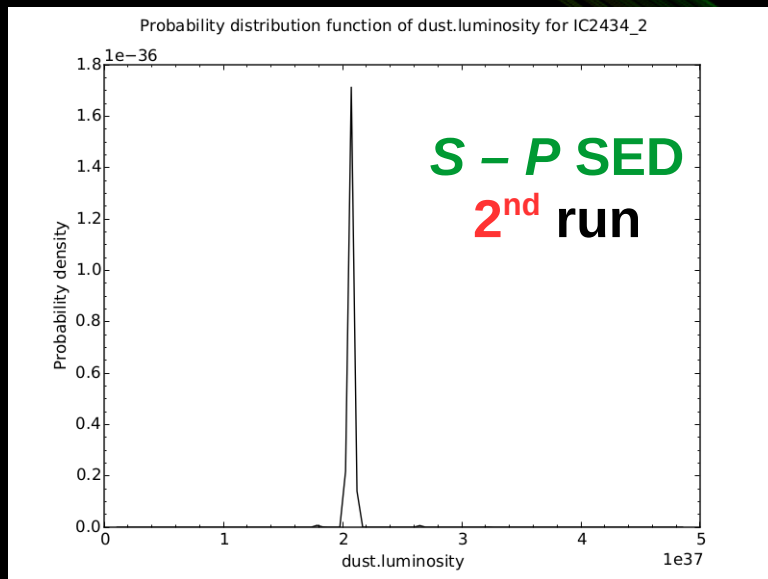
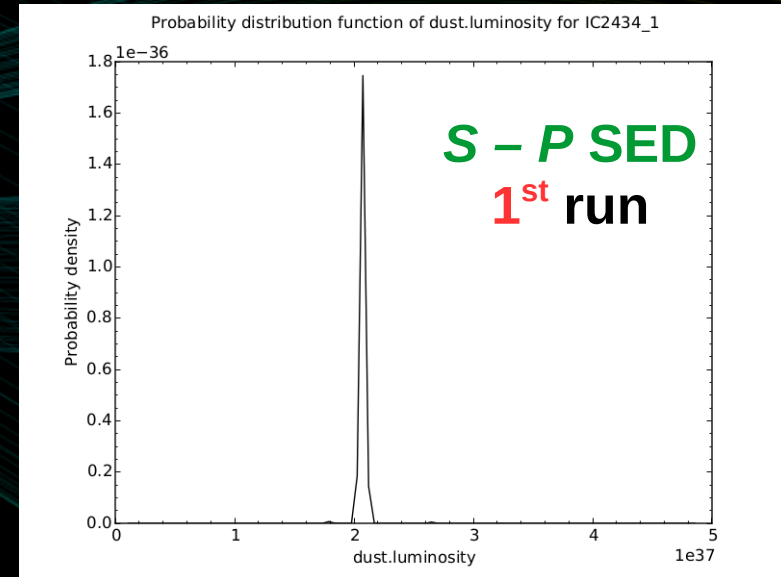
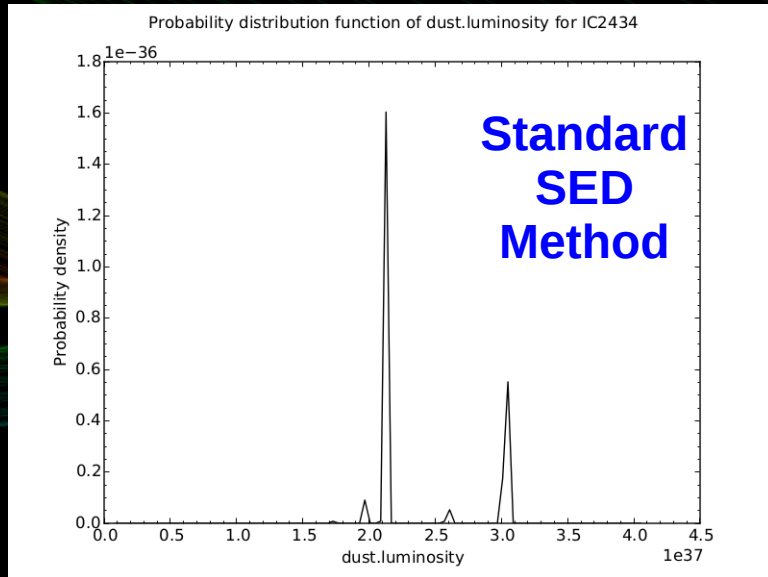
Other Parameters Improved

Stellar Mass of Old CSP



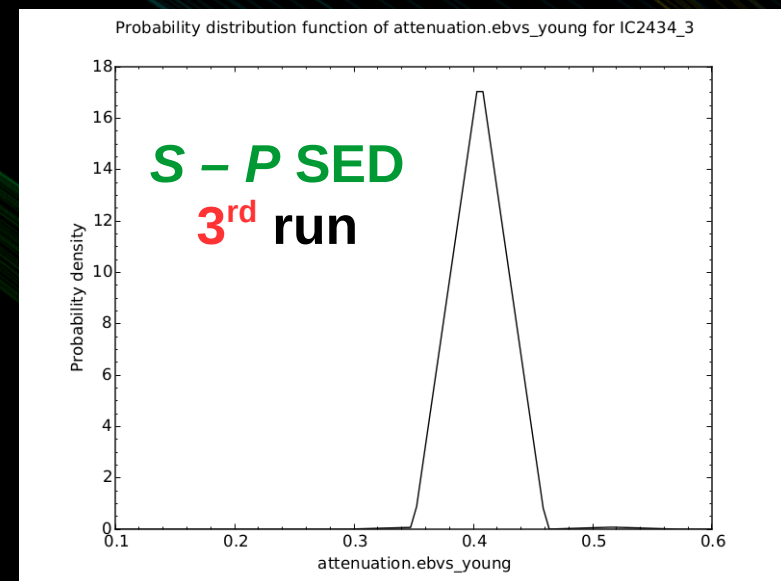
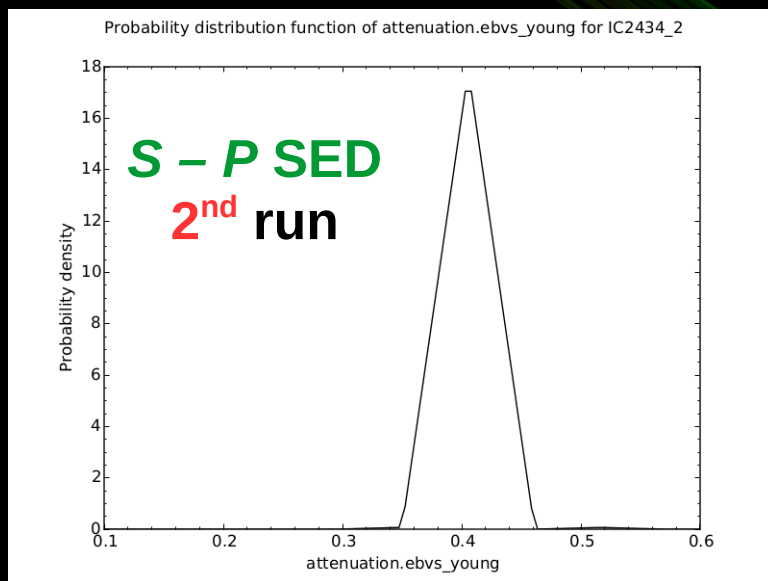
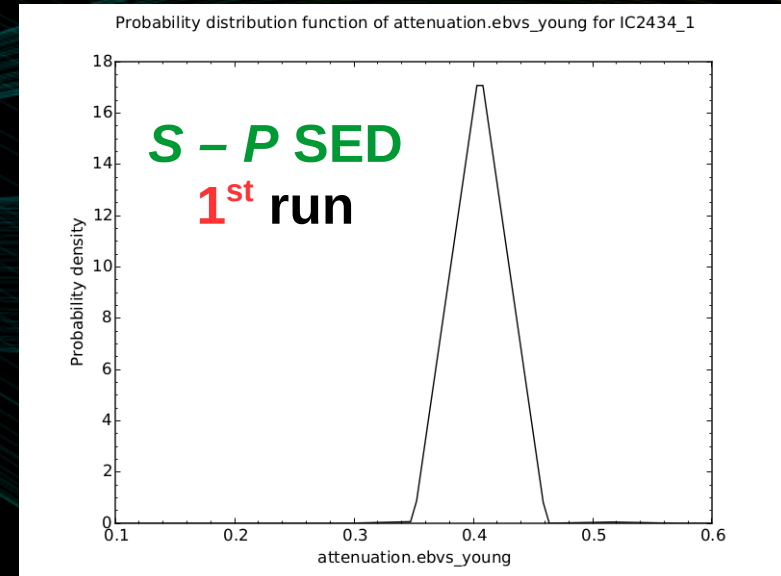
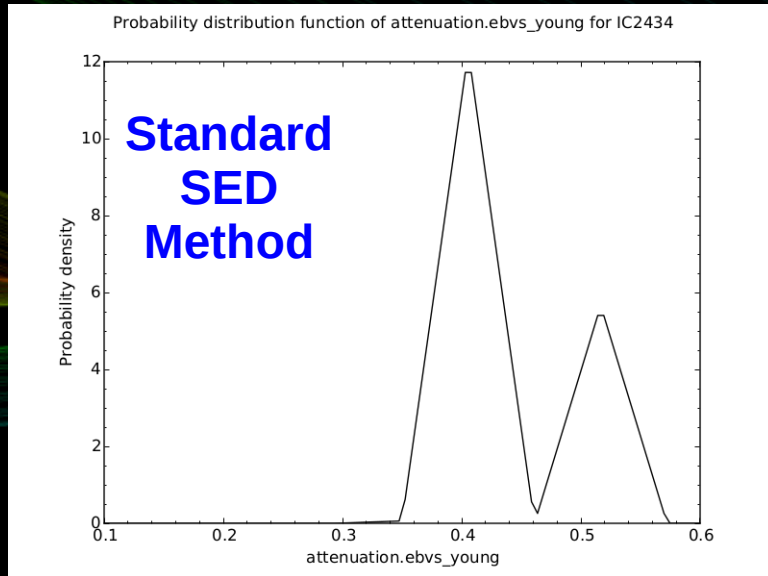
Other Parameters Improved

Dust Luminosity



Other Parameters Improved

$E(B - V)$ of Young (and Old) Populations



Next Steps

- **Cross-check the S – P SED results with *STARLIGHT* code.**
- **Use galaxy simulations to assess SED fitting results:**
 - **SFH**
 - **AGN fraction**
 - **Emission lines**
- **Compare results between different SED modeling codes (CIGALE / MAGPHYS).**
- **Recalculate the bi-variate sSFR – M_* function of the SFG and AGN – host galaxies.**

Summary

- We use a **representative sample** of nearby galaxies to probe the AGN – Star formation connection.
- **Develop accurate methods** to identify activity types.
- Derive the bi-variate sSFR – M_* function for the different activity types.
- Use **Spectro – Photometric** SED fitting method that sets **better constrains** on the derived host – galaxy properties.