Resolved stellar populations using KCWI

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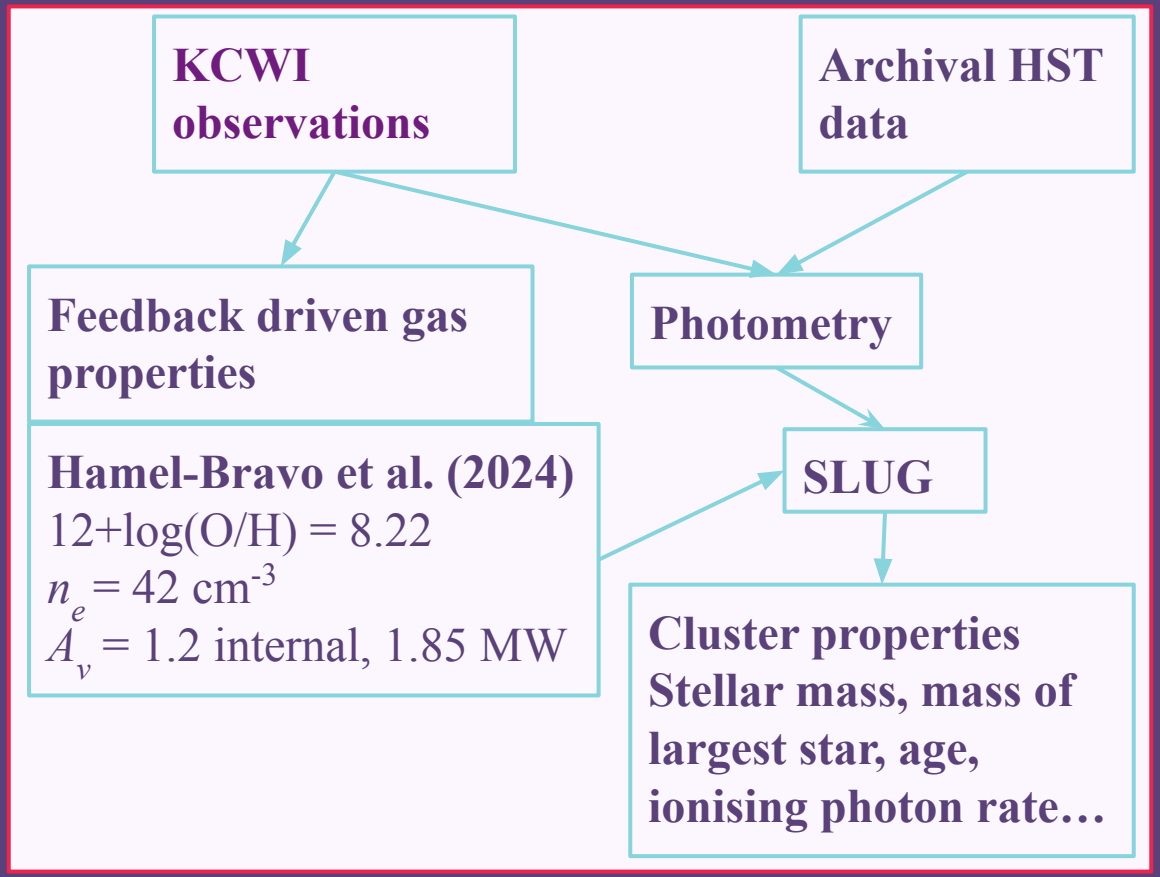
Aims: Determine the properties of stellar clusters in a nearby starburst galaxy to better quantify the effects stellar feedback has on galaxy evolution

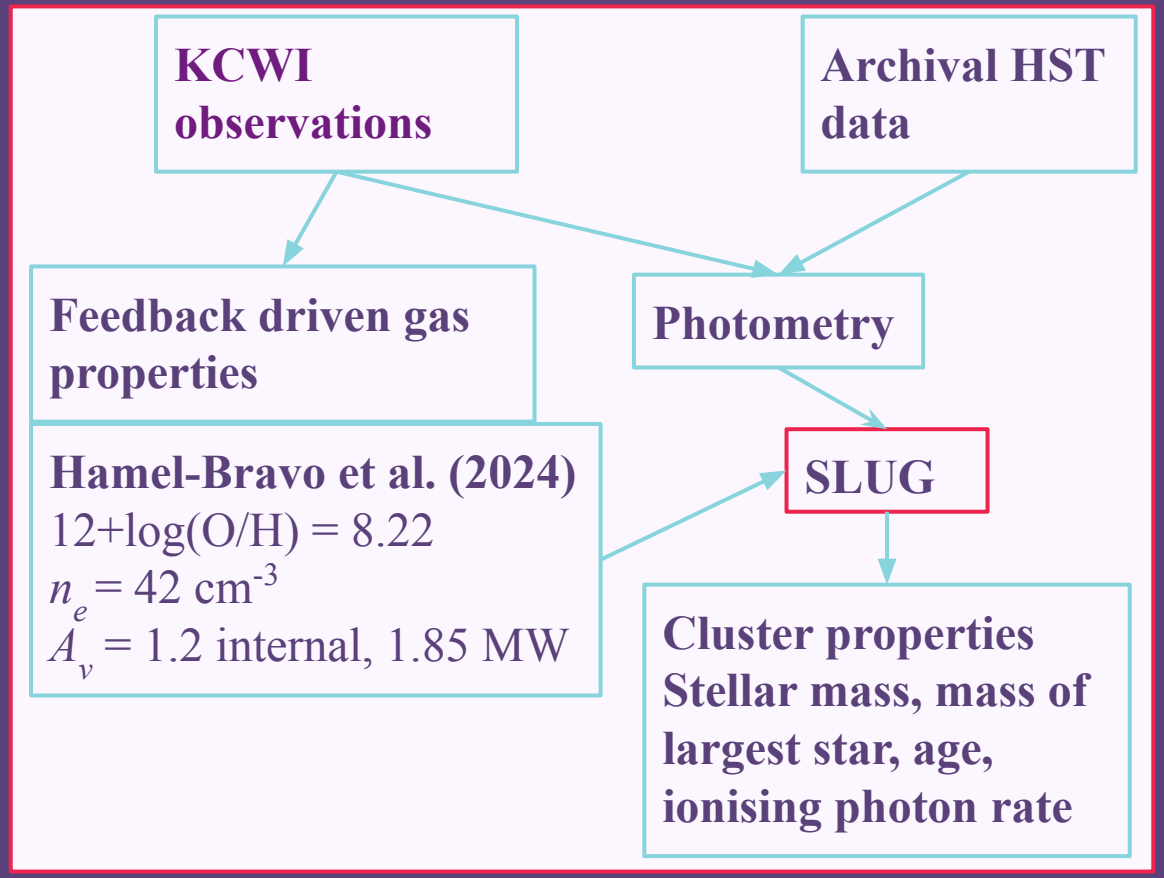
Methods:

We use Keck/KCWI data, in addition to archival HST data used to overcome crowding and increase spectral coverage.

This data is used in combination with SLUG (Krumholz et al. 2015) and its associated python modules to obtain the physical properties of the clusters.

The physical properties of the clusters can then be used to study the effects of stellar feedback on the galaxy


KCWI observations
Archival HST data
Feedback driven gas properties
Photometry
Hamel-Bravo et al. (2024)
12+log(O/H) = 8.22
n_e = 42 cm^{-3}
A_v = 1.2 internal, 1.85 MW
SLUG
Cluster properties
Stellar mass, mass of largest star, age, ionising photon rate…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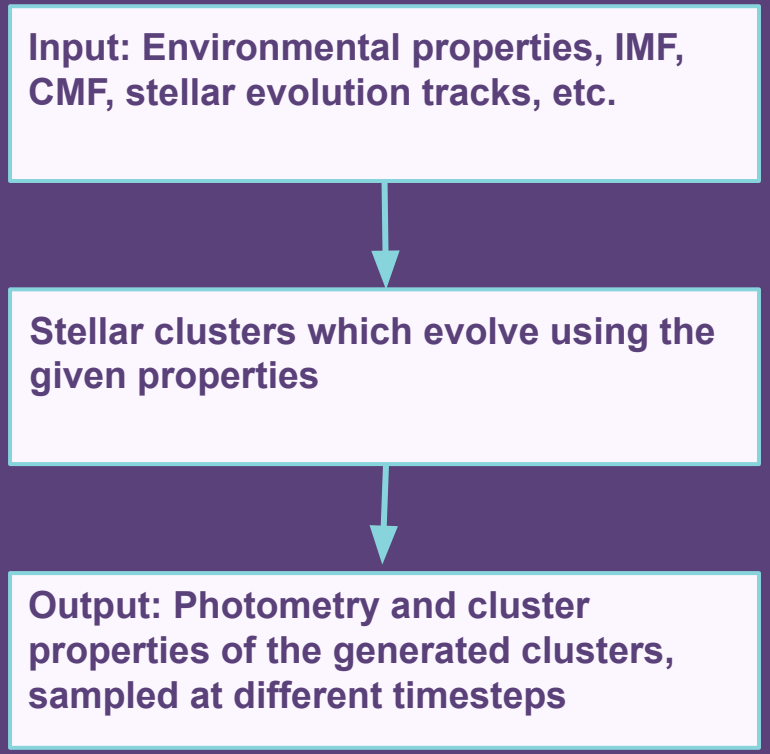
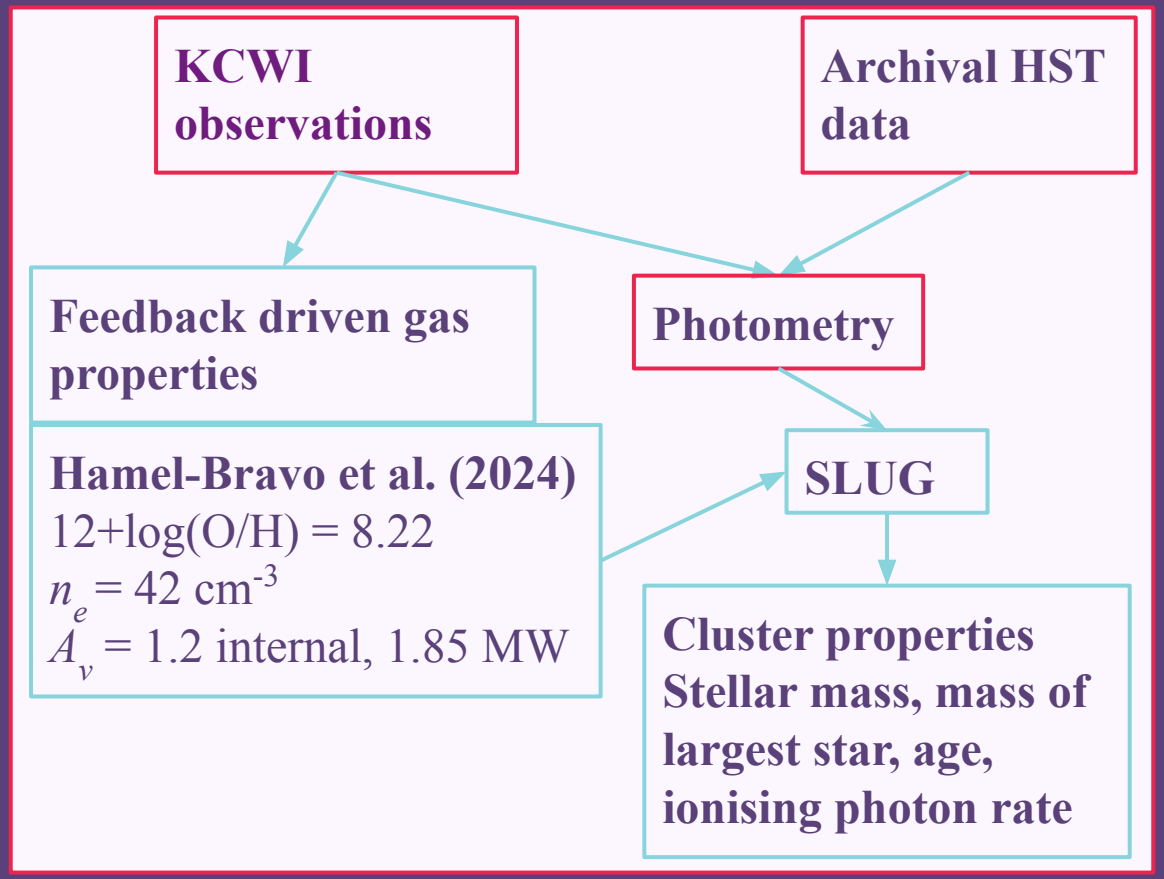
Stochastically Lighting Up Galaxies (SLUG)

- **SLUG (Krumholz et al. 2015) generates a stellar population by stochastically sampling a given IMF**
- **SLUG generates photometry in selected filters given parameters such as metallicity, electron density, and extinction**
- **By running multiple times with a range of parameters we generate a large library of clusters with different properties**

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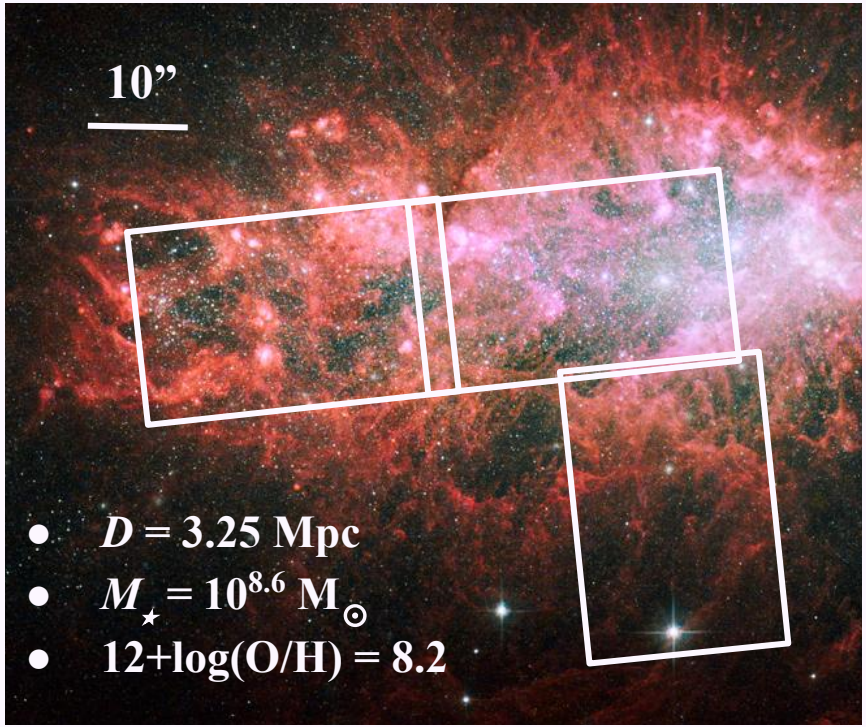
	MUSE	KCWI	BlueMUSE
Spatial sampling	0.2” × 0.2”	0”.29×(0.35”–1.4”)	> 0.3”
FOV	1 × 1 arcmin	20” × (8 to 33)”	2 arcmin^2
Wavelength range	4650 - 9300 Å	3500 - 5600 Å	3500 - 5800 Å
Spectral Resolution	2000 - 4000	1000 - 20000	~ 3500
Location	Southern hemisphere, 2635 m elevation	Northern hemisphere, 4145 m elevation	Southern hemisphere, 2635 m elevation
AO	Yes	No	No

Keck Observations of NGC 1569

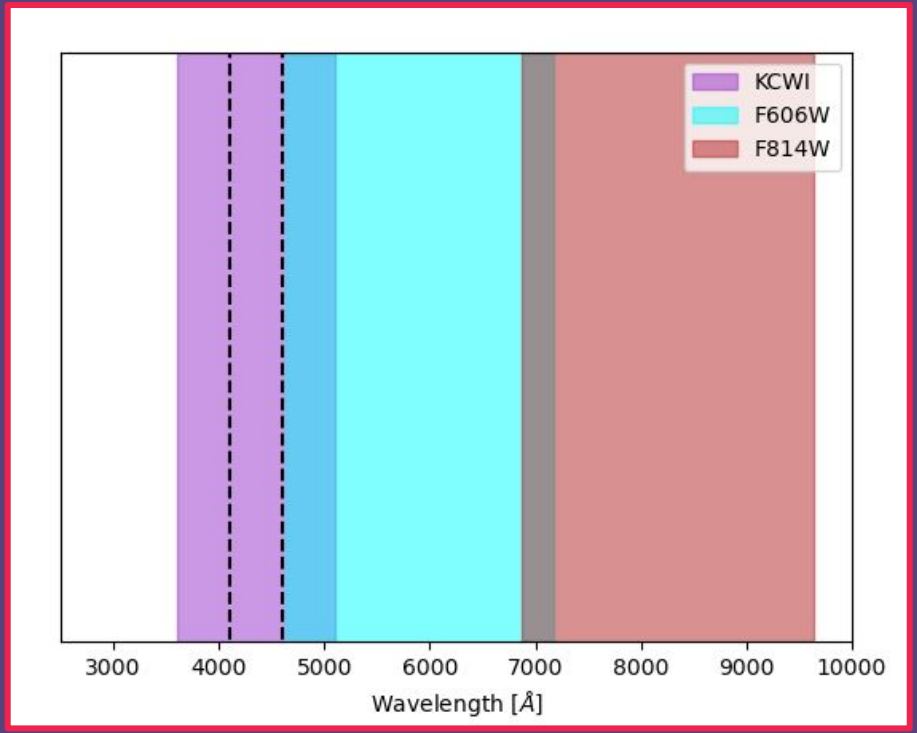
- **Observed as part of the DUVET (Deep near-UV observations of Entrained gas in Turbulent Galaxies) survey (PI Deanne Fisher)**
- **3 pointings**
  - **FOV of each frame: 20” × 33”**
  - **All pointing use the large IFU slicer**
  - **Spaxel size 0”.29 × 1”.35**
- **Two grating configurations**
  - **Centered at 4050 Å (blue)**
  - **Centered at 4700 Å (red)**
  - **Total wavelength range 3600 Å - 5130 Å with R ~ 2000**



Red: F658N (Hα + [N II]), Green: F606W,
Light blue: F5002N ([O III]), Dark blue: F487N (Hβ)

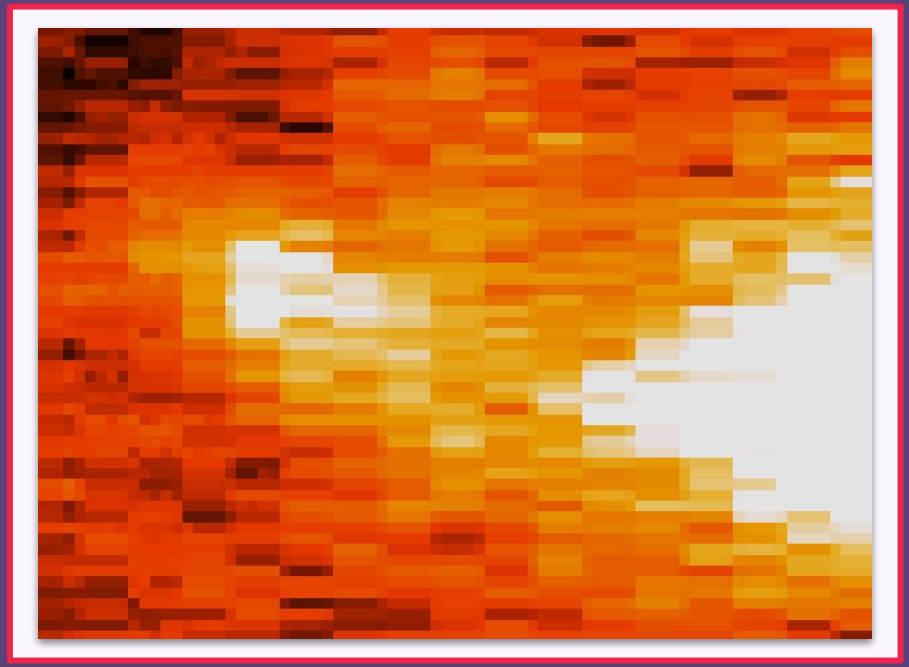
Archival HST data used to overcome crowding and increase wavelength coverage

- **The spatial resolution of KCWI is not sufficient to resolve individual clusters**
- **In order to locate the clusters we use archival HST data**
  - **ACS F606W and F814W from Aloisi, 2006 (HST Proposal ID #10885)**
- **Also serves to increase spectral coverage**



Resampling spaxels for comparison with other instruments

- **The rectangular spaxels of KCWI complicate comparisons with data from other instruments, as the aspect ratios differ**
- **In order to align the IFU and HST data, the rectangular spaxels of KCWI must be resampled to squares, which may mean loss of data and/or increased errors**
- **For this data, the 0”.29 × 1”.35 spaxels were reprojected into 0”.29 × 0”.29 using Montage and then binned 3 × 3 to have a size of 0”.87 × 0”.87**



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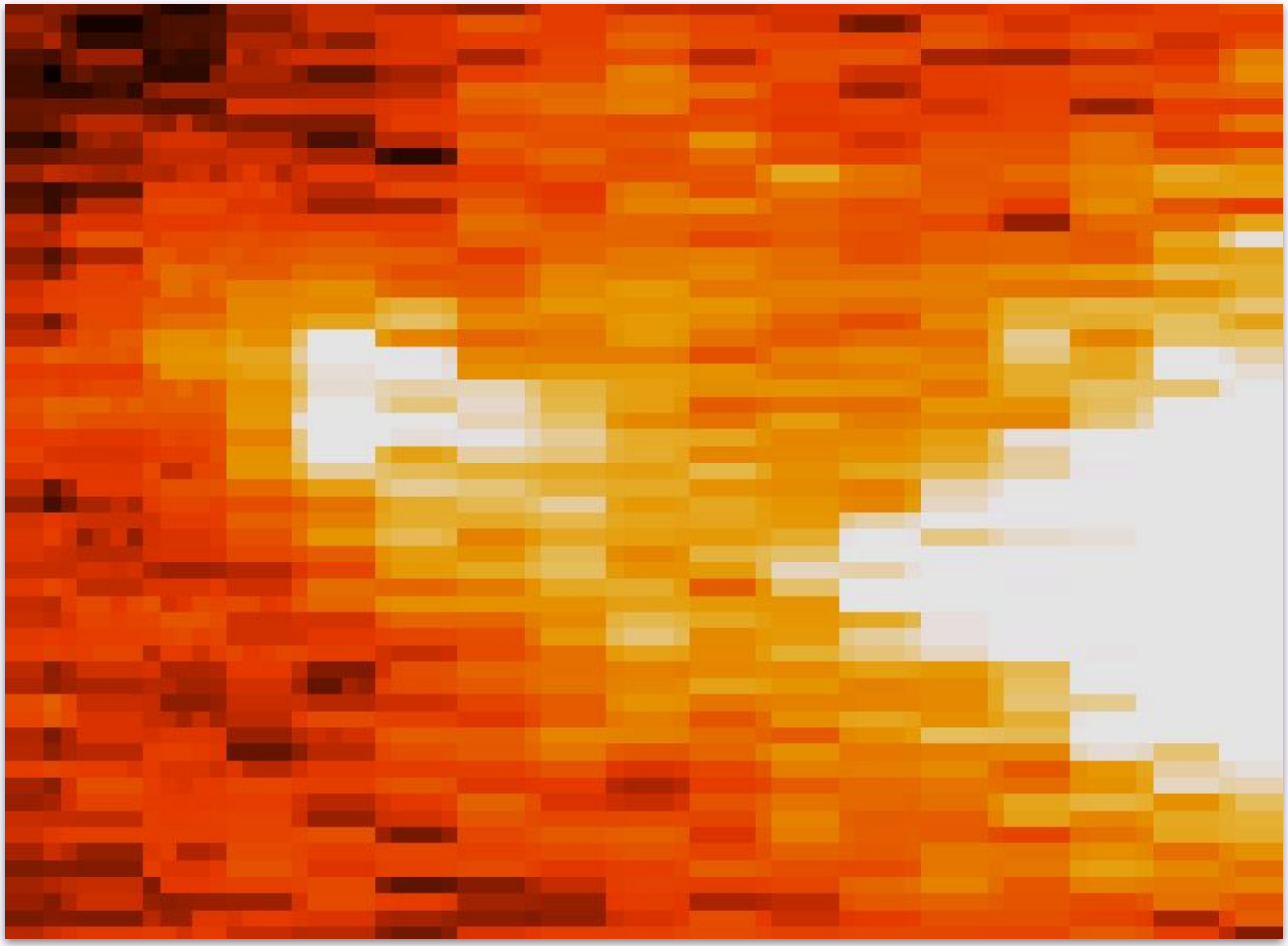
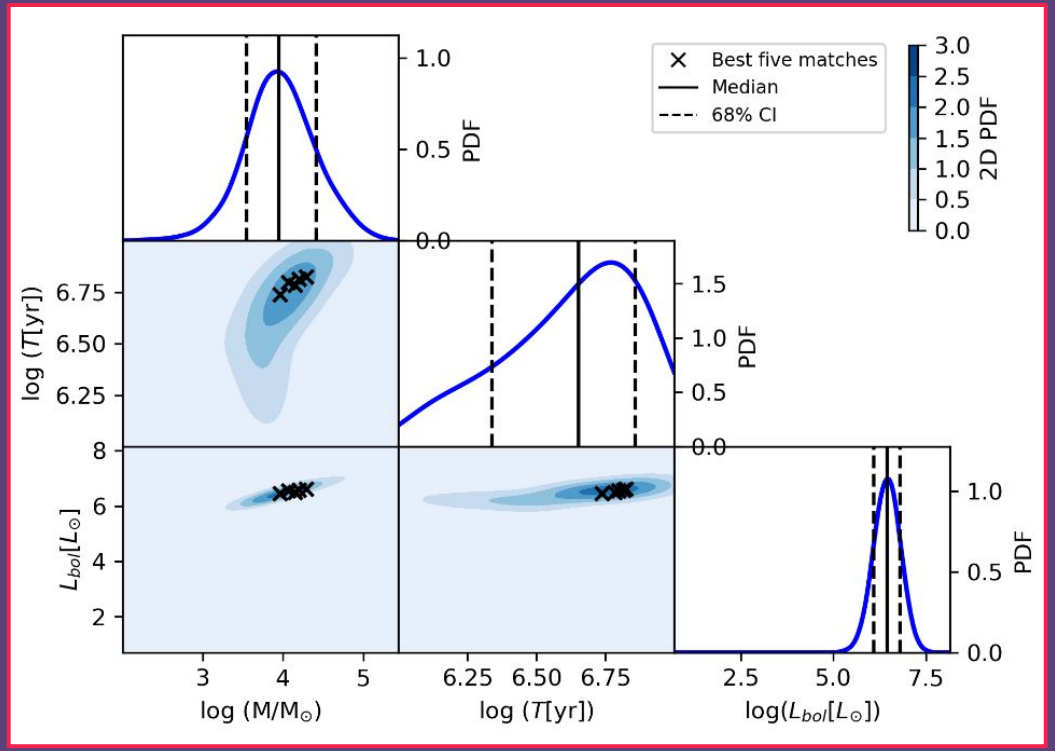


Finding the physical properties of the clusters

- **Once we have the photometry in all filters, these can be matched with the synthetic photometry**
- **This provides a PDF over the parameter space for each cluster**



Rowland et al. (2024)

Next steps

- **With these results, along with the results of Hamel-Bravo et al. (2024) on the feedback driven gas, we can quantify the effects of stellar feedback on the gas, and the galaxy as a whole**
- **This work will then be extended to nearby galaxies which have IFU data and high resolution photometry, creating a tool to automate (parts of) the process**
- **This could then be applied to surveys such as PHANGS and SIGNALS to get large amounts of data for detailed studies of stellar feedback**

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- **Comparing observed cluster photometry and synthetic clusters allows us to extract cluster properties**
- **This allows us to study the effects of stellar feedback on the galaxy**
- **BlueMUSE would make obtaining the data for similar work more efficient in the future, given it's large FOV and wavelength coverage**

Thank you!

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