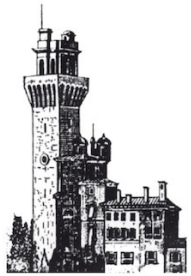
Tracing ongoing quenching in jellyfish galaxies

Ariel Werle

& **the GASP collaboration**



OSSERVATORIO
ASTRONOMICO DI PADOVA

A long, long time ago…

Abell 2744 with JWST + HST by Peter Watson

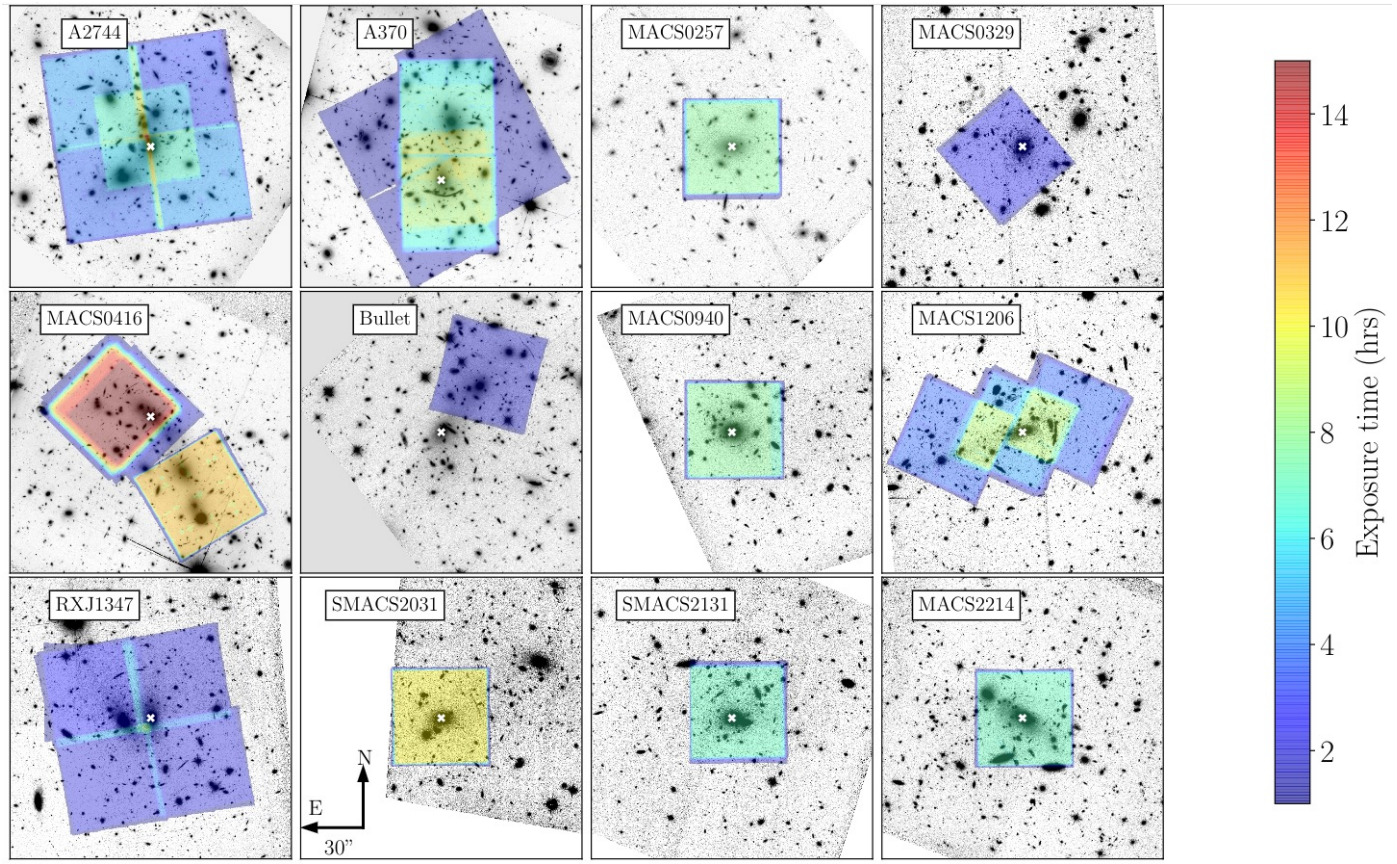
Ram-pressure stripping and galaxy evolution

Jellyfish galaxies showcase **long tails of gas** that is being stripped by ram-pressure.

This process can lead to **fast quenching**, turning star-forming galaxies into **post-starbursts**.

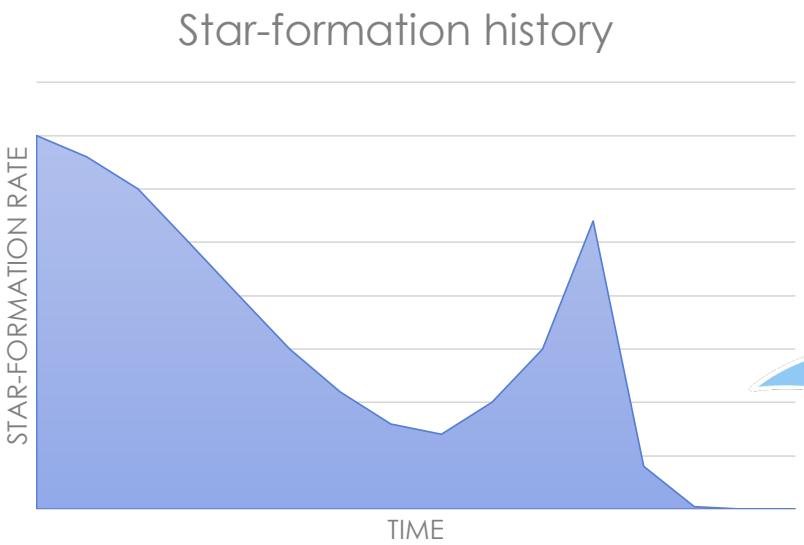
Gullieuszik et al. 2023, see also Giunchi et al. 2024ab and Werle at al. 2024

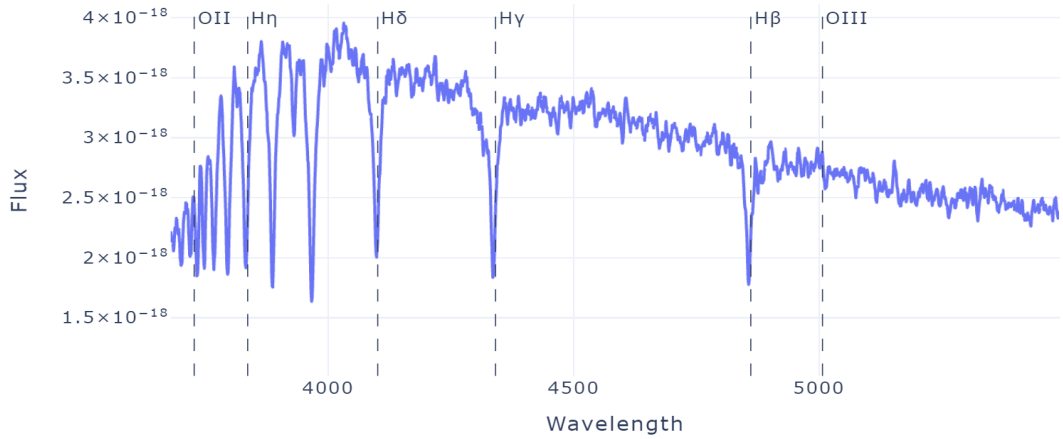
MUSE GTO clusters

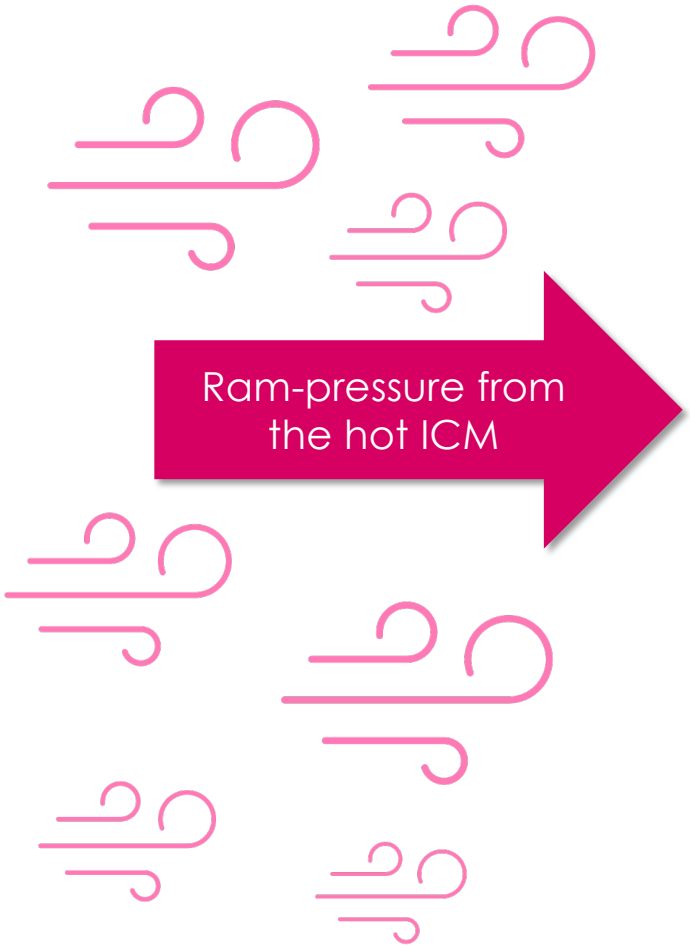


Richard et al. 2021

Post-starburst galaxies



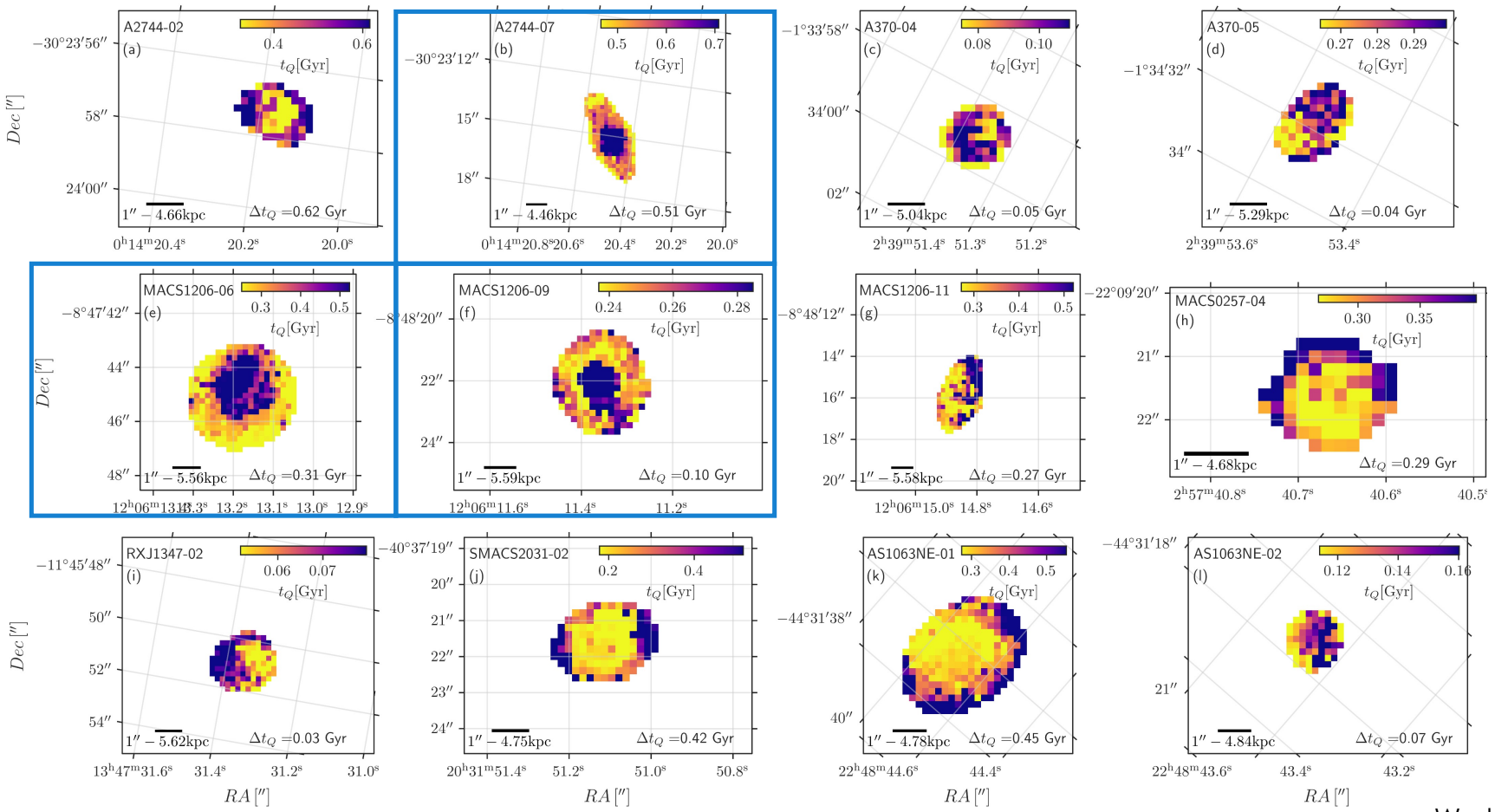




Side-to-side
quenching

Outside-in
quenching

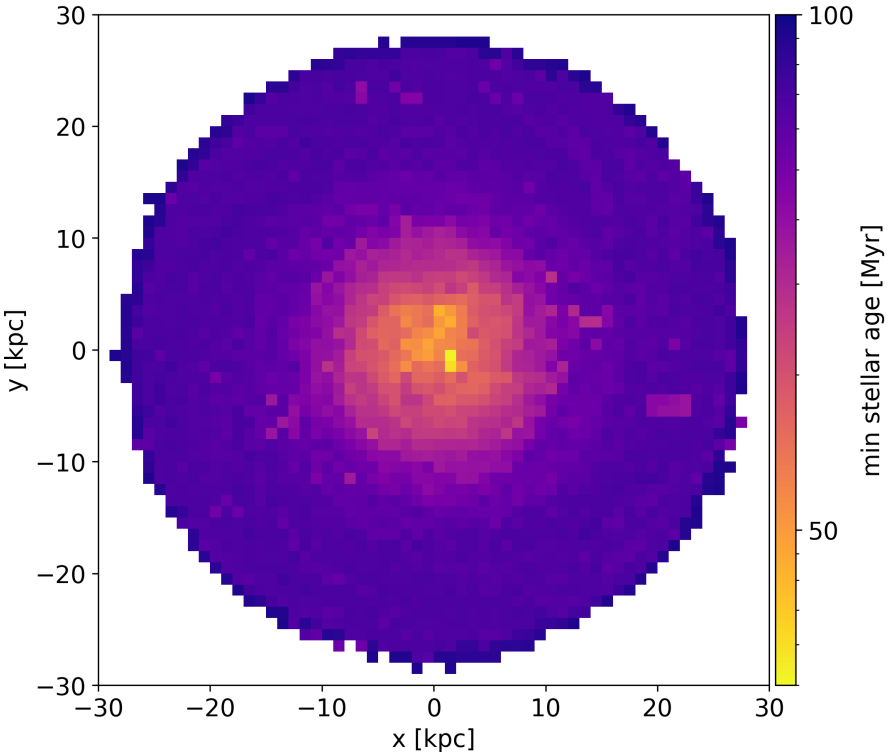
Quenching directions in post-starbursts



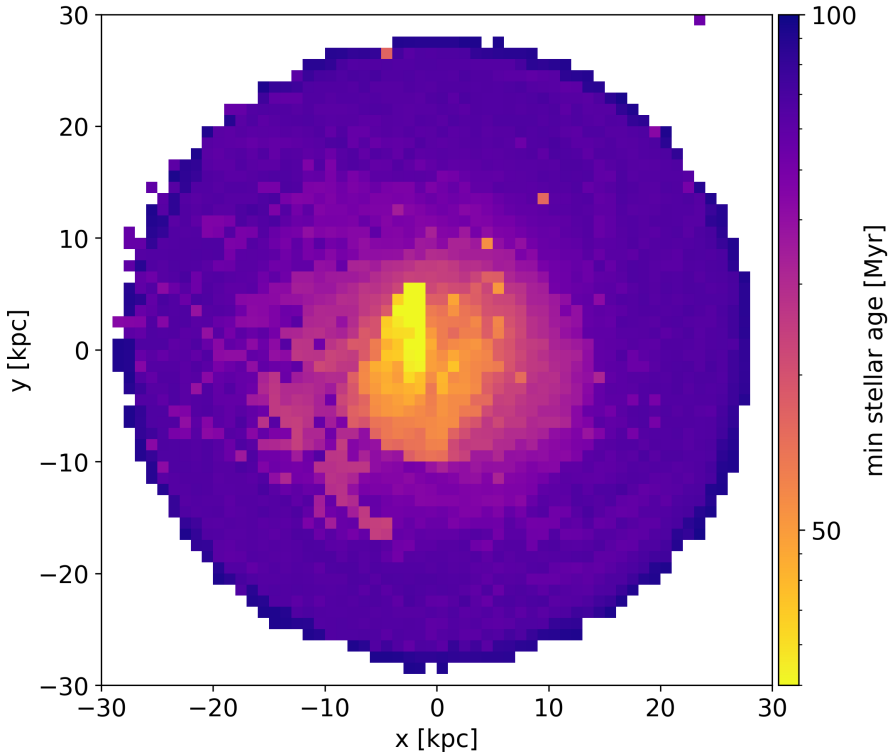
Werle et al. 2022

Simulations

Face-on wind



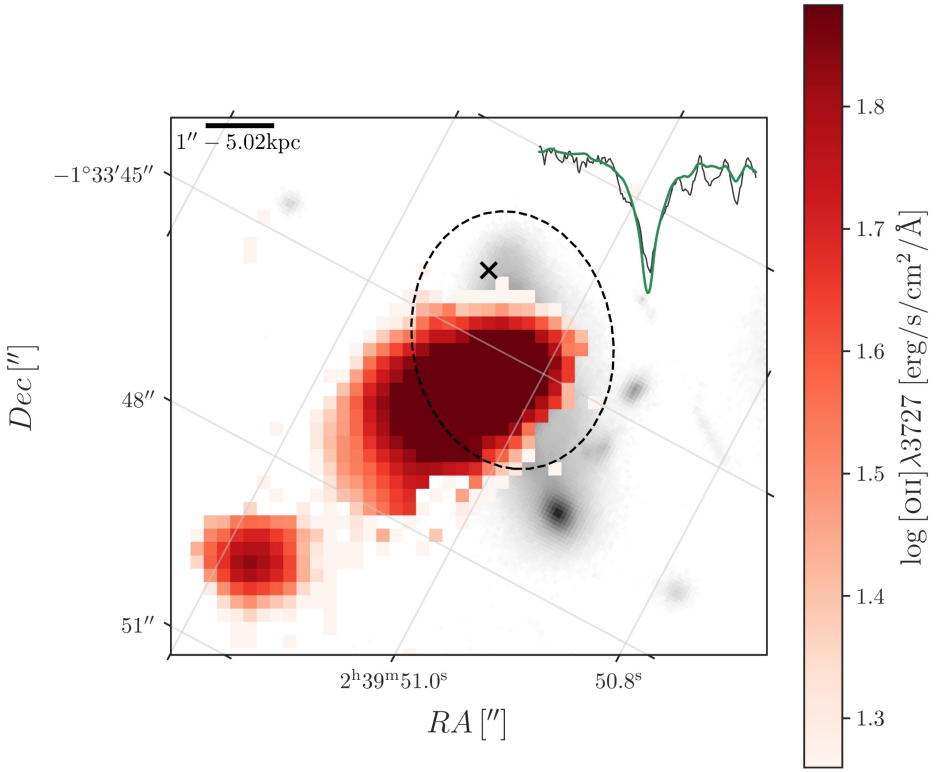
45° wind

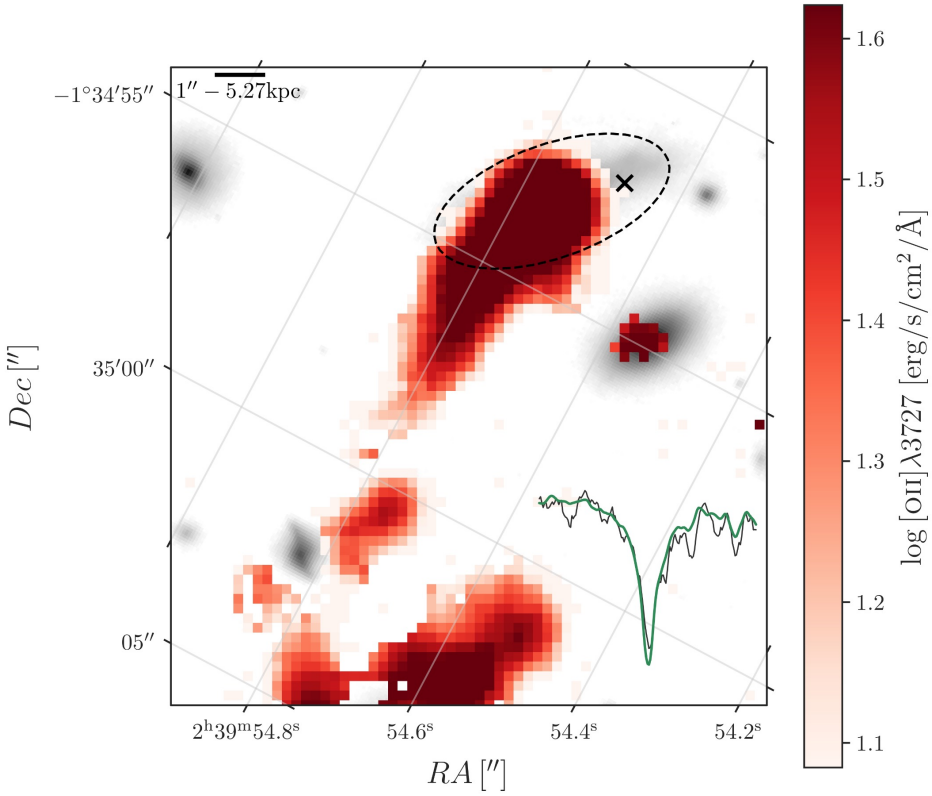


Edge-on case doesn't quench!

Simulations by Nina Akerman

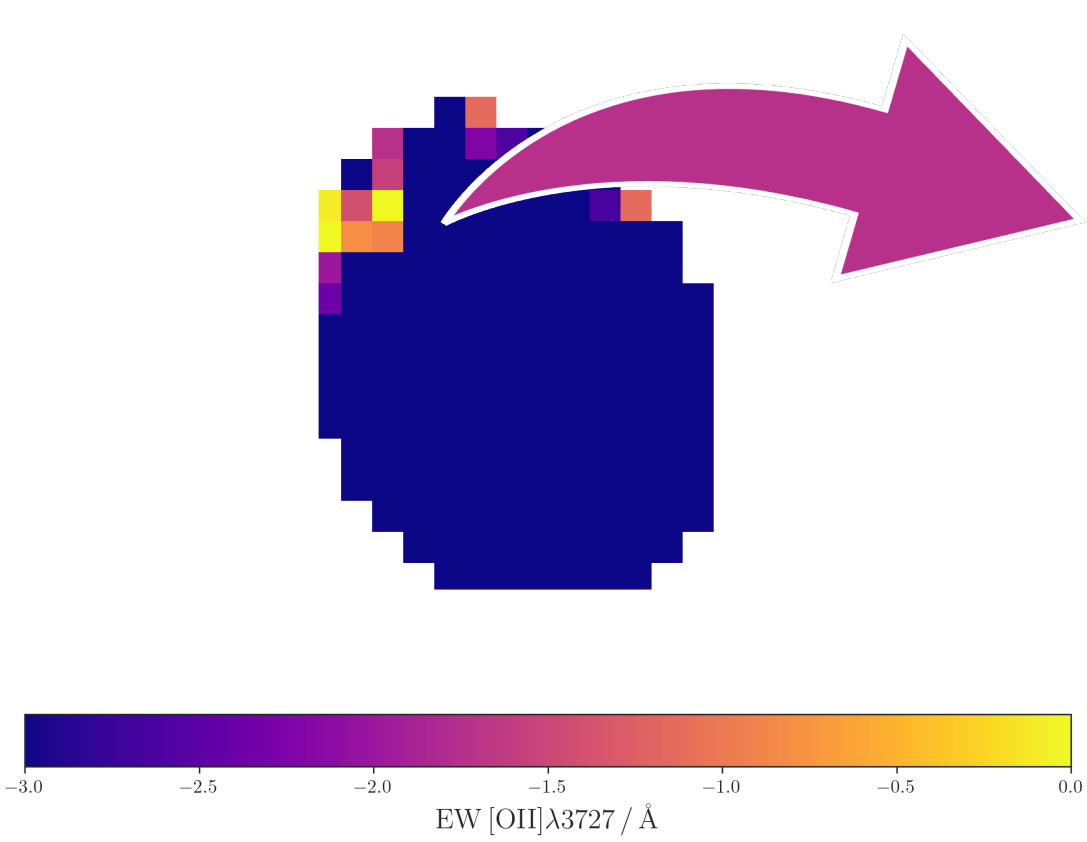
Post-starburst features in jellyfish galaxies

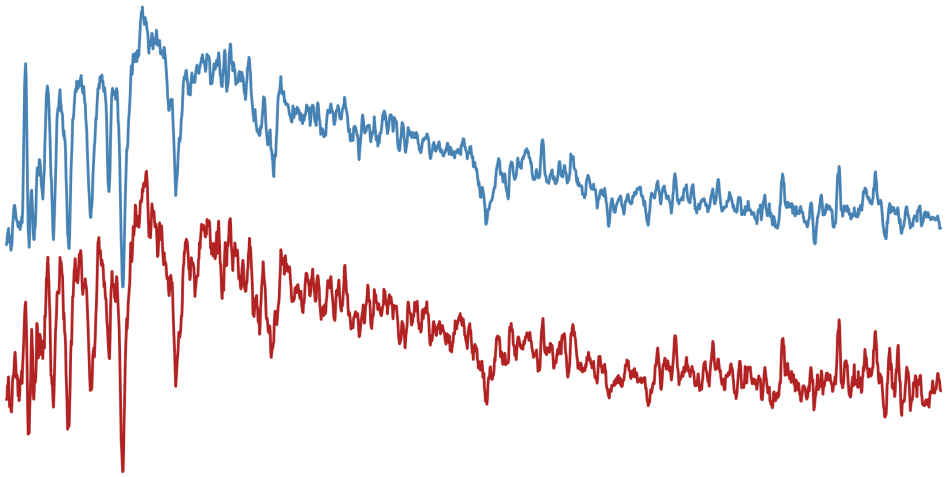




Werle et al. 2022

The problem with traditional classification





Too much importance given to one spectral feature!

Method should consider the **entire spectrum** and be **probabilistic**!

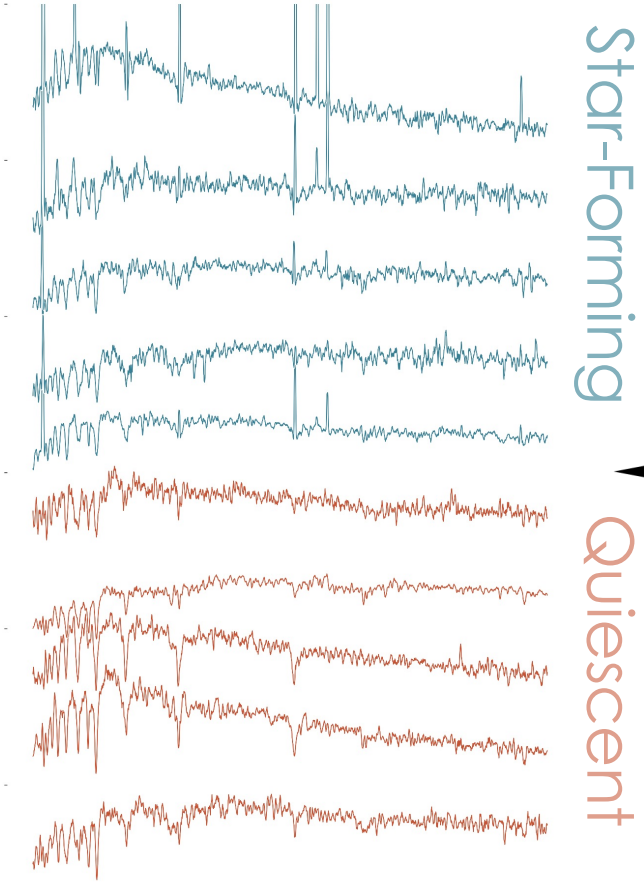
Our proposed solution

There are loads of **star-forming** and **quiescent** galaxies in our observations. We can use spaxel-by-spaxel spectra of these objects to build a training set to classify regions of jellyfish galaxies!

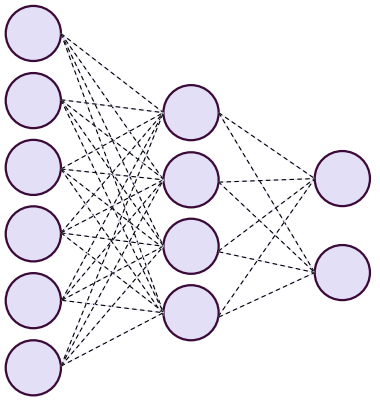
Our proposed solution

Training set obtained from **star-forming** and **quiescent** galaxies in the same MUSE data cubes (individual spaxels).

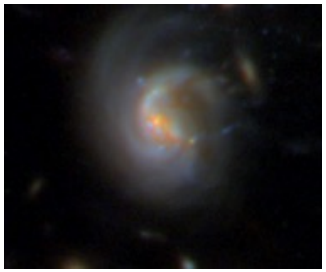
Normalized and **restframed** using the redshift of the galaxy!



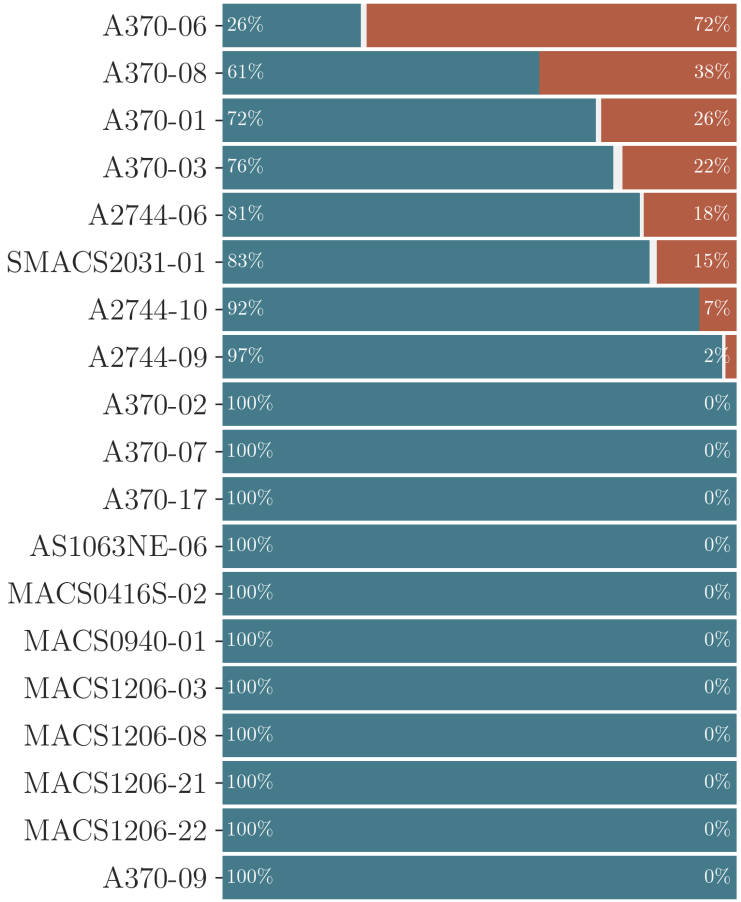
1D CNN classifier



Classify spaxels in a sample of 19 Jellyfish galaxies.



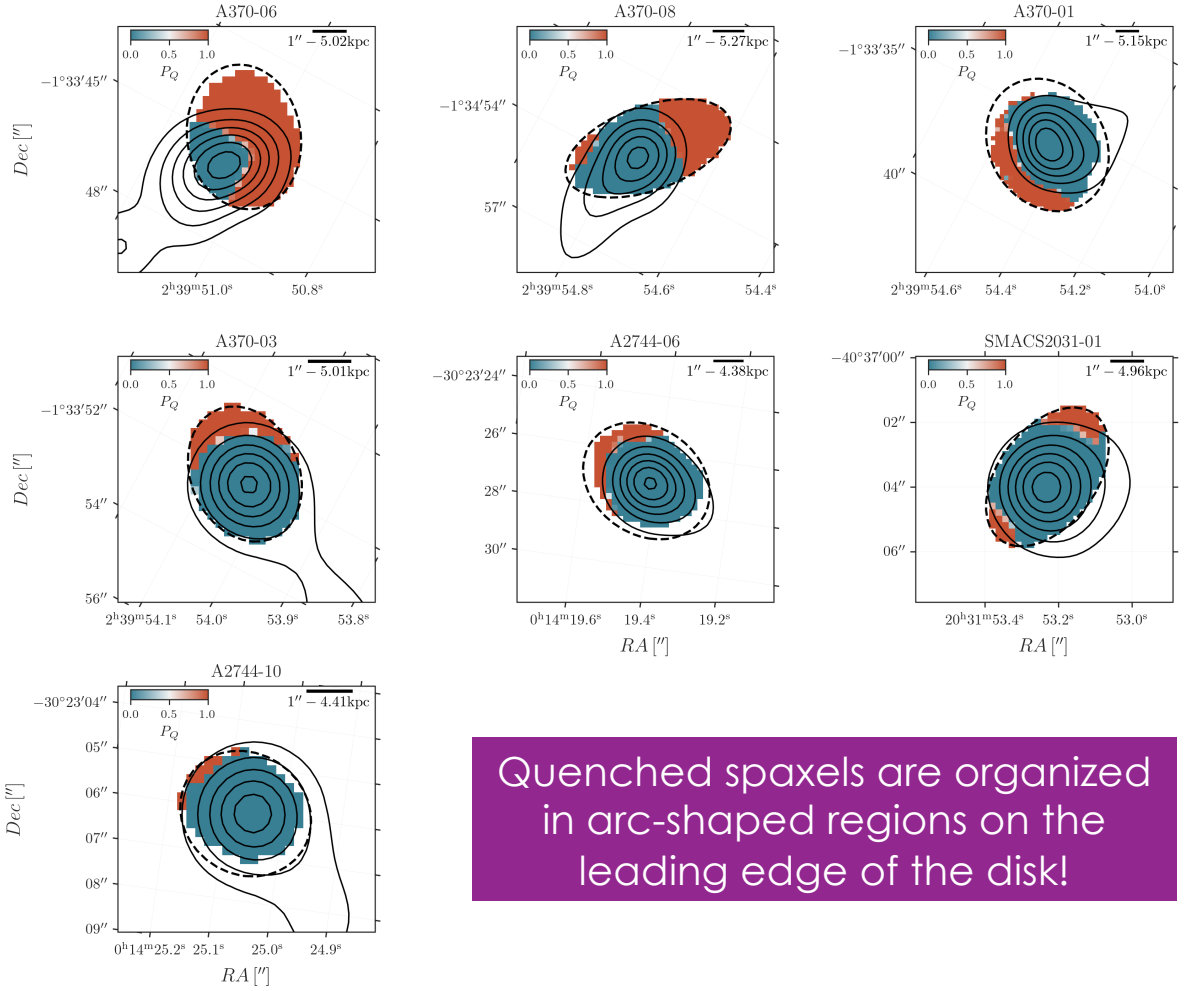
How much quenching do we find?



Seven galaxies with substantial quenched fraction! (Arguably)

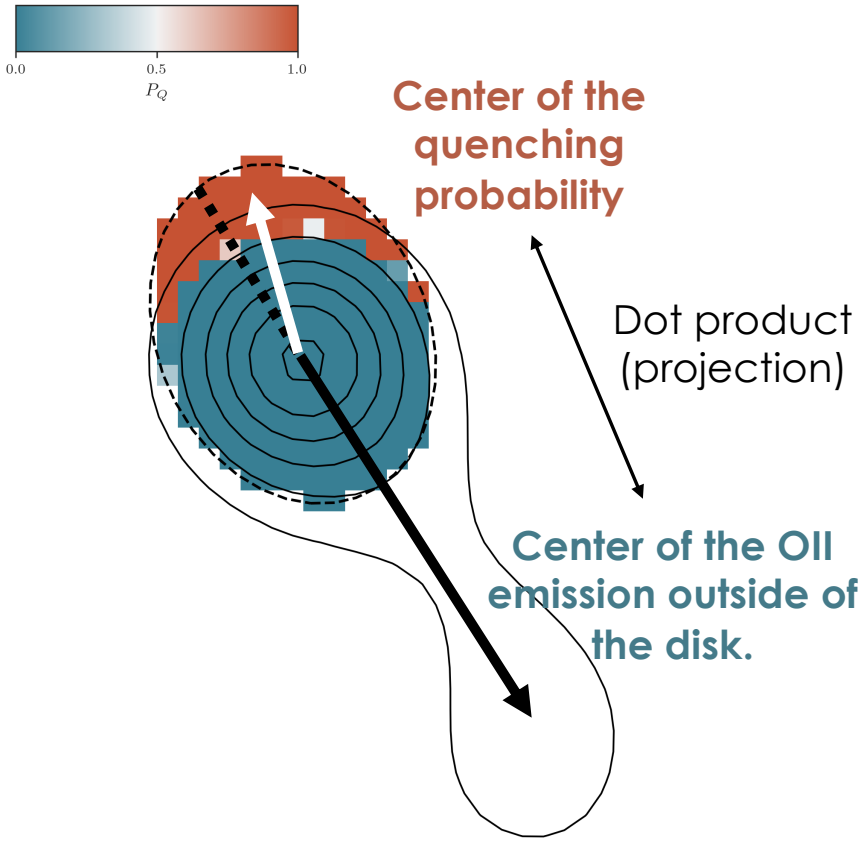
Eleven galaxies with no quenching signatures!

Morphology of quenched regions

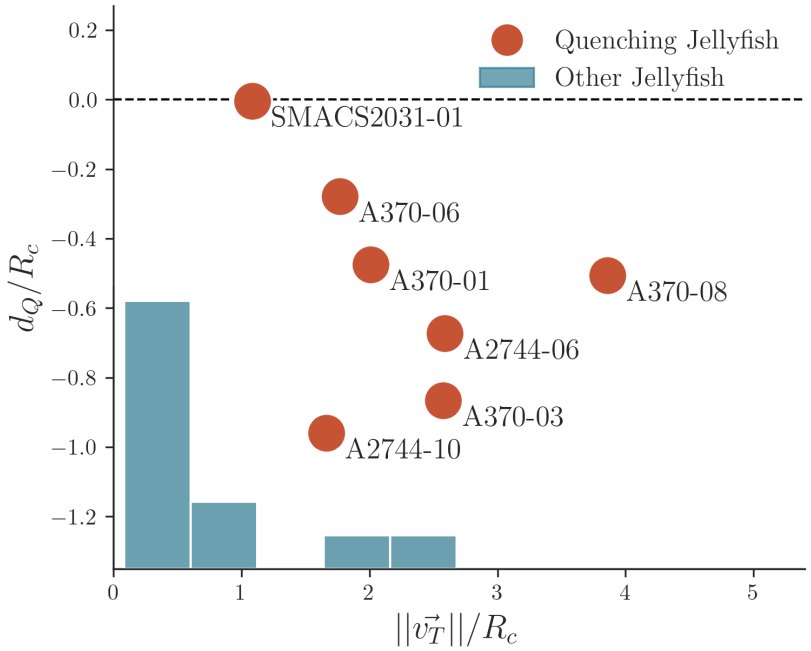


Quenched spaxels are organized in arc-shaped regions on the leading edge of the disk!

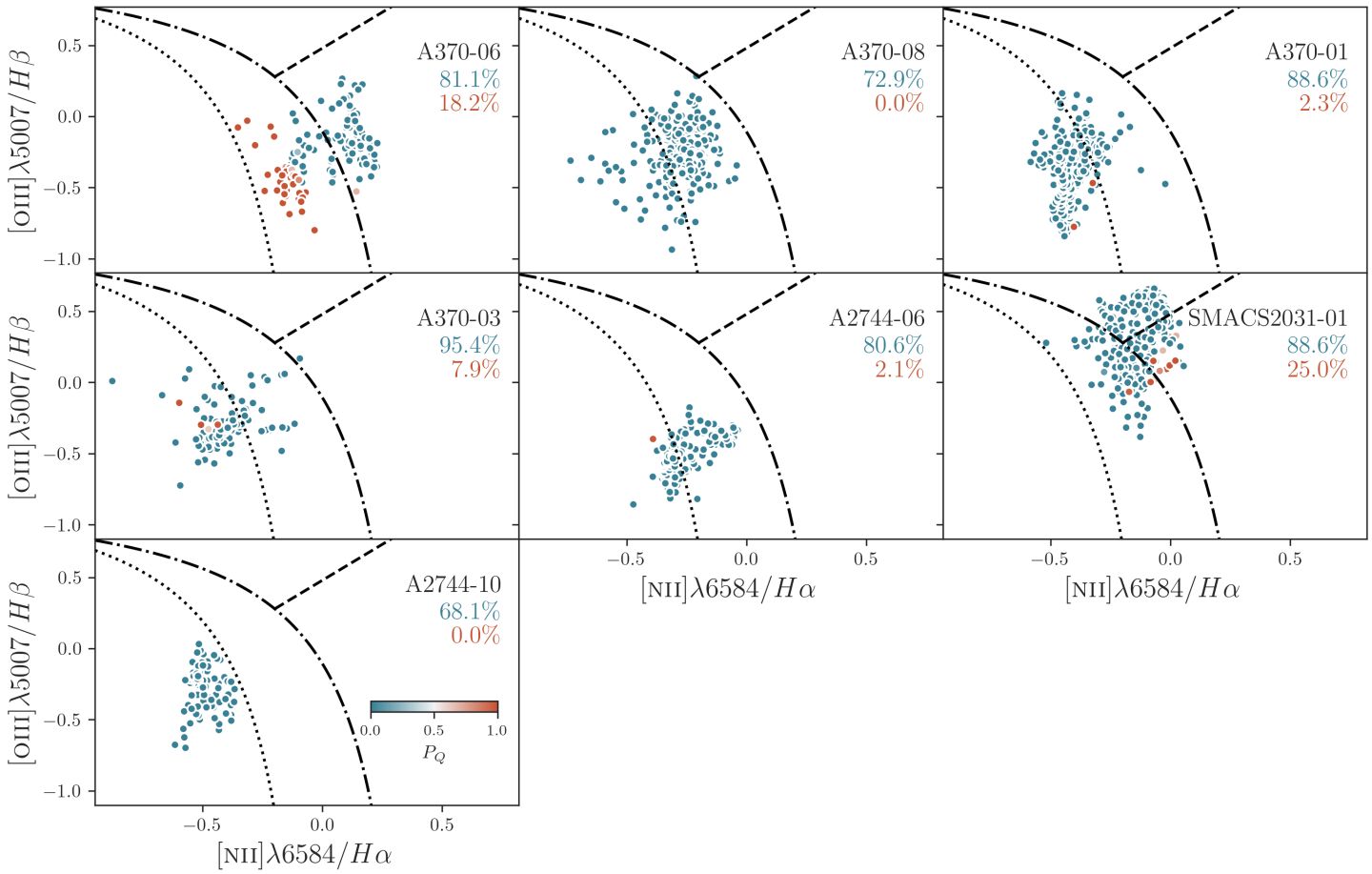
Morphology of quenched regions



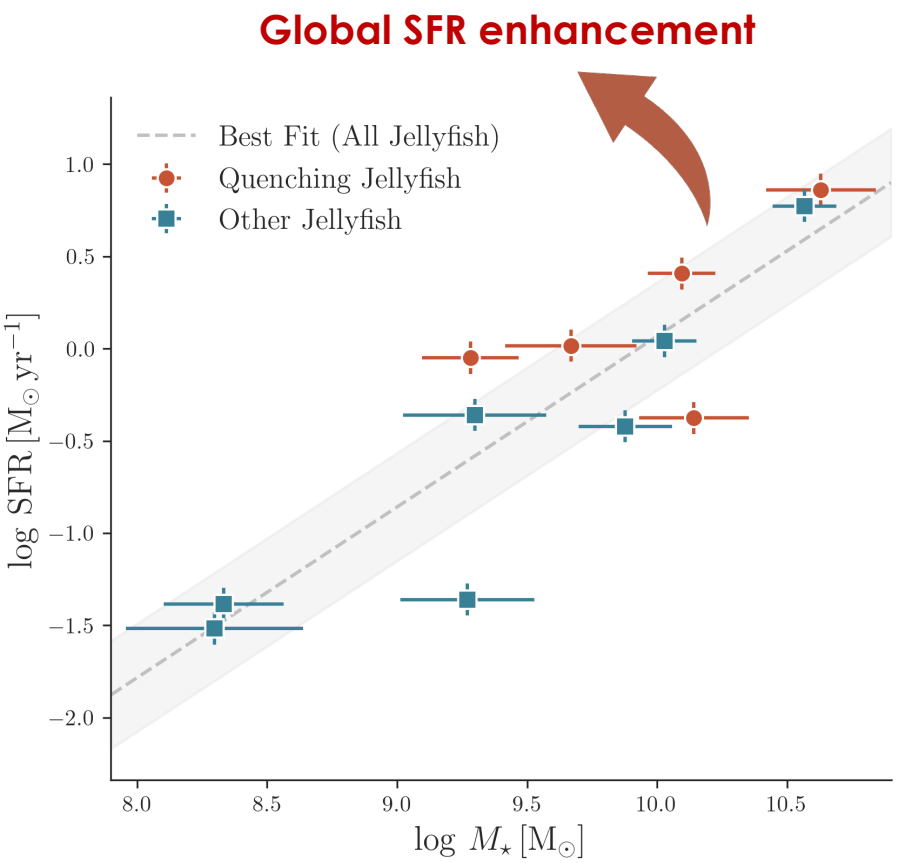
Almost all galaxies with long tails (>1.5 R_e) are undergoing quenching.



What about the remaining gas?



Star-formation rates



Main points

We are able to explain how the **quenching patterns** observed in cluster **post-starburst** galaxies take shape in the gas stripping phase.

- A **1D CNN** can reproduce the spectral **classification** expected from **visual inspection**.
- **Quenching** in Jellyfish galaxies happens in **arc-shaped** regions, being **outside-in and side-to-side** at the same time.
- While the outskirts quench, **star-formation** is **enhanced towards the centre**.