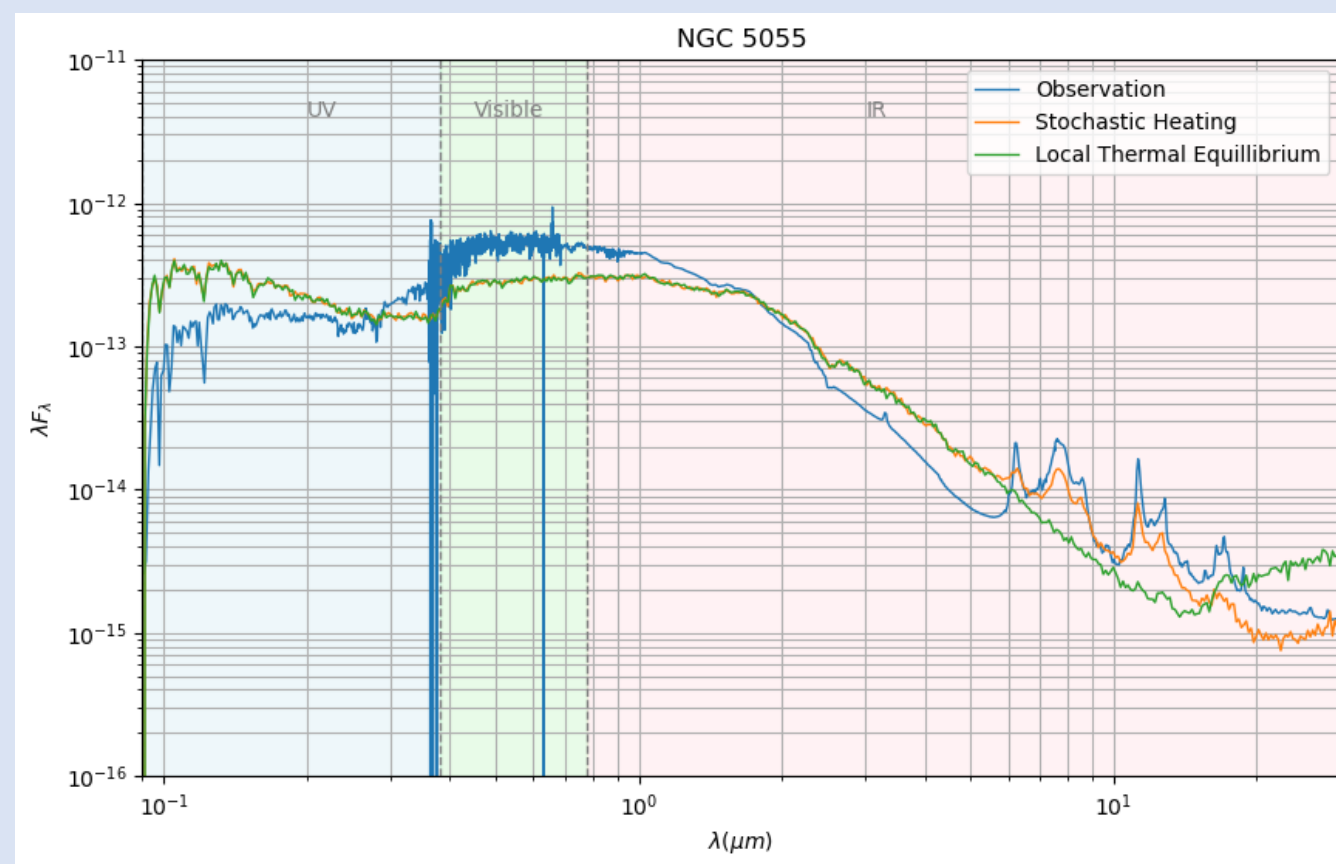


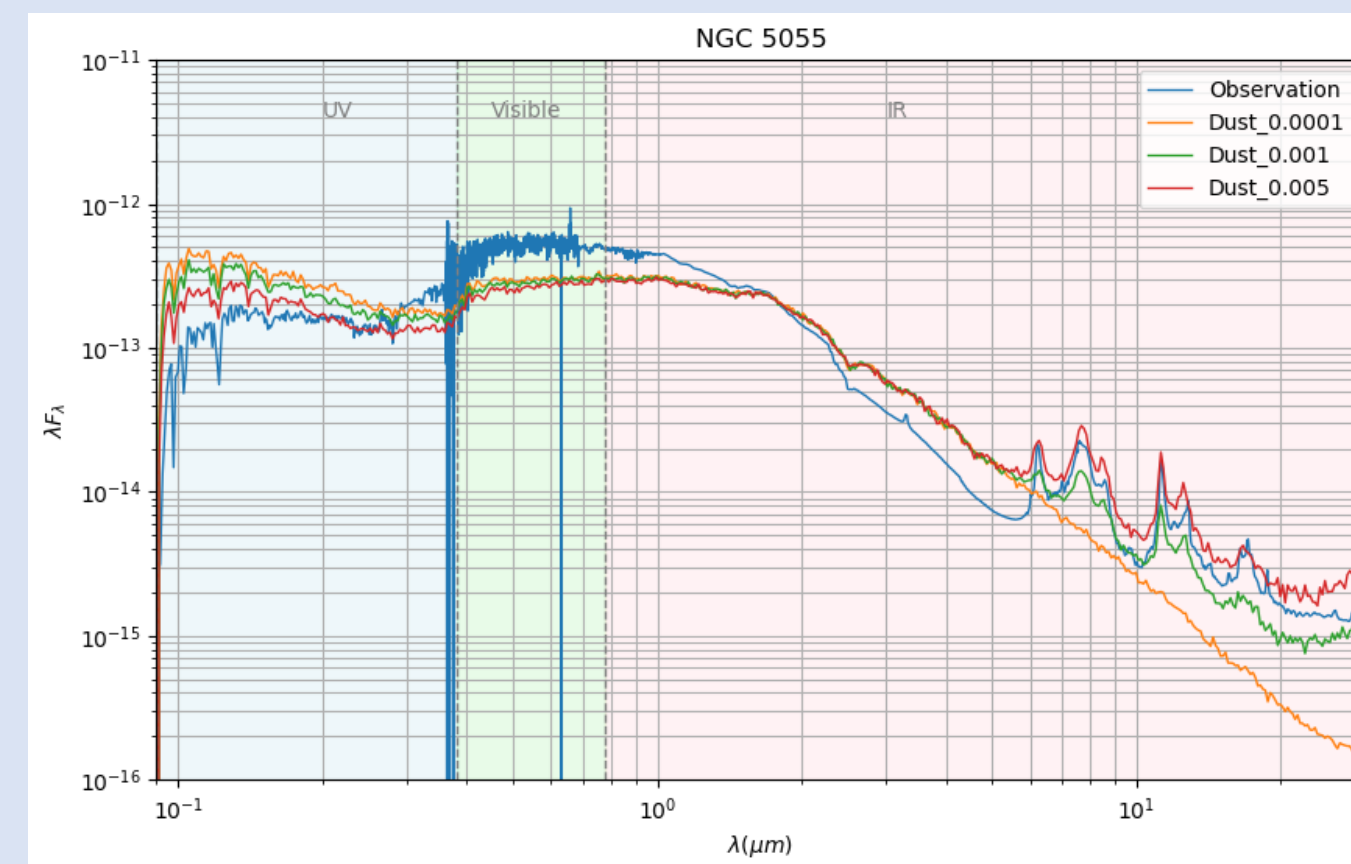
## Introduction

We create mock observations of simulated galaxies with varying Dust, Gas and Stellar profile parameters to investigate the role the medium plays in defining the emission characteristics of spiral galaxies. The observations are created using SKIRT (a radiative dust transfer code based on Monte Carlo technique to emulate the relevant physical processes including scattering, absorption and emission by the transfer medium. Our goal is to produce an SED for a galaxy mimicking the observations with minimal error.

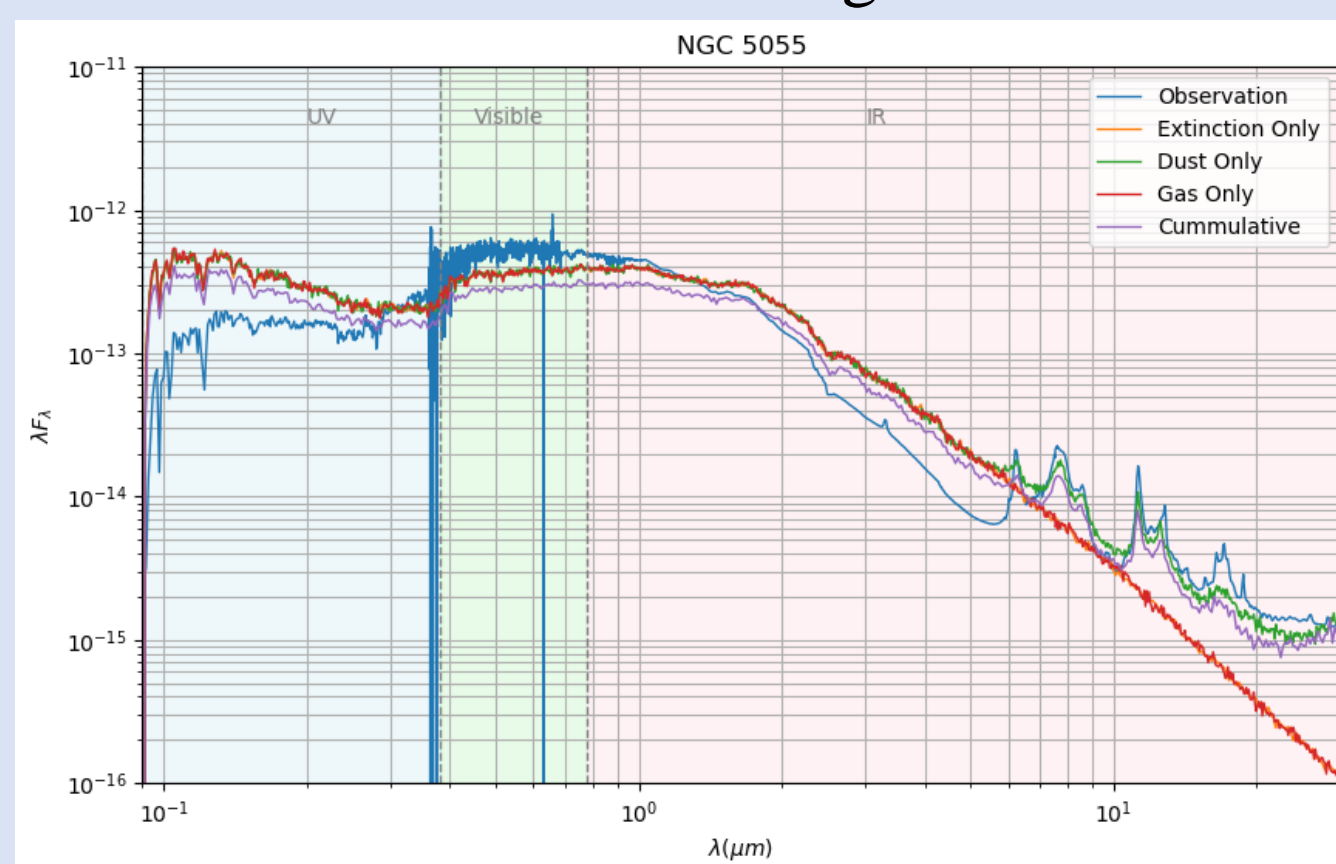
Further, a machine learning algorithm will be developed and deployed using the target and parameters as the galactic emission profile and transfer medium properties, respectively for automated transfer medium creation.



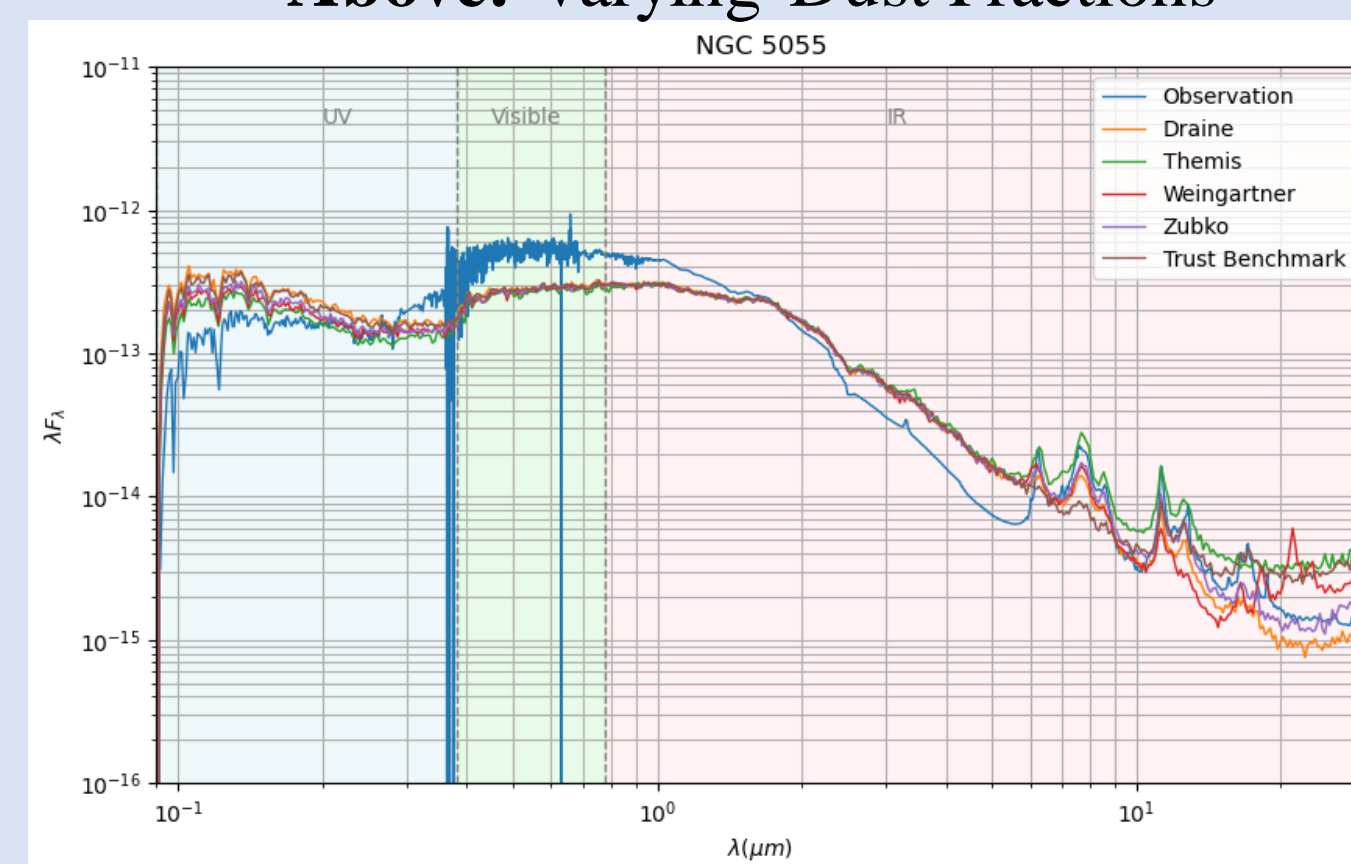
Above: Stochastic Heating versus LTE



Above: Varying Dust Fractions



Above: Varying Emission agents



Above: Varying Dust Mixes

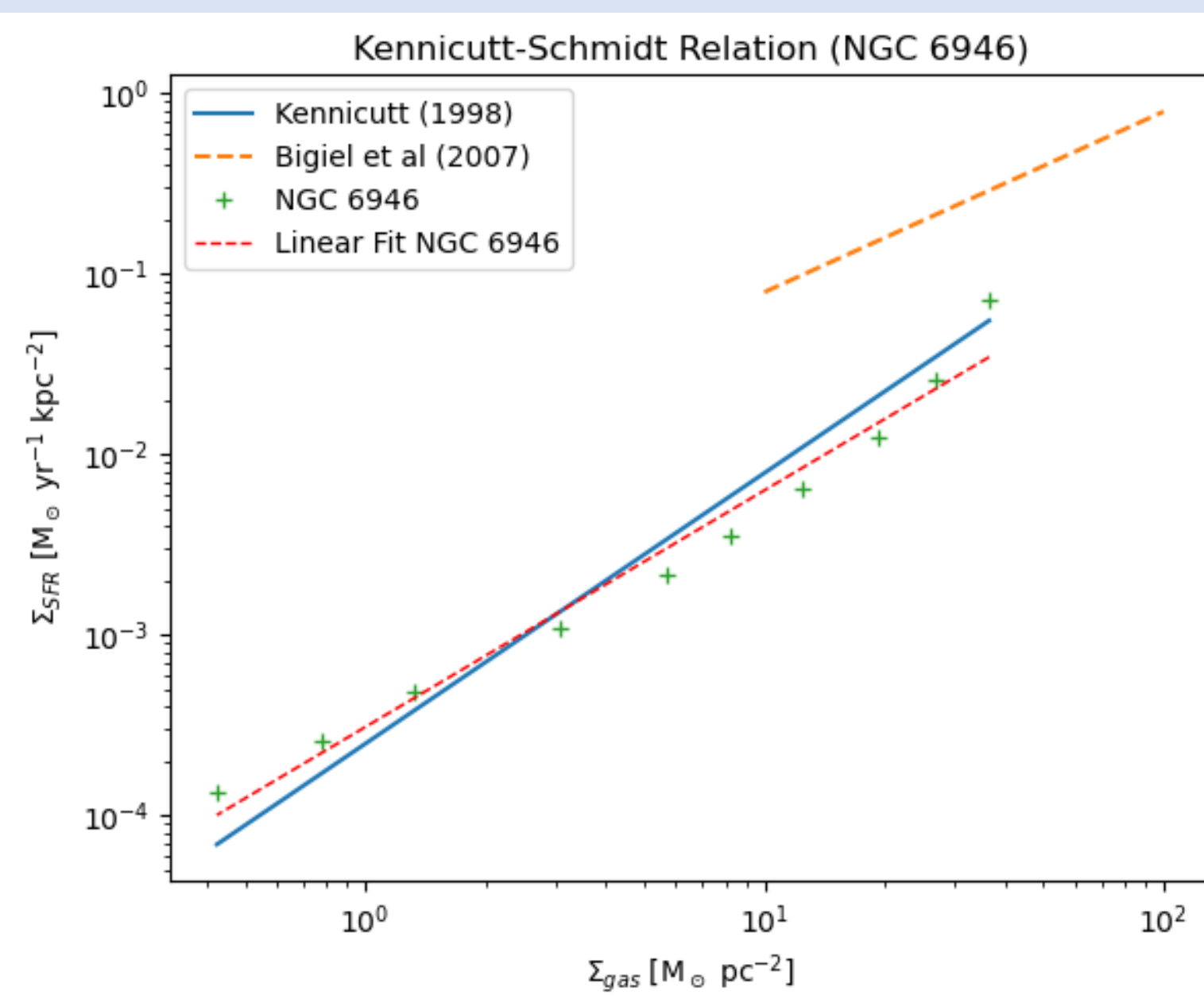
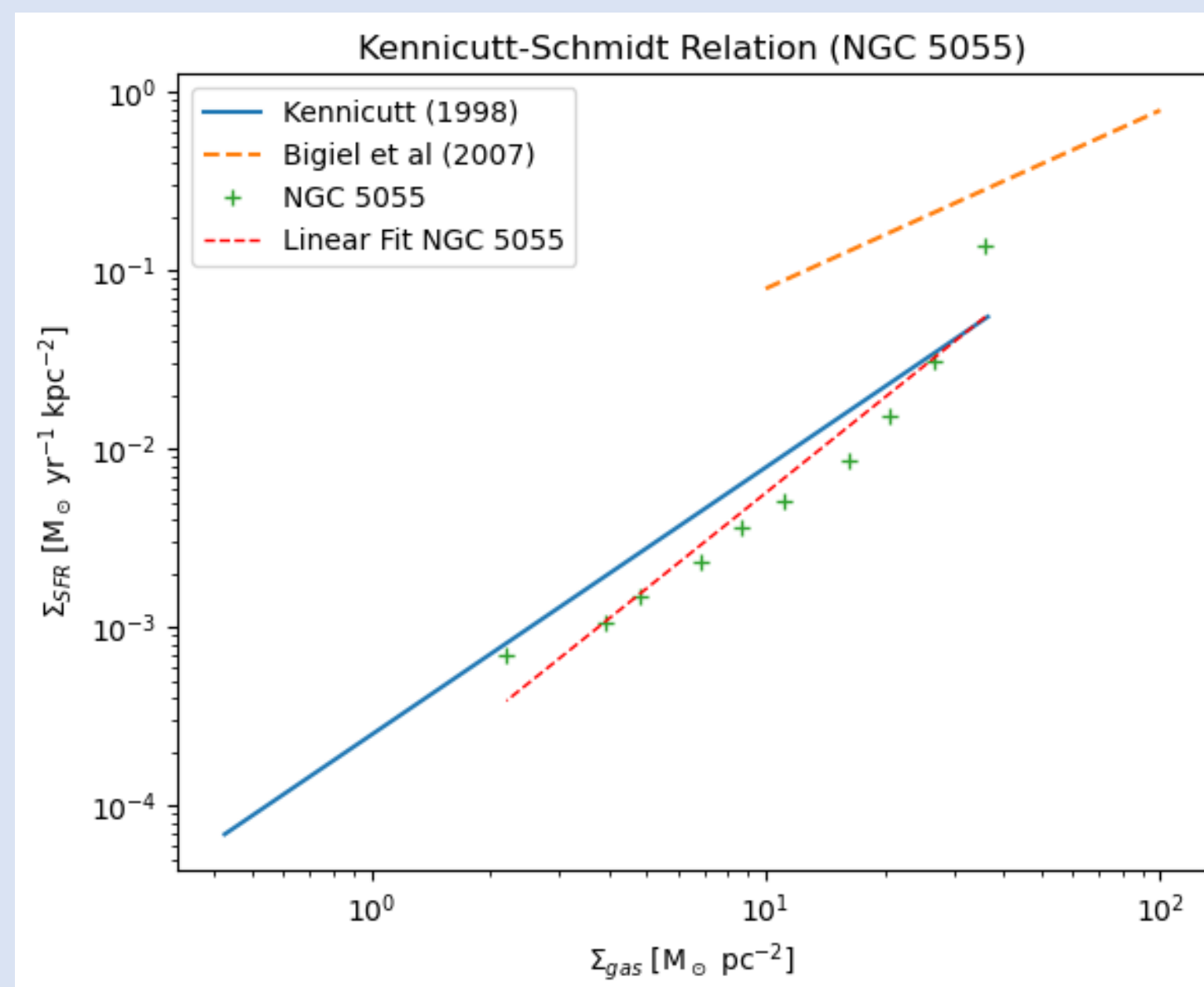
## Kennicutt-Schmidt Relation

In astronomy, the **Kennicutt-Schmidt law** is an empirical relation between the surface gas density and star formation rate (SFR) in a given region. The relation was first examined by **Maarten Schmidt** in a 1959 paper where he proposed that the SFR surface density scales as some positive power "n" of the local gas surface density.

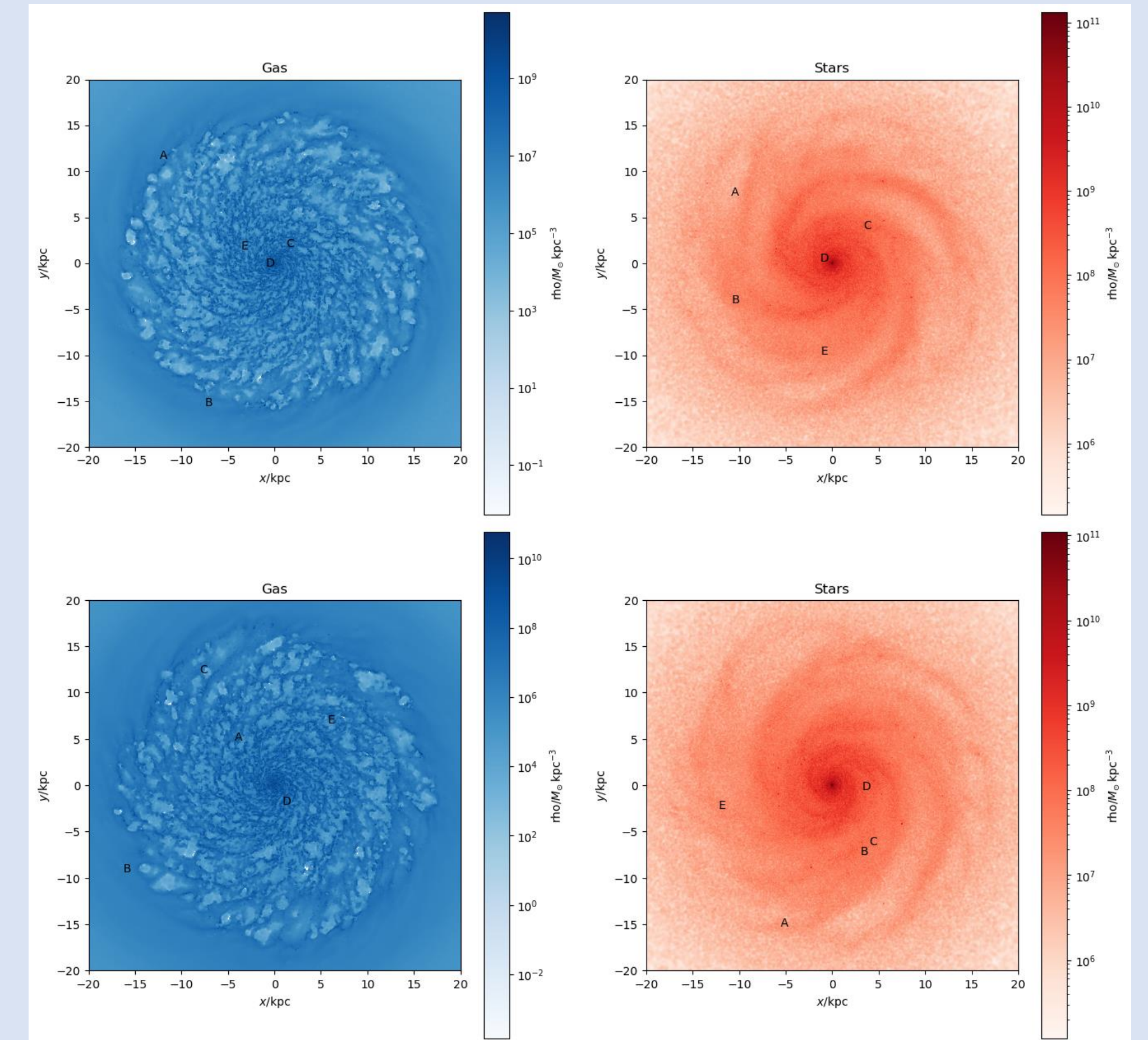
$$\Sigma_{SFR} \propto (\Sigma_{gas})^n$$

$$\Sigma_{SFR} = \text{Surface SFR Density} [M_{\odot} \text{yr}^{-1} \text{pc}^{-2}]$$

$$\Sigma_{gas} = \text{Gas Surface Density} [g \text{pc}^{-2}]$$

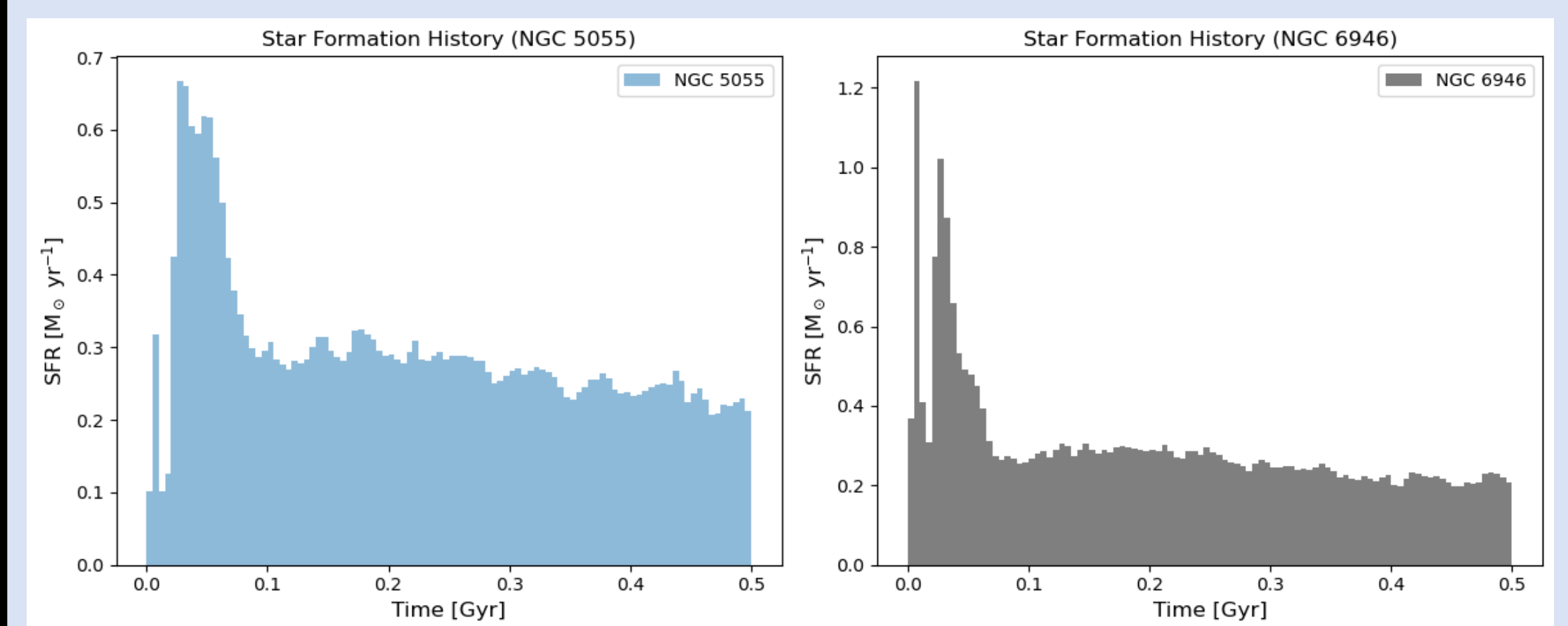


## Galactic Dynamics



Above: Positional time stamps for 5 randomly selected gas and star cells with a temporal separation of 100 Myrs depicting crude dynamics

## Star Formation History



## SFR versus HI+H2

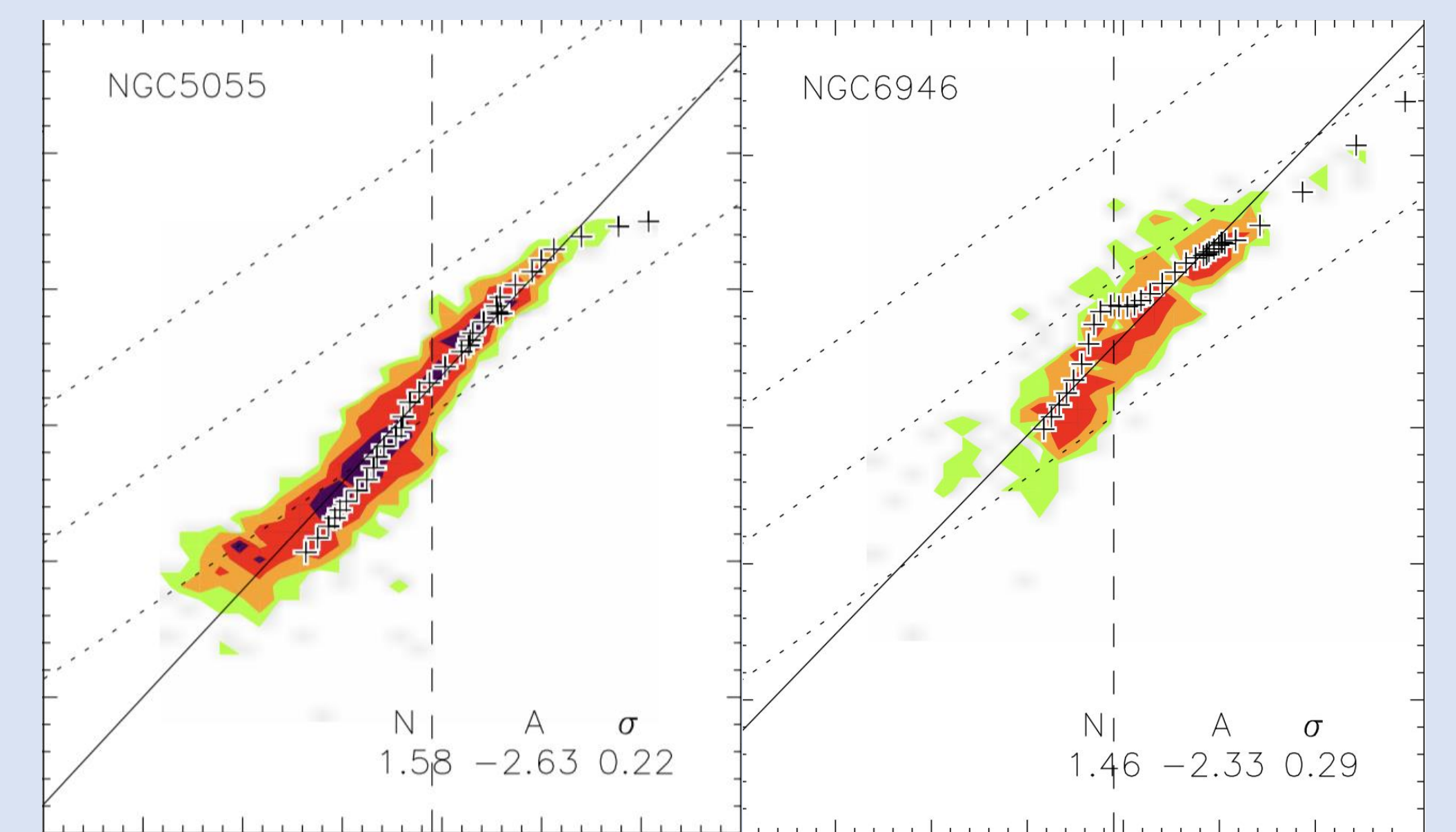
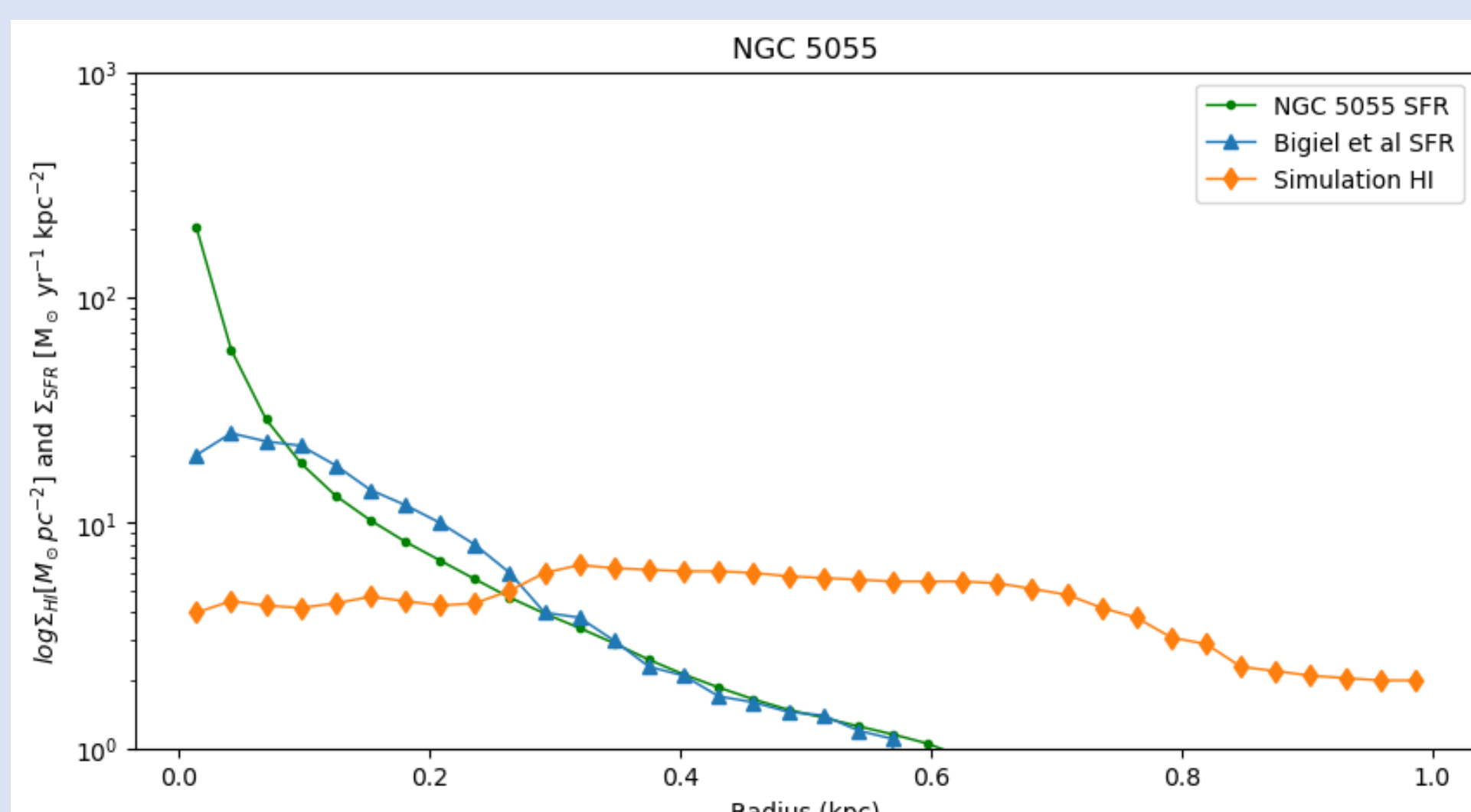
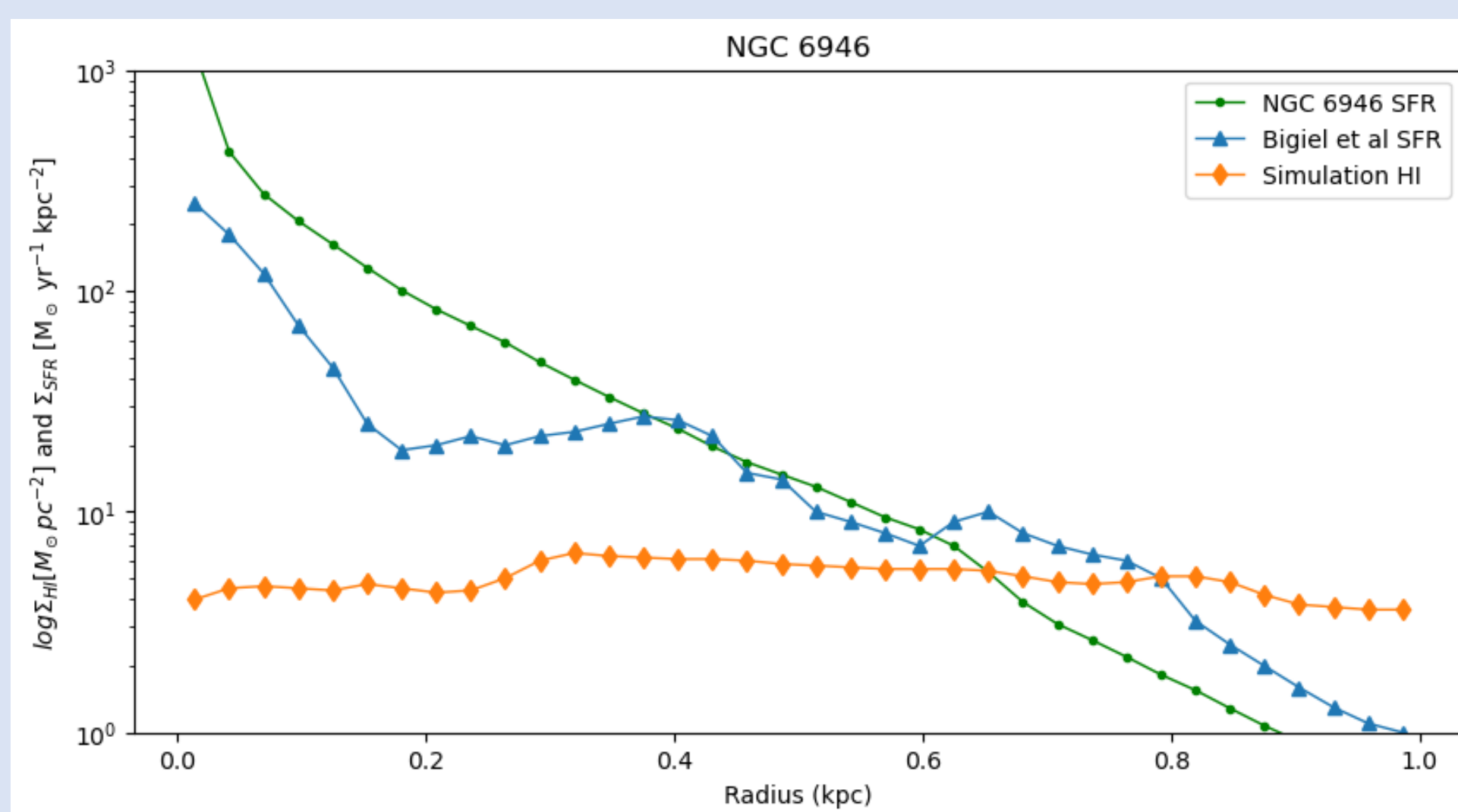


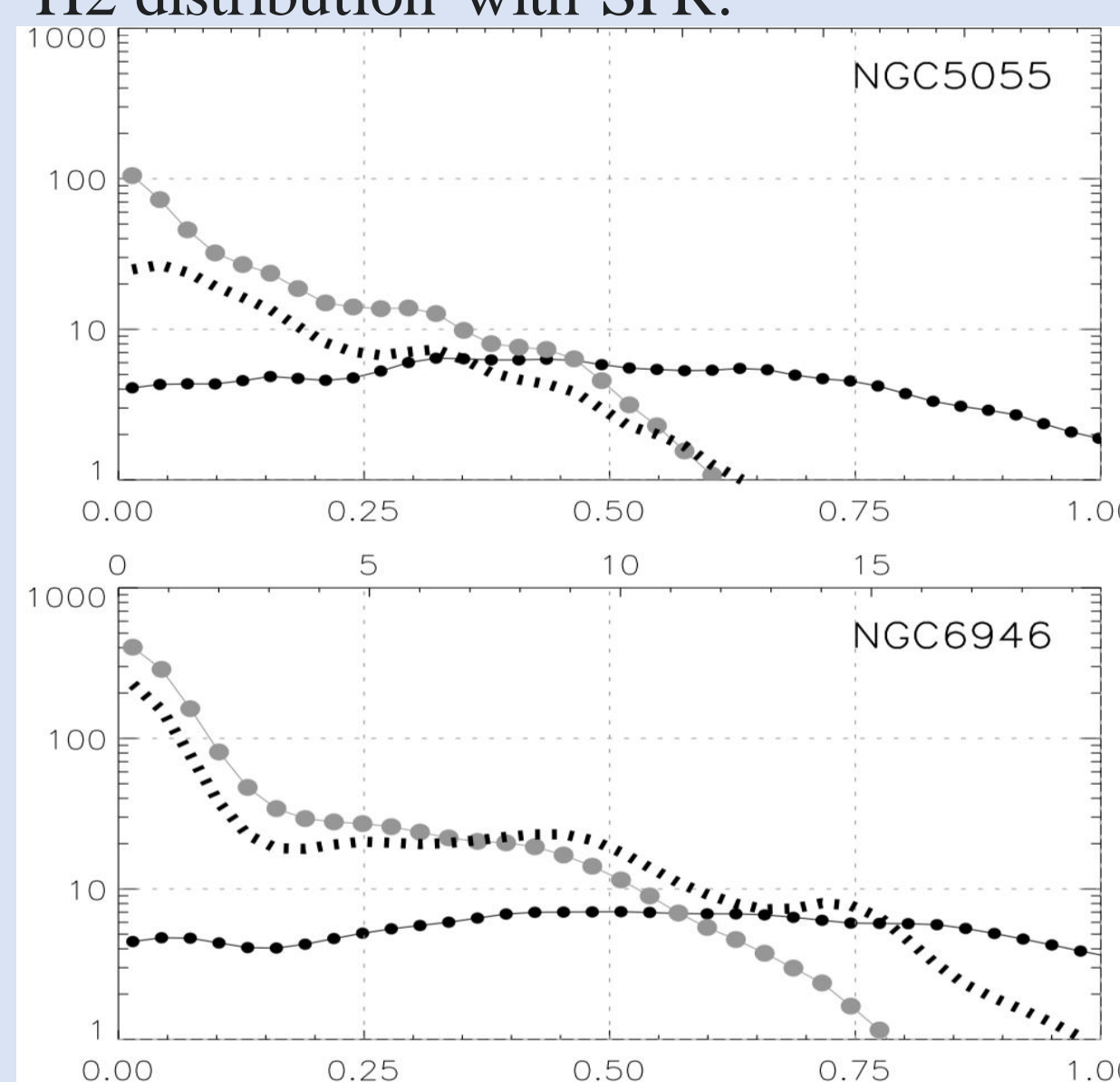
Fig 4. F. Bigiel et al 14 Oct 2008

## Hydrogen and the Star Formation Rate



**Left:** Relation between the SFR as recorded in the simulation (green) (and as also observationally noted by Bigiel et al (blue)) and neutral Hydrogen I (orange).

Demonstrates the irrelevance of HI as a mapping feature for SFR in a galaxy and the coincidence of H2 distribution with SFR.

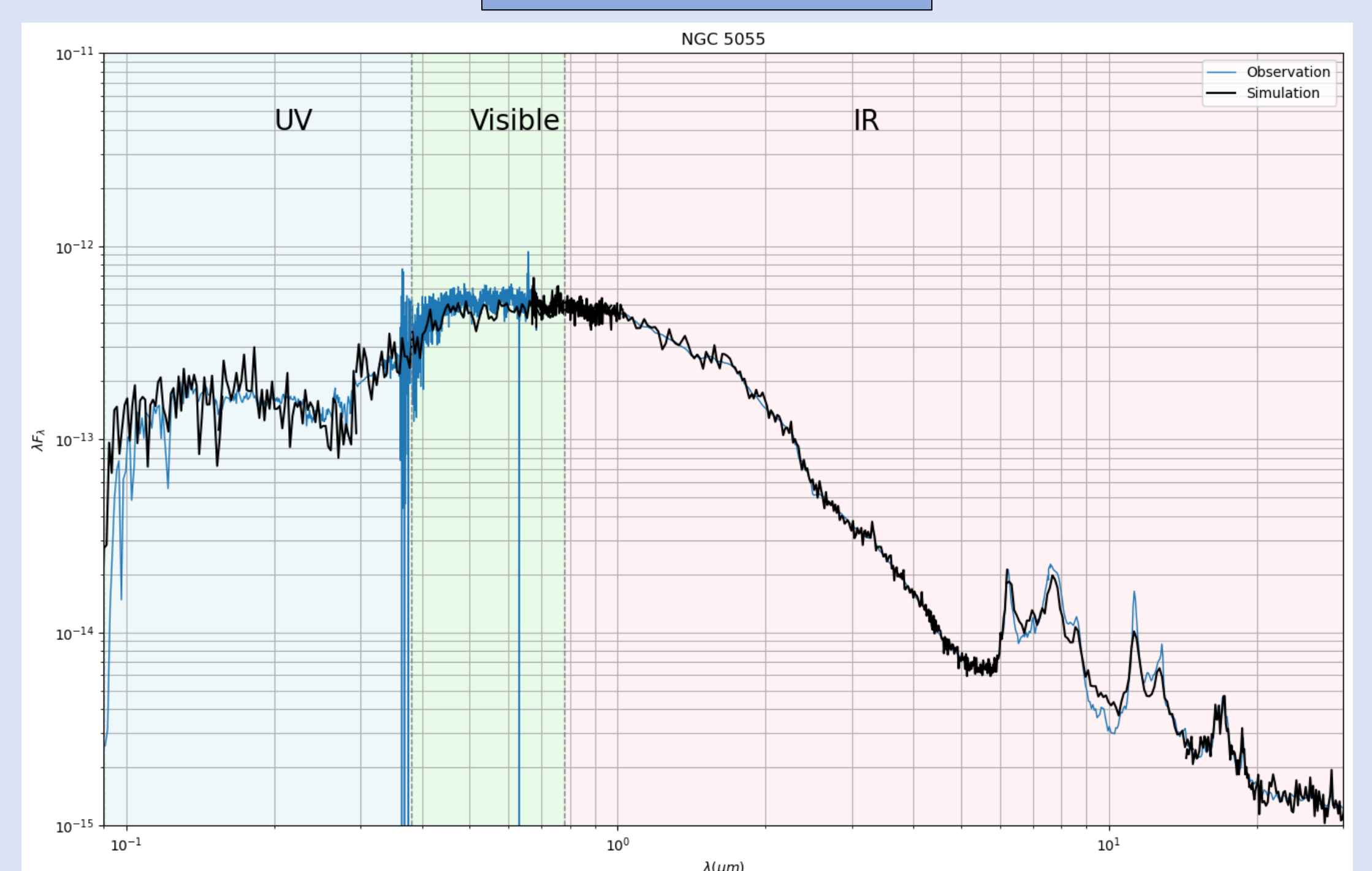


Left: SFR, HI and H2 profiles for NGC 5055 and 6946  
Fig 3 Bigiel et al 2008

### References:

- Galaxy Simulations: Pittitt et al (in prep)
- P Camps & M Baes: SKIRT 9 arXiv:2003.00721
- F. Bigiel et al 2008 AJ 136 2846

## Results



Above: The figure shows the final SED of the transfer medium created by a careful custom mix of Themis, Draine Li and the Zubko Dust mixes, as compared to the observational SED of NGC 5055. The final plot was achieved by carefully mapping the effects of various transfer medium parameters on the emission in different electromagnetic domains and creating the custom mixture of the dusts to mimic the observed SED.