

# On the Origin of Quenched but Gas-rich Regions at Kiloparsec Scales in Nearby Galaxies

Jing & Li (2024), ApJ accepted, [arXiv:2408.12348](https://arxiv.org/abs/2408.12348)

## Introduction

How do galaxies quench their star formation?

- External & Internal processes remove or heat cold gas
- Investigate the significance of local/global properties of galaxies to quenching at kpc scales

## Data

Isolated disk galaxies from MaNGA (Optical IFS)

-(Some selections)-> 265304 spaxels in 1205 galaxies

$\Sigma_{H2}$  from empirical estimator (Appendix B)

- Four parameters from MaNGA
- Estimator calibrated by EDGE-CALIFA

## Method

Identify quenched regions by  $D_n(4000) - \log EW(H\alpha) > 1.3$

- Divide the regions into gas-rich quenched regions (GRQRs) and gas-poor quenched regions (GPQR)
- Explore global properties of host galaxies
- Random forest classifier to identify important properties for quenching
- Explore property combinations in predicting quenching

## Results

- Both QRs tend to be hosted non-AGN, high-mass, red NUV-r, low SFR, and high central density, but span wide ranges in other parameters
  - Largely independent on the global parameters
- N2H $\alpha$  is the most significant single parameter associated with quenching
  - ← Gas ionization by photons from large amounts of old stars
- $\Sigma_*$  is the most important for quenching in GRQRs
  - $\Sigma_*$  should drive the simultaneous decrease of  $f_{gas}$  and SFE
  - Discussion in detail
- For GPQRs, the importance of  $\Sigma_{SFR}$  is enhanced to be comparable to  $\Sigma_*$ 
  - Decrease of SFE is much more independent on  $\Sigma_*$

## Discussion

Mechanism of quenching in GRQRs:  $\Sigma_*$  is important

- Existing evolved stars
- Dynamical stabilization -> X
- Unshielded gas -> X
- Stellar feedback -> radiation pressure from evolved star O
  - Provide support for surrounding gas to prevent collapse → Reduce SFE

Fig.1 Identification of GRQRs and GPQRs

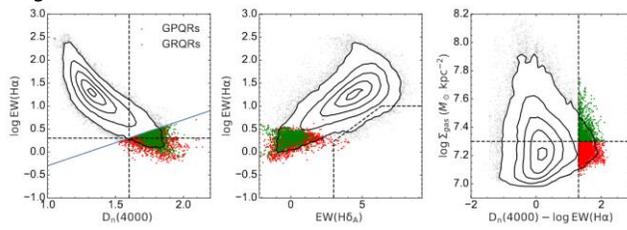


Fig.5 BPT diagram for host galaxies

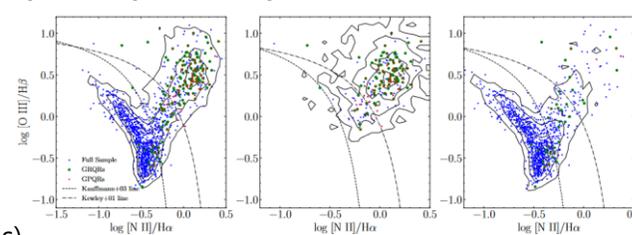


Fig.2 GRQRs and GPQRs in scaling relations

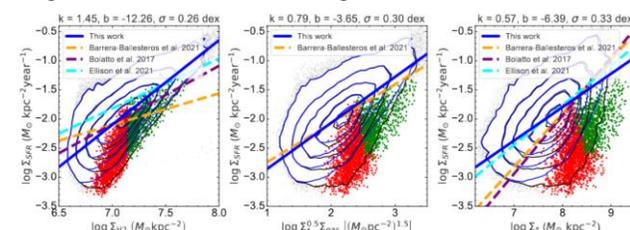


Fig.4 Global properties of host galaxies

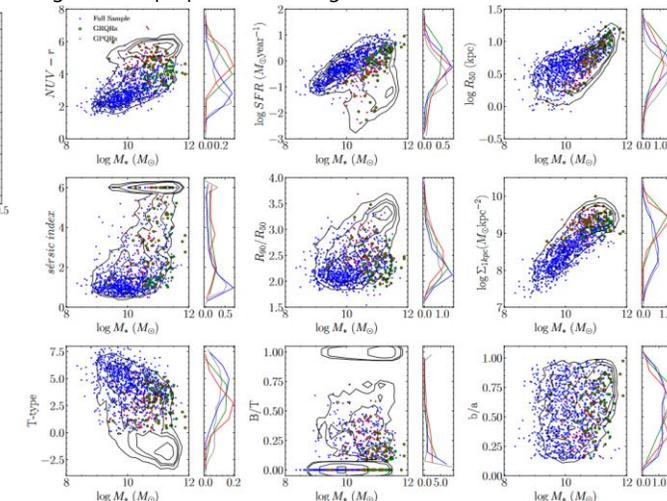


Fig.6 Feature importance of resolved properties

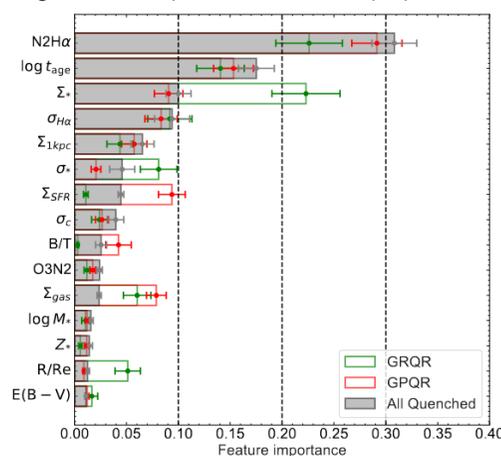


Fig.8 Property combination to predict quenching regions

