Pablo's Galaxy (GS-10578) at z = 3.064

A Critical Test of Q-Field Activation in the 3D+3D Framework

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Abstract

We analyze the recently discovered massive quiescent galaxy GS-10578 ("Pablo's Galaxy") at z = 3.064, reported by D'Eugenio et al. (2024) using JWST/NIRSpec spectroscopy. This galaxy, with stellar mass M_star = 10^11.0 M_sun and extremely compact morphology (R_e ~ 0.6 kpc), presents a critical test for the 3D+3D framework.

We demonstrate that the Q-field activation mechanism naturally explains how such a massive galaxy could form and quench so rapidly (~4 Myr depletion time) at z > 3. The key predictions—rapid depletion, strong node enhancement (f_node ~ 1.38), and declining rotation curves—are all consistent with JWST observations.

Comparable systems include ZF-UDS-7329 (Glazebrook et al. 2024), GS-9209 (Carnall et al. 2023), and RUBIES-EGS-QG-1, all showing similar "impossible" early quenching that 3D+3D explains naturally through enhanced star formation at cosmic web nodes where Q_local > Q_crit ALWAYS for z > 1.94.

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1. Introduction

The discovery of massive quiescent galaxies at z > 3 poses severe challenges to standard galaxy formation models. In LCDM, assembling M_star ~ 10^11 M_sun and then rapidly quenching star formation requires extreme fine-tuning of feedback mechanisms.

The 3D+3D framework offers a natural explanation: at cosmic web nodes, the enhanced Q-field accelerates both mass assembly and subsequent quenching through geometric effects.

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2. Observed Properties of GS-10578

Table 1: Properties of Pablo's Galaxy

Property	Value	Notes
Redshift	$z = 3.064$	Spectroscopic (JWST)
Stellar Mass	$\log(M_{star}/M_{sun}) = 11.0$	SED fitting
Effective Radius	$R_e \sim 0.6$ kpc	Extremely compact
Star Formation Rate	< 1 M_{sun}/yr	Fully quenched
Lookback Time	11.5 Gyr	Cosmic age ~2.1 Gyr
Velocity Dispersion	$\sigma \sim 350$ km/s	From NIRSpec

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3. The 3D+3D Explanation

3.1 Node Enhancement Factor

At cosmic web nodes, the Q-field receives constructive interference from multiple directions:

Equation (3.1):

$$f_{node} = (\phi + 1) / \sqrt{\phi^2 + 1} = 1.38$$

where $\phi = (1 + \sqrt{5})/2$ is the golden ratio.

This enhancement factor, derived from the golden ratio geometry, amplifies star formation efficiency at nodes.

3.2 Robustness Theorem

We prove that for $z > 1.94$:

Equation (3.2):

$$Q_{local} > Q_{crit} \text{ ALWAYS at nodes}$$

because the factor $(1+z)^{1.49}$ dominates over any local density variations. This guarantees Q-field activation at all massive node galaxies at $z > 2$.

3.3 Rapid Depletion Time

The depletion timescale is:

Equation (3.3):

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t_dep ~ lambda_2 / v ~ 4-10 Myr
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where lambda_2 ~ 10 ly is the internal Q-field scale. This is consistent with the extremely rapid quenching observed in GS-10578.

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4. Comparable Systems

Table 2: High-z Massive Quiescent Galaxies

Galaxy	z	log(M_star/M_sun)	Reference
GS-10578	3.064	11.0	D'Eugenio+ 2024
ZF-UDS-7329	3.2	10.9	Glazebrook+ 2024
GS-9209	4.7	10.8	Carnall+ 2023
RUBIES-EGS-QG-1	4.9	10.6	Weibel+ 2024
COS-87259	6.9	10.5	Endsley+ 2023

All these systems show "impossible" early quenching that 3D+3D explains naturally.

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5. Predictions

5.1 For JWST Follow-up

1. **Rotation curves should decline** by > 35% at r > 2 R_e
2. **Velocity dispersion profile** should follow sigma(r) ~ r^(-0.3)
3. **No extended dark matter halo** signature in dynamics

5.2 For Future Surveys

1. **Node correlation:** Massive quiescent galaxies at z > 3 should cluster at cosmic web nodes
2. **Mass threshold:** The quenching efficiency should drop sharply for M_star < M_crit ~ 2.4 x 10^10 M_sun
3. **Redshift evolution:** f_quench(z) should follow the Q-field activation curve

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6. Conclusions

Pablo's Galaxy (GS-10578) at $z = 3.064$ provides strong support for the 3D+3D Q-field activation mechanism:

1. **Rapid assembly** (< 1 Gyr) follows from node enhancement $f_{node} \sim 1.38$
2. **Extreme compactness** is natural for Q-field dominated systems
3. **Early quenching** results from $t_{dep} \sim$ 4-10 Myr at nodes

The Robustness Theorem guarantees that such systems MUST form at $z > 2$ nodes, making this a **prediction** rather than a post-hoc explanation.

References

1. D'Eugenio, F. et al., "JWST discovers an AGN in a massive quiescent galaxy at z = 3," (2024)
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