

# Relation between dust, gas and metallicity in the extended HI disk

# Methods

- Current works

- Calculating total gas surface mass density from THINGS and HERACLES
- Fitting dust surface mass density from Herschel maps ( $>100\mu\text{m}$ )
  - Using Voronoi binning to increase SNR
  - Using modified blackbody model with MCMC for fitting

- Future works

- Analyzing DGR versus radius
- Adding metallicity data

# Methods

- Current works

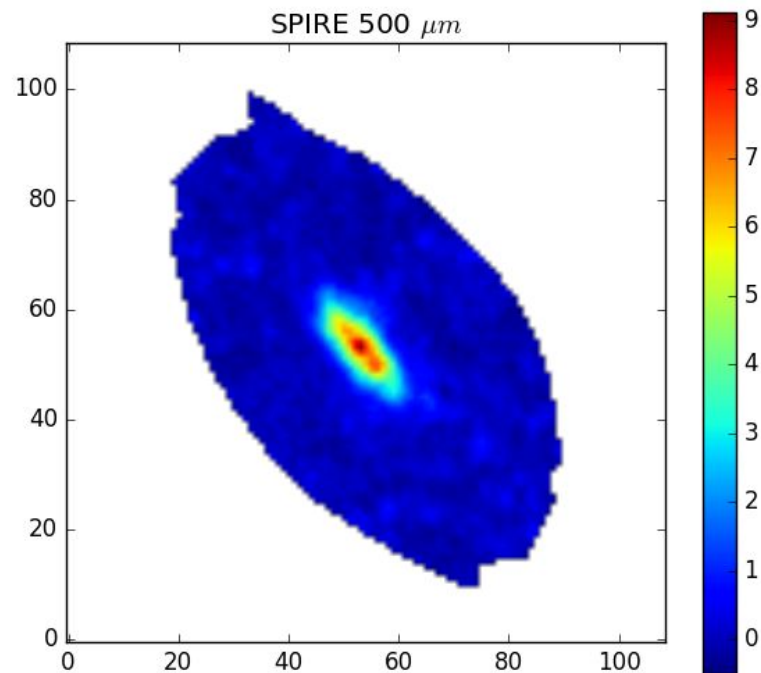
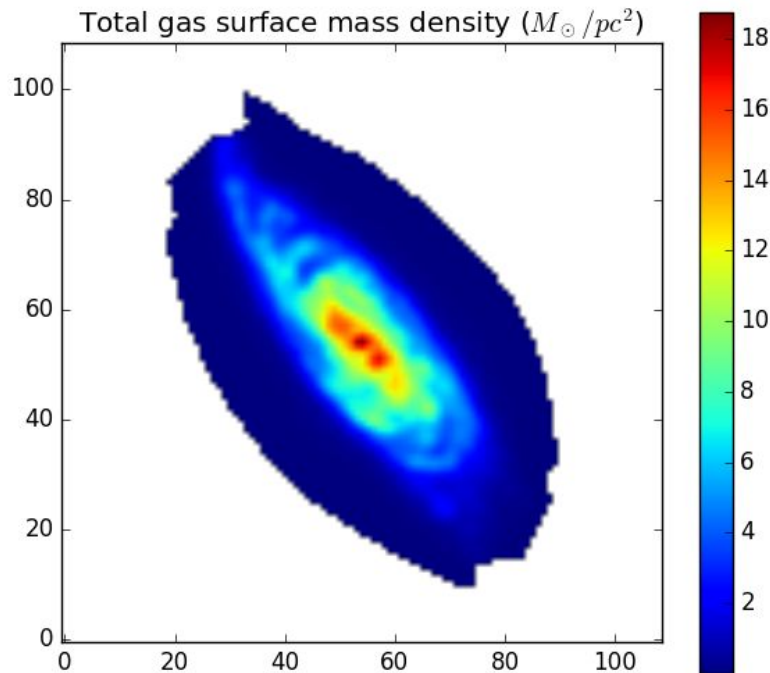
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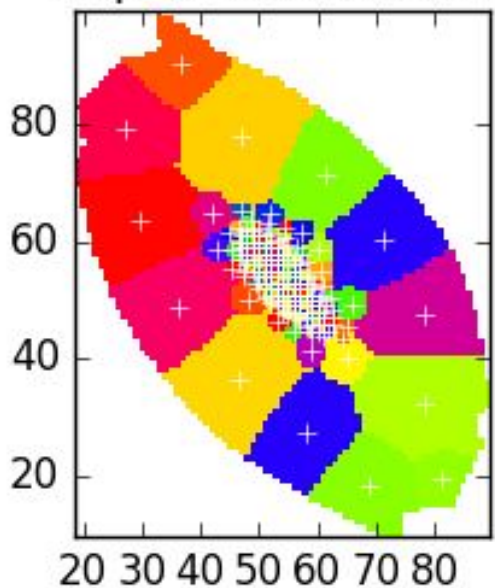
# Why we need binning?

NGC 3198

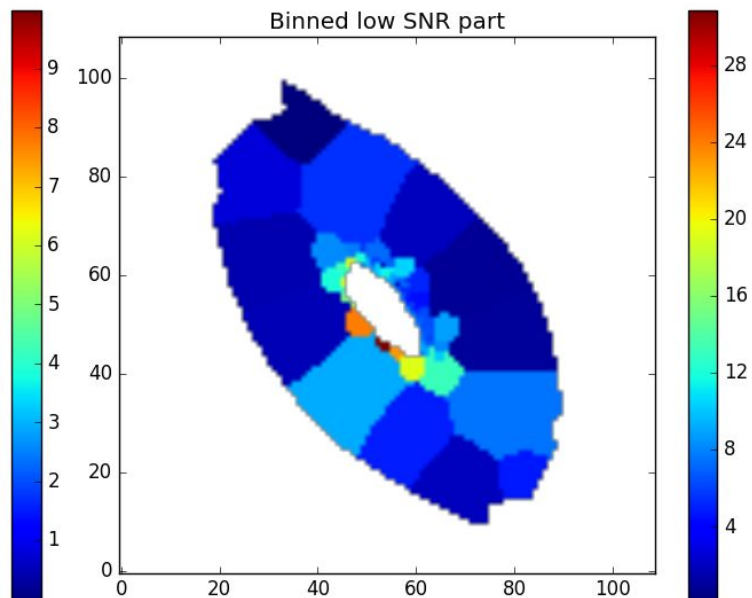
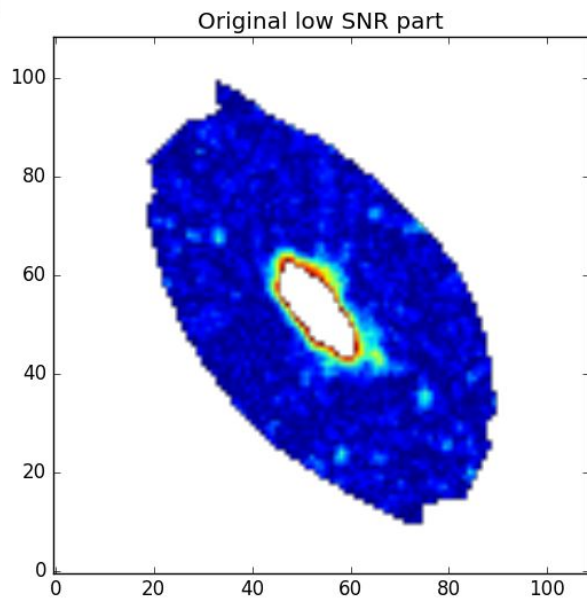


# Voronoi binning

Map of Voronoi bins



NGC 3198 SPIRE 500  $\mu m$



# Methods

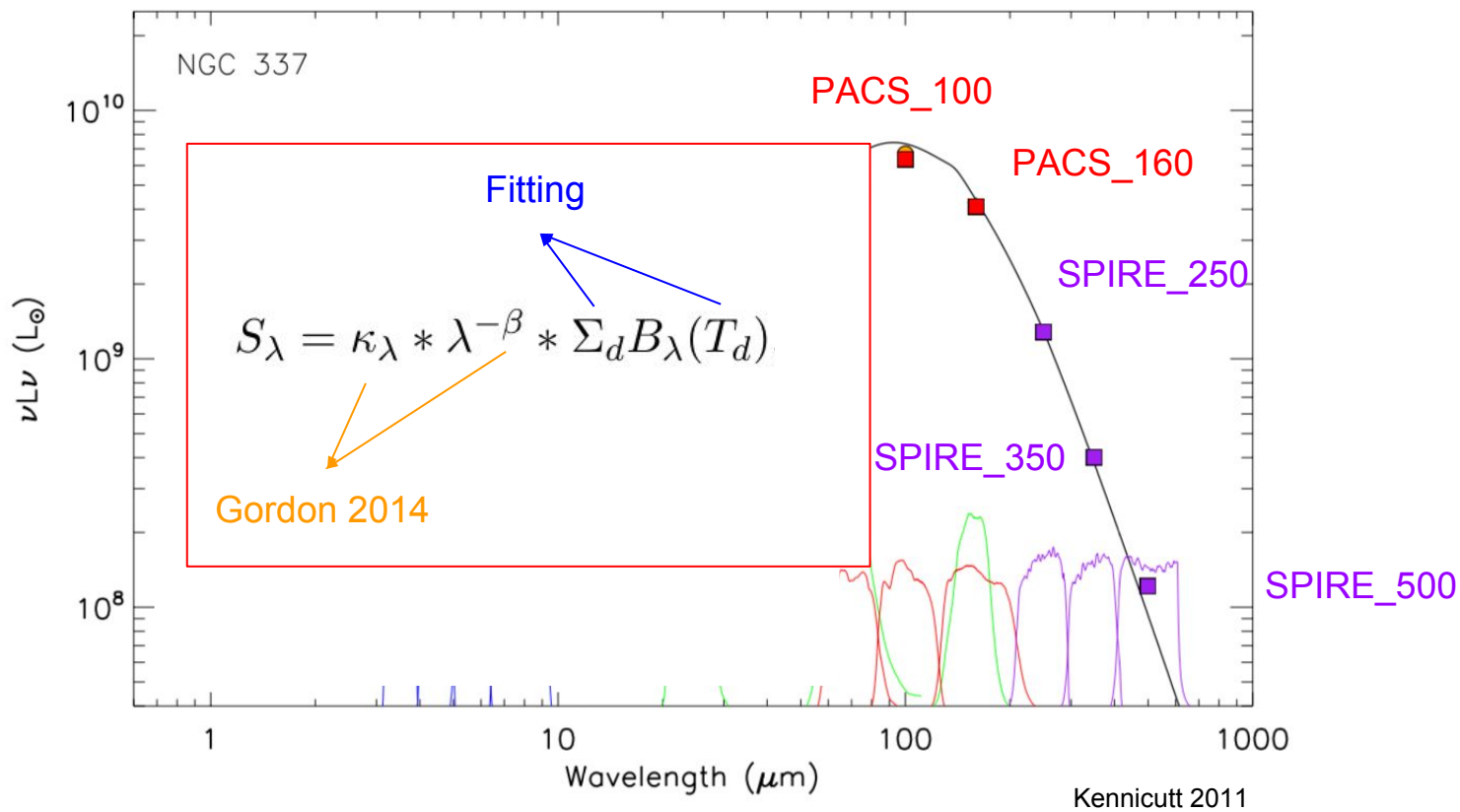
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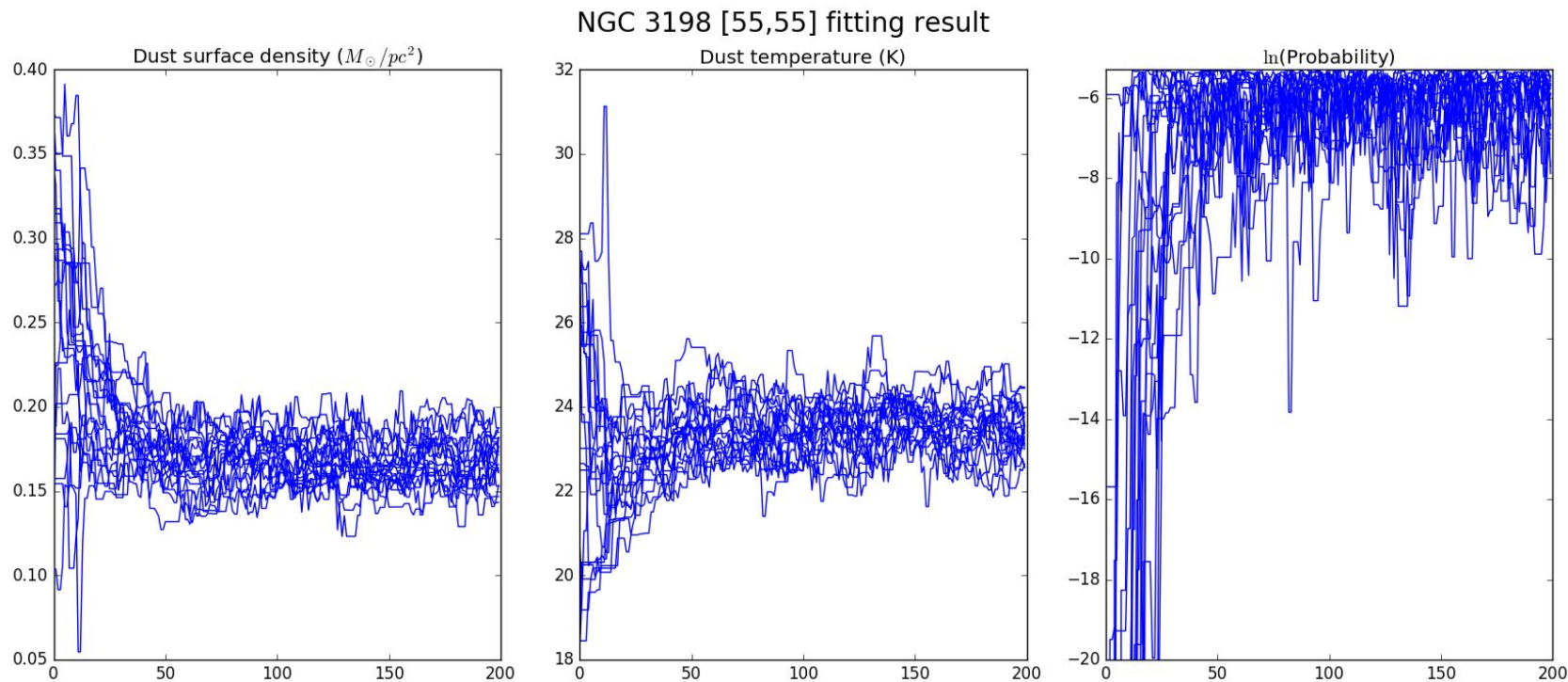
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# Modified Blackbody model and Herschel maps



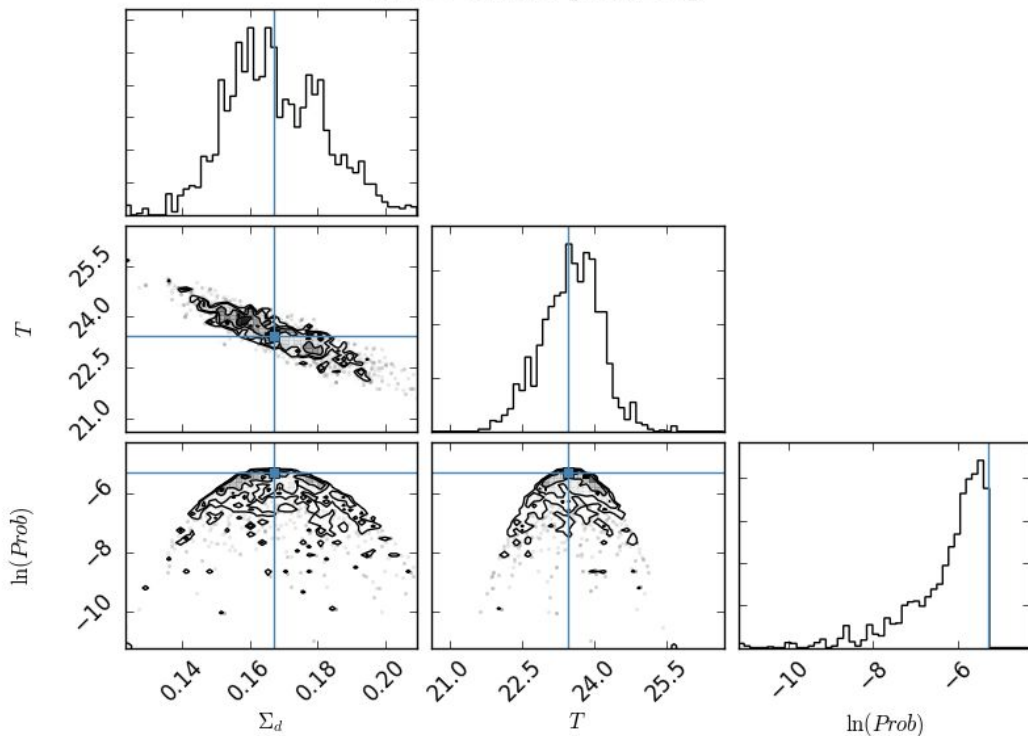
# Fitting results: trend in parameter space





# Fitting results: parameter space

NGC 3198 [55,55]



- We use the “likelihood function” as:

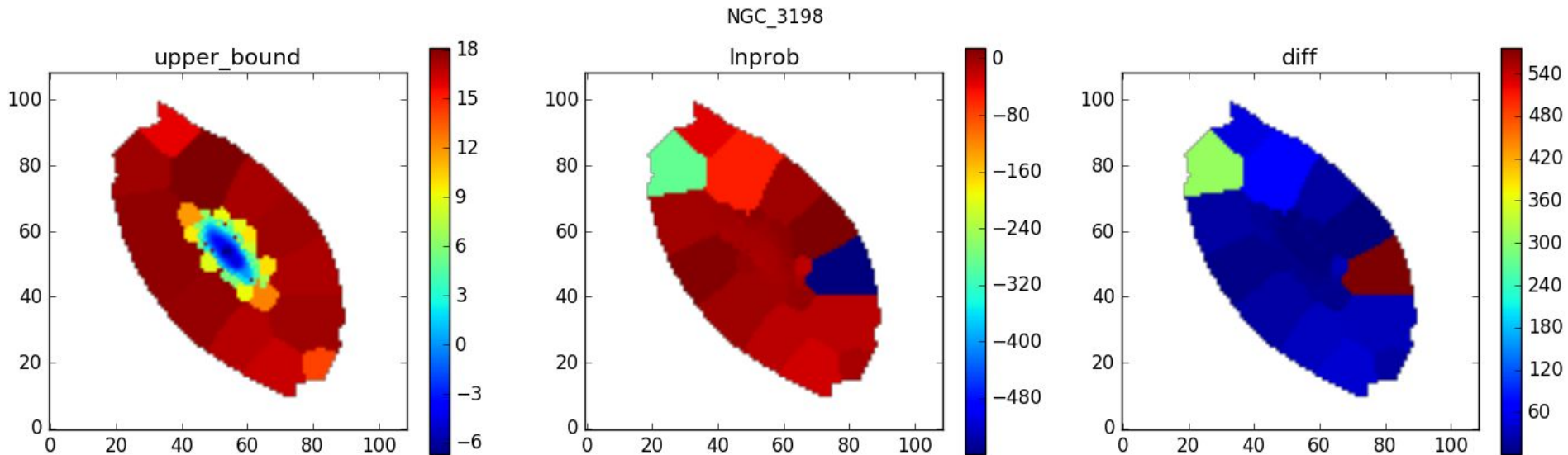
$$\text{Prob}(\Sigma, T) \propto \exp(-(\text{data-fit})^2 / 2\sigma^2) / \sigma,$$

thus,  $\ln(\text{Prob})$  has an upper bound as

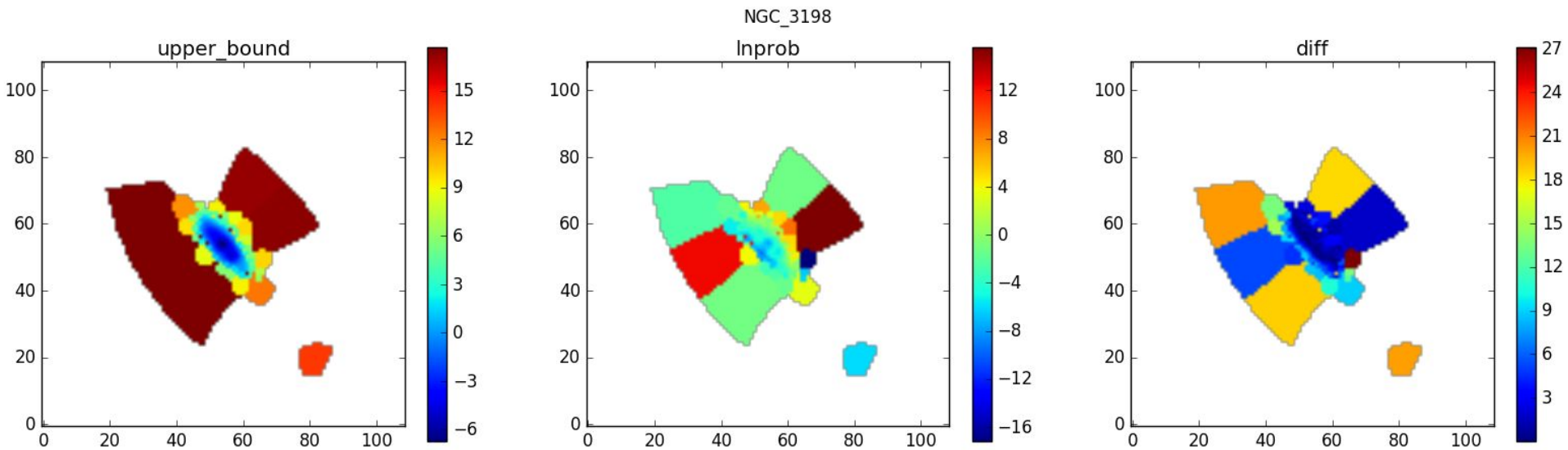
$$\ln(\text{Prob}) \leq -\ln(\sigma).$$

- In this case, upper bound = -4.29, while the value we take have  $\ln(\text{Prob}) = -5.29$
- Still testing parameters to define a “good fitting” according to upper bound

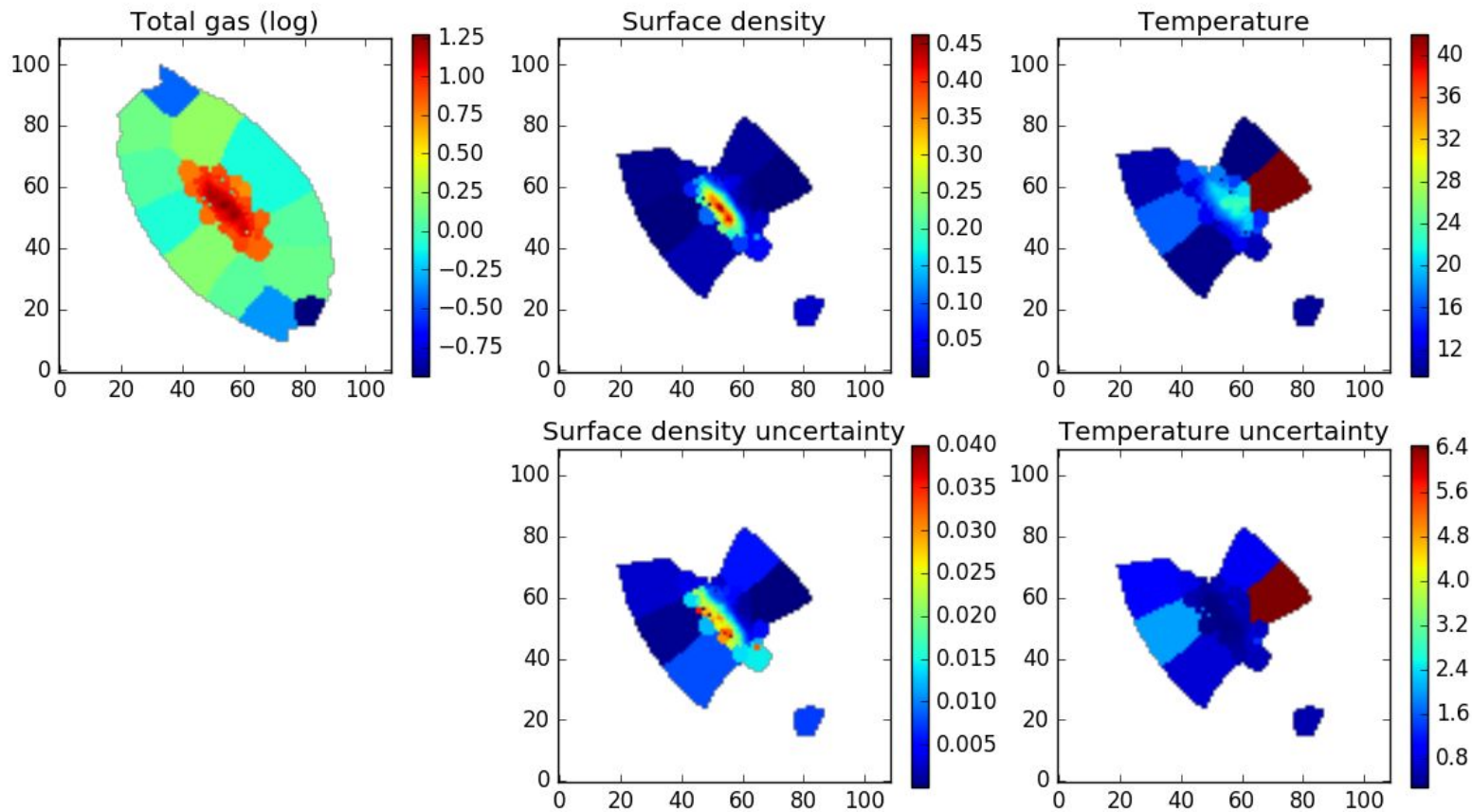
# Fitting results: upper bound versus $\ln(\text{Prob})$



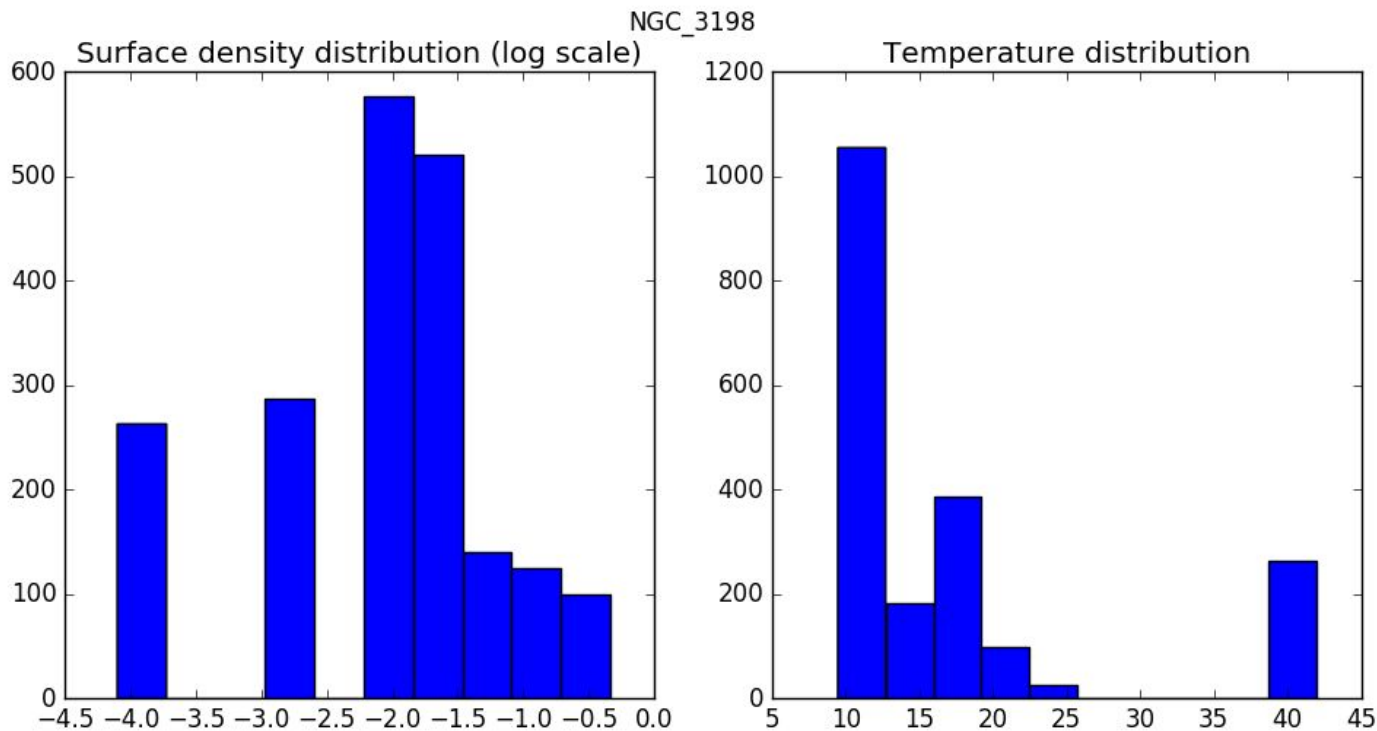
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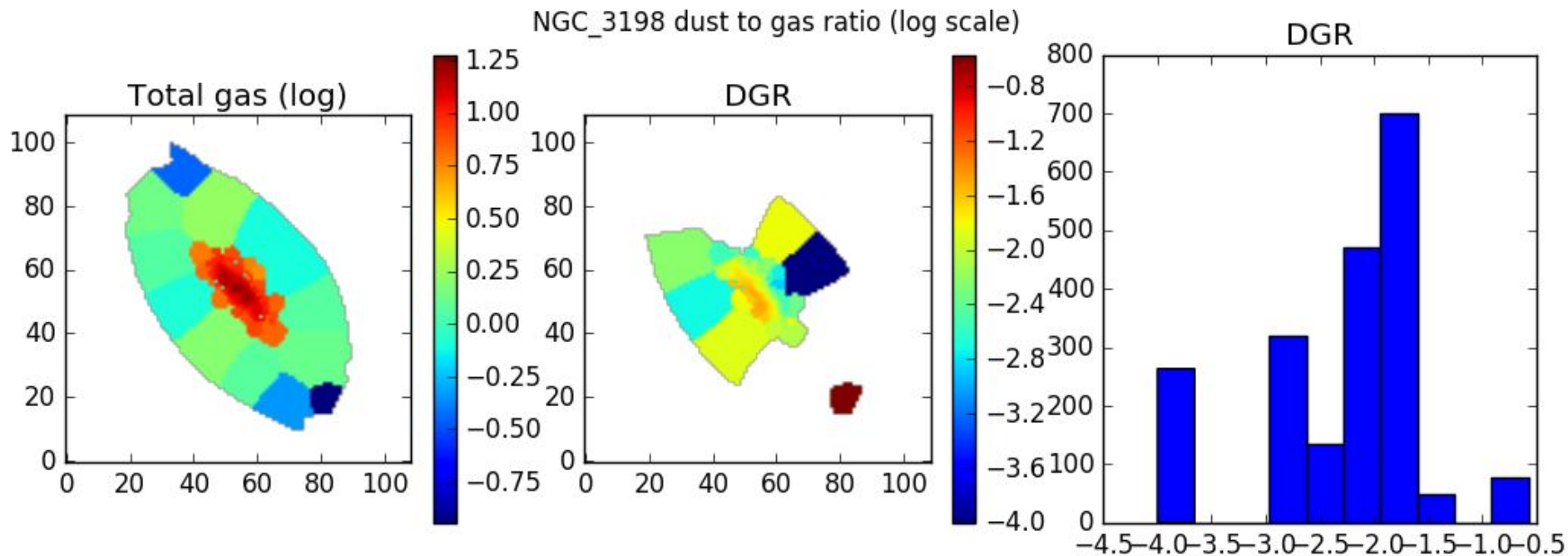
# Fitting results: (cut at diff = 30)



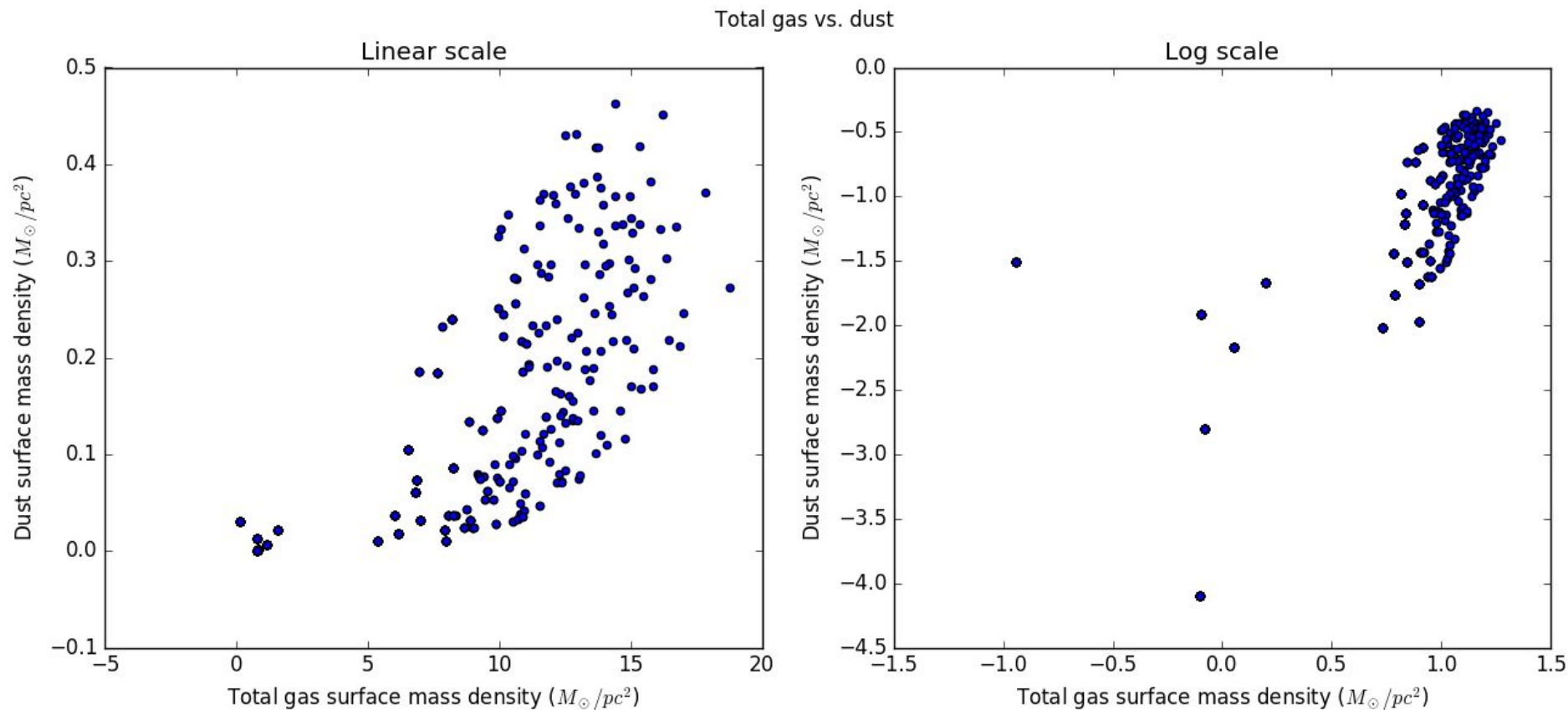
# Fitting results: histogram



# Fitting results: DGR



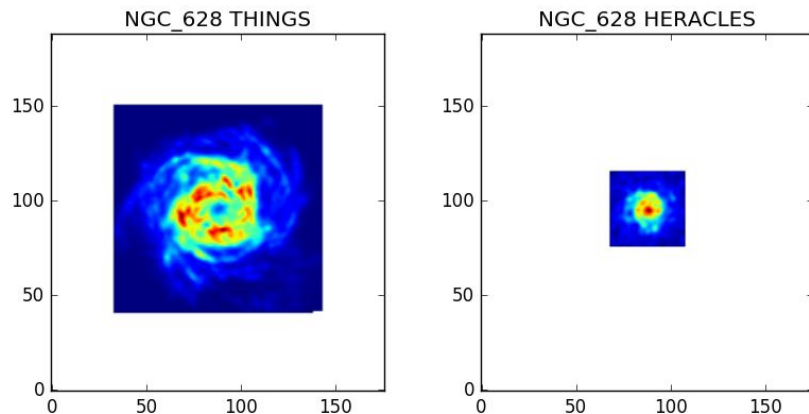
# Fitting results: scatter plot



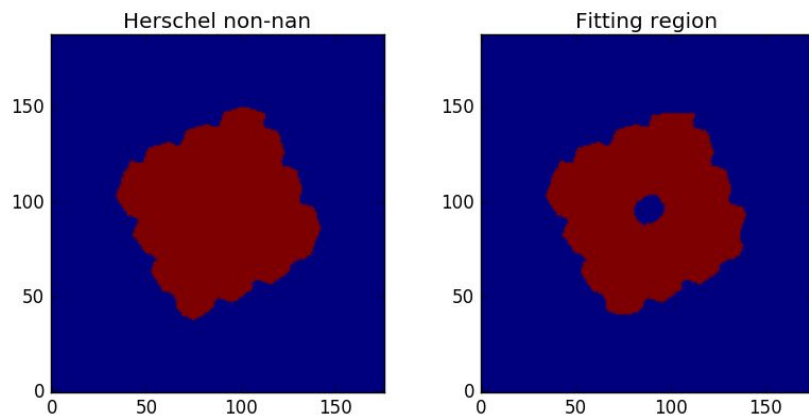
End



# Region to fit: HI dominate region



$N(\text{HI}) > 10^{-18} \text{ cm}^{-2}$  &  
 $N(\text{HI}) > 2 * N(\text{H}_2)$  &  
All Herschel maps are not NAN



Calculate uncertainty by variance  
of region with:  
not ( $N(\text{HI}) > 10^{-18} \text{ cm}^{-2}$ ) &  
The Herschel map is not NAN

# Fitting results: exp calculation

[60, 70] → weird high temperature point

[55, 55] → normal point

If  $D = a \cdot G^b$ , then  $\log(D) = \log(a) + b \cdot \log(G)$