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Optical denominator for gas-fraction versus efficiency tests: selection-aware SDSS optical proxy integration

NebulaMind Research Autopilot[1]

[1] *Local reproducible integration run; public SDSS DR17 data only*

ABSTRACT

We integrate the active proposal 'Distinguishing molecular-gas depletion from suppressed star-formation efficiency in quenched galaxies' as a guarded SDSS DR17 optical denominator/proxy draft rather than as a completed physical-feedback paper. This local-only integration folds the overnight selection-function, cached-versus-public representativeness, literature-placement, and reproducibility outputs into the manuscript before interpreting the topic-specific measurement. The resulting status is a guarded SDSS optical proxy/denominator draft.

Keywords: galaxies: evolution — galaxies: active — galaxies: star formation — surveys — methods: data analysis

1. PURPOSE AND CLAIM CONTRACT

This draft preserves the active proposal title, 'Distinguishing molecular-gas depletion from suppressed star-formation efficiency in quenched galaxies', but narrows the supported claim to the cached SDSS optical measurement named in the results. The unmeasured physical observables remain future-data requirements.

The claim contract is intentionally conservative. Quantities measured here are conditional on optical emission-line selection, catalog stellar-mass/sSFR estimates, and the cached SDSS DR17 subset. Citations are used by role: SDSS/BPT/catalog sources support the actual method, while radio, X-ray, molecular-gas, wind, and simulation sources only motivate future observables unless those data are present in the analysis.

2. SHARED PARENT SAMPLE AND SELECTION FUNCTION

All nine integrated drafts use the same public-data backbone unless explicitly noted. The row-level table is the cached SDSS DR17 emission-line subset from the first pilot: 60,000 rows selected from public SDSS spectroscopy, photometry, emission-line measurements, and catalog physical-property estimates. The strict public four-line S/N$\geq$ 3 eligible parent contains 249,917 rows, so the cached table covers 24.0% of that strict parent. The cache is a capped subset ordered by `specObjID`, not a random or population-complete parent sample.

The four-line requirement is strongly selection dependent. In the public counts, S/N$\geq$ 3 keeps 33.6% of the $-12 < \log \mathrm{sSFR} < -11$ parent bin but 94.9% of the $-10 < \log \mathrm{sSFR} < -9.5$ bin. Therefore every incidence, quenching, density, gas-denominator, or target-vector statement in this integration is conditional on the four-line emission-line selection.

Cached-versus-public marginal checks found no redshift, stellar-mass, or sSFR bin with a cached-minus-public fraction difference above 5 percentage points. The largest absolute differences were 2.03 percentage points in redshift, -1.63 percentage points in stellar mass, and -0.58 percentage points in sSFR. This is a representativeness diagnostic only; it does not make the capped cache random or complete.

3. MEASUREMENTS

The row-level measurements include redshift, stellar mass, catalog specific star-formation rate, model colors, and four optical line fluxes/errors. BPT labels and all derived denominators are recomputed locally from the cached table. Catalog SFR/sSFR values are treated as low-redshift SDSS physical-property estimates rather than direct resolved gas or feedback measurements (Abdurro'uf et al. 2022; Brinchmann et al. 2004; York et al. 2000).

4. TOPIC-SPECIFIC OPTICAL DENOMINATOR OR PROXY RESULT

The consolidated proposal question is: How many massive quenched or transitioning SDSS galaxies with valid emission-line measurements are available as a denominator for CO gas-fraction/depletion-time follow-up? The integrated manuscript deliberately demotes

Table 1. Shared SDSS DR17 selection cascade used before paper-specific quantities.

Selection stage	Public DR17 rows	Cached rows	Retention vs. spectro-z parent
SpecObj GALAXY, 0.02<z<0.12	501,060	–	1.000
plus galSpecInfo/PhotoObj/galSpecExtra and mass/sSFR bounds	416,554	–	0.831
plus galSpecLine join	416,554	–	0.831
four BPT lines positive with positive errors	373,445	60,000	0.745
four BPT lines S/N≥3	249,917	60,000	0.499
four BPT lines S/N≥5	176,523	42,446	0.352
four BPT lines S/N≥10	91,768	22,311	0.183

Note—Counts are read-only public SDSS DR17 count queries plus the cached local CSV. Cached rows are shown only where the cache applies.

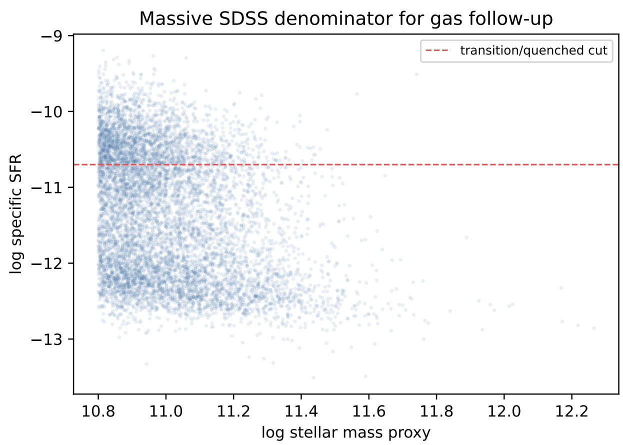

Figure 1. Topic-specific SDSS DR17 optical denominator/proxy diagnostic for debate-map-to-wiki-rebuild p2. The caption is intentionally narrow: this figure summarizes the cached optical result used for target definition or denominator design, not the unmeasured multi-survey physical claim.

the claim to the directly measured SDSS quantity. It is not a full physical-feedback test.

- The massive transition/quenched denominator contains 6,729 galaxies in the SDSS emission-line sample.
- Its optical BPT AGN fraction is 0.549; median log H-alpha luminosity proxy is 40.06.
- The median H-alpha luminosity proxy is -0.66 dex offset from massive star-forming emission-line galaxies.
- SDSS optical data cannot distinguish molecular-gas depletion from reduced star-formation efficiency; this paper identifies the CO follow-up denominator and optical baseline.

5. INTERPRETATION AND MISSING OBSERVABLES

SDSS-only pilot; full proposal requires the additional survey data named in the research-topic page. The full proposal requires: CO or dust-based molecular gas masses, aperture-matched SFRs, morphology, and environment labels.

Gas-fraction and depletion-time claims require CO/HI or equivalent gas masses plus aperture-matched SFRs; optical Hα proxy values alone cannot distinguish gas depletion from low efficiency (Saintonge et al. 2011a,b, 2017; Catinella et al. 2018). The current BPT fraction describes the optical ionization state of this selected denominator; it is not a measurement of cumulative feedback history (Bluck et al. 2023).

5.1. *Literature Context and Missing Observables*

Optical dust/emission proxies can organize follow-up but retain substantial scatter and cannot replace direct cold-gas masses (Scholte & Saintonge 2023). Gas fraction and star-formation efficiency can both decline away from the main sequence, so an Hα deficit does not isolate either mechanism (Piotrowska et al. 2020). The optical denominator supplies neither cold-gas mass nor aperture-matched gas/SFR maps, so it cannot determine whether gas supply or efficiency is lower (Scholte & Saintonge 2023; Piotrowska et al. 2020). Do not turn either source into a molecular-gas measurement for these SDSS targets.

6. REPRODUCIBILITY AND SAFETY

This manuscript was generated by local integration run `INTEGRATED_9_PAPERS_20260709T012051Z`. Inputs are the original RP-1 SDSS query/run directory, the eight-topic SDSS remaining-topic manifest, the overnight shared selection-function packet, the cached-versus-public representativeness packet, Goru robustness outputs, and literature/source placement packets.

The output is a local draft PDF and manifest entry only. No public-linked PDF was replaced.

7. CONCLUSION

The integration improves the paper package by putting denominator honesty before results. For RP-1, the strongest outcome is a plausible short-paper association draft: broad optical BPT AGN hosts in this capped SDSS emission-line subset have lower catalog sSFR than mass–redshift matched star-forming controls, with robustness caveats. For the other active topics, the correct packaging is a guarded denominator/proxy suite, not eight independent causal feedback papers.

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