

Search for High-Ionization Nebular Emission (SHINE). I. A Systematically Selected [Ne V] Sample at $z > 3$ with *JWST*/NIRSpec PRISM

SHOBITA SATYAPAL,¹ SARA DOAN,¹ D. SCHAEERER,^{2,3} R. MARQUES-CHAVES,⁴ A. SAWARKAR,⁴ WILLIAM MATZKO,¹
CAMILO VAZQUEZ,¹ C. DAOUTIS,⁴ D. KORBER,⁴ I. MOREL,⁴ AND MENGYUAN XIAO⁴

¹*George Mason University, Department of Physics and Astronomy, MS3F3, 4400 University Drive, Fairfax, VA 22030, USA*

²*Observatoire de Genève, Université de Genève, Chemin Pegasi 51, 1290 Versoix, Switzerland*

³*CNRS, IRAP, 14 Avenue E. Belin, 31400 Toulouse, France*

⁴*Department of Astronomy, University of Geneva, Chemin Pegasi 51, 1290 Versoix, Switzerland*

ABSTRACT

We conduct the first systematic Search for High-Ionization Nebular Emission (SHINE) using [Ne V] $\lambda 3426$ in *JWST*/NIRSpec PRISM spectroscopy at $z > 3$. From more than 9,000 galaxies, we identify 25 [Ne V] emitters spanning $z = 3.059\text{--}9.444$ and $\log_{10}(L_{[\text{Ne V}]}/\text{erg s}^{-1}) = 40.70\text{--}42.86$. Their [Ne V] luminosities overlap with those of local [Ne V]-selected active galactic nuclei (AGNs) and exceed those of local metal-poor [Ne V] emitters, although such low-luminosity systems would fall below our sensitivity. The population is diverse, spanning compact and extended morphologies and a broad range of continuum properties and stellar masses, including very low-mass hosts. It includes sources with broad Balmer emission as well as others whose higher-resolution spectra do not **require a broad component**. The [Ne V] emitters overlap only partly with conventional AGN diagnostics: most do not satisfy conservative high-redshift AGN criteria based on strong rest-optical narrow-line ratios, and only a minority have adopted broad-line classifications. [Ne V] upper limits for independently selected broad-line AGNs and little red dots are too shallow to establish a population-wide [Ne V] deficit. Six sources have secure *Chandra* counterparts, showing that X-ray weakness is not universal among luminous [Ne V] emitters. Strong [Ne V]/[Ne III] emission is associated with redder ultraviolet slopes and stronger Balmer breaks, but not with UV luminosity, possibly linking strong high-ionization emission to recent changes in star formation. The observed incidence of luminous [Ne V] emission shows no significant evolution over $z > 3$, despite an increasing robust [Ne III] detection fraction. The high [Ne V] luminosities and hard line ratios favor black-hole accretion as the dominant power source, establishing [Ne V] emission as a complementary probe of early black-hole growth.

Keywords: Active galactic nuclei — Emission line galaxies — Galaxy evolution — Galaxy spectroscopy — High-redshift galaxies — Supermassive black holes

1. INTRODUCTION

The *James Webb Space Telescope* (*JWST*) has revolutionized our view of black hole growth in the early Universe, uncovering an unexpectedly abundant population of faint broad-line AGNs at $z \gtrsim 4$, together with an overlapping population of compact red sources commonly referred to as Little Red Dots (LRDs) (e.g., Kocevski et al. 2023; Harikane et al. 2023; Matthee et al. 2024; Greene et al. 2024; Maiolino et al. 2024; Kokorev et al. 2024; Labbe et al. 2025; Kocevski et al. 2025; Akins et al. 2025; Hviding et al. 2025). These

sources extend to substantially lower luminosities than the UV-luminous quasars that dominated the pre-*JWST* view of early black hole growth, with number densities significantly exceeding extrapolations of the quasar luminosity function (e.g., Harikane et al. 2023; Matthee et al. 2024; Kokorev et al. 2024; Akins et al. 2025). Yet despite several years of intensive study, their physical nature remains uncertain. While exceptions have been reported (e.g., Tang et al. 2025; Gloudemans et al. 2025; Delvecchio et al. 2025; Barro et al. 2026) high-redshift AGNs uncovered by *JWST* generally differ from low-redshift counterparts in that they are often extremely compact, show red optical continua, are weak or undetected in X-rays, lack hot/cold dust emission, exhibit little variability, and display prominent broad Balmer lines alongside weak or absent high-ionization lines. (e.g., Ananna et al.

2024; Yue et al. 2024; Maiolino et al. 2025; Casey et al. 2025; Setton et al. 2025; Kokubo & Harikane 2025; Zhang et al. 2025; Burke et al. 2026; Lambrides et al. 2026; Wang et al. 2026; Zucchi et al. 2026). Proposed explanations include intrinsically X-ray-weak or softer ionizing continua associated with high- or super-Eddington accretion, weak X-ray coronae, heavy absorption, and accreting black holes embedded in dense gaseous envelopes that absorb and reprocess radiation from the central source (e.g., Pacucci & Narayan 2024; Inayoshi & Maiolino 2025; Naidu et al. 2025; Begelman & Dexter 2026; Madau 2026; Rusakov et al. 2026). These discoveries suggest that *JWST* is revealing modes of black hole growth that were largely inaccessible to previous surveys.

Through the past several years, much of the rapidly expanding high-redshift AGN population has been identified through broad Balmer lines or photometric LRD selection. Broad-line searches by definition select systems in which a broad-line region is present and directly visible, and therefore probe only the Type 1 portion of the accreting population. In the local Universe, obscured and narrow-line AGNs constitute a large fraction of the active-galaxy population, showing that black hole growth commonly occurs in physical configurations that would not be recovered through Type 1 selection alone (e.g., Maiolino & Rieke 1995; Hickox & Alexander 2018). At high redshift, however, identifying the analogous population through conventional narrow-line diagnostics is especially difficult. The low metallicities and high ionization parameters characteristic of early galaxies cause standard rest-optical diagnostic ratios to overlap substantially between stellar and accreting-black-hole photoionization models (e.g., Groves et al. 2006; Cann et al. 2019; Richardson et al. 2022; Cleri et al. 2025). Recent *JWST* studies have begun to recover candidate narrow-line AGNs using combinations of rest-frame UV diagnostics, auroral-line ratios, and high-ionization transitions (e.g., Scholtz et al. 2025; Mazzolari et al. 2024, 2025). These searches demonstrate that a substantial narrow-line population may be present at high redshift, but also emphasize that no single rest-optical diagnostic provides both a complete and uncontaminated selection of Type 2 AGNs under the physical conditions characteristic of early galaxies (e.g., Scholtz et al. 2025; Mazzolari et al. 2025; Juodžbalis et al. 2026). The resulting incompleteness affects more than just estimates of AGN abundance: selection through broad lines or LRD colors may preferentially miss obscured, embedded, or otherwise distinct phases of black hole activity and their connection to the evolving host galaxy. This problem may be particularly acute for lower-mass black holes, for which broad-line signatures become increasingly difficult to identify and whose low-mass, metal-poor hosts occupy the regime in which conventional narrow-line diagnostics provide the least discrimination between stellar and accretion-powered ionization (e.g., Reines

& Comastri 2016; Cann et al. 2019; Richardson et al. 2022; Nakajima & Maiolino 2022). A substantial component of early black hole growth may therefore remain poorly represented by the selection methods currently driving the high-redshift AGN population.

Very-high-ionization nebular emission provides a complementary route to identifying hard radiation from accreting black holes without requiring either a directly visible broad-line region or placement in the AGN region of conventional narrow-line diagnostic diagrams. Emission from ions with ionization potentials above ~ 54 eV requires photons that are difficult for even extreme stellar populations to produce in sufficient numbers, thereby offering additional insight into the nature of the ionizing source (e.g., Satyapal et al. 2021; Cleri et al. 2025). Among these diagnostics, [Ne V] $\lambda 3426$ is particularly effective. The production of Ne^{4+} requires photons with energies above 97.1 eV, probing a significantly higher-energy regime of the ionizing continuum than those probed by the standard lower ionization optical lines (Cleri et al. 2023a). Because neon is a noble gas, it does not deplete onto dust grains, leaving its gas-phase abundance unaffected by the presence of dust in the ionized gas (McKaigne et al. 2024). Furthermore, [Ne V] $\lambda 3426$ is typically the most luminous optical coronal line and among the most frequently detected in low-redshift spectroscopic samples (e.g., Reefe et al. 2022; Negus et al. 2023; Doan et al. 2025; Matthews Acuña et al. 2026). Coronal lines have long been used to identify highly ionized gas associated with AGNs. Indeed, searches for [Ne V] and other coronal lines in the local Universe have uncovered accreting black hole candidates missed by standard optical narrow-line diagnostics (e.g., Satyapal et al. 2008, 2009; Molina et al. 2021; Reefe et al. 2022; Negus et al. 2023; Matthews Acuña et al. 2026). [Ne V] has also proven effective for identifying obscured and otherwise elusive AGNs (e.g., Gilli et al. 2010; Feillet et al. 2024; Reiss et al. 2025; Peca et al. 2025). High-ionization lines can also offer valuable constraints on lower-mass black holes. Under standard thin-disk assumptions, the characteristic disk temperature increases toward lower black hole mass at a fixed Eddington ratio and spin; consequently, photoionization models predict prominent very-high-ionization emission from accreting intermediate-mass black holes (e.g., Kubota & Done 2018; Cann et al. 2018).

[Ne V] is not, however, an unambiguous signature of accretion in every galaxy. Optical [Ne V] $\lambda 3426$ emission has been detected in a number of metal-poor star-forming galaxies (e.g., Izotov et al. 2004; Thuan & Izotov 2005; Izotov et al. 2012, 2021). Recent *JWST*/MIRI spectroscopy has extended these results to the mid-infrared, revealing [Ne V] $14.3\,\mu\text{m}$ emission in the extremely metal-poor galaxies SBS 0335–052E and I Zw 18, as well as in the metal-poor dwarf CGCG 007–025 (Mingozi et al. 2025; Arroyo-Polonio et al.

2025; Hunt et al. 2025; del Valle-Espinosa et al. 2026). These observations demonstrate that very hard ionizing radiation can be present in intensely star-forming, metal-poor environments, while also emphasizing the difficulty of uniquely identifying its physical source. Radiative shocks, unusually hard stellar populations, X-ray binaries or ultraluminous X-ray sources, and accretion onto lower-mass black holes have all been considered, with their relative importance likely differing among individual systems (e.g., Izotov et al. 2012; Kehrig et al. 2018; Mingozi et al. 2025; Arroyo-Polonio et al. 2025; Hunt et al. 2025; del Valle-Espinosa et al. 2026). The interpretation of [Ne V] therefore requires its luminosity and excitation to be considered together with a broader spectroscopic and multiwavelength analysis.

The apparent weakness of high-ionization emission in many *JWST*-selected AGNs makes such lines valuable probes of accretion physics at high redshift. Several studies of broad-line AGNs and Little Red Dots (LRDs) have reported weak or undetected high-ionization lines and X-ray emission relative to expectations for conventional lower-redshift AGNs (e.g., Ananna et al. 2024; Maiolino et al. 2025; Wang et al. 2026; Lambrides et al. 2026; Zucchi et al. 2026). In a sample of 851 $z > 4$ galaxies targeted with NIRSpec grating spectroscopy, Tang et al. (2025) identified only a small fraction of candidate very-high-ionization line emitters, indicating that such emission is either intrinsically rare or typically faint at high redshift. Conversely, high-ionization emission is clearly detected in a subset of high-redshift galaxies and AGNs (e.g., Tang et al. 2025; Chisholm et al. 2024; Scholtz et al. 2025; Valentino et al. 2026; Curti et al. 2025), demonstrating that the production of such lines is not universally suppressed.

Most existing studies, however, rely on samples selected by broad lines, LRD colors, or other galaxy properties, only subsequently evaluating whether high-ionization emission is present. Building on lower-redshift [Ne V] surveys (e.g., Gilli et al. 2010; Cleri et al. 2023b) and recent NIRSpec grating searches (Tang et al. 2025), the growing *JWST*/NIRSpec PRISM archive enables a complementary strategy at $z > 3$: selecting target populations directly by [Ne V] emission.

We refer to this survey as the **Search for High-Ionization Nebular Emission (SHINE)**. SHINE is designed to identify high-redshift sources using high-ionization nebular emission, leveraging lines across a broad range of ionization energies to constrain the hard ionizing radiation field and surrounding gas. In this initial paper, we conduct a systematic search for [Ne V] $\lambda 3426$ in public *JWST*/NIRSpec PRISM spectroscopy at $z > 3$ to construct the SHINE-[Ne V] sample. We evaluate the source properties recovered when selecting purely by [Ne V] emission, characterizing their continuum, host-galaxy, morphological, and emission-line features. Furthermore, we quantify the overlap between [Ne V]-selected

sources and existing broad-line, narrow-line, LRD, and X-ray-selected populations, examining line excitation and observed incidence across redshift. This selection strategy offers a complementary probe of early black hole growth independent of broad-line visibility, LRD colors, or conventional optical diagnostics, potentially revealing physical conditions that are poorly represented in current high-redshift AGN samples.

Throughout this work, we adopt a flat Λ CDM cosmology corresponding to the Planck18 cosmology implemented in *Astropy*, with $H_0 = 67.4 \text{ km s}^{-1} \text{ Mpc}^{-1}$, $\Omega_m = 0.315$, and $\Omega_\Lambda = 0.685$.

2. JWST/NIRSPEC DATA AND CONSTRUCTION OF THE SHINE-[NEV] SAMPLE

2.1. DJA parent sample

We searched for [Ne V] emission using a new tool called PRISMATIC, which provides automatic fits of numerous spectral features (emission lines and others) in NIRSpec PRISM spectra and an efficient search and visualization tool (see Sawarkar et al., in preparation). We used the public *JWST*/NIRSpec spectroscopic products available through the Dawn *JWST* Archive (DJA; Brammer 2023; Heintz et al. 2025; Valentino et al. 2025) as of 2026 May 21. We restricted the analysis to NIRSpec PRISM/CLEAR spectra assigned a secure spectroscopic-redshift quality grade of 3 in the DJA. When more than one pipeline reduction of a given observation was available, we adopted the latest reduction available on that date.

Many galaxies in the archive were observed more than once, either through repeated visits or through overlapping *JWST* programs. For galaxies with more than one available PRISM observation, we selected as the representative spectrum the observation with the lowest local flux uncertainty at the expected observed wavelength of [Ne V] $\lambda 3426$. Each physical galaxy was therefore counted only once, and multiple spectra of the same galaxy were not treated as independent objects. After de-duplication, the parent catalog contained 9002 unique galaxies, with one representative PRISM spectrum adopted for the initial [Ne V] search.

The NIRSpec PRISM/CLEAR configuration provides broad, nearly continuous observed-frame wavelength coverage from approximately 0.6 to 5.3 μm , with a strongly wavelength-dependent spectral resolution (Jakobsen et al. 2022; Ferruit et al. 2022). The galaxies in our parent catalog span the exact adopted spectroscopic-redshift range $z = 2.989\text{--}14.462$. Across this interval, [Ne V] $\lambda 3426$ is observed from 1.367 to 5.297 μm . We evaluated the PRISM resolving power at the expected observed wavelength of [Ne V] $\lambda 3426$ for every galaxy in the parent catalog using the wavelength-dependent PRISM dispersion relation. The resulting resolving powers span $R \simeq 31\text{--}323$, with a median value of $R \simeq 43$.

These resolving powers correspond to instrumental velocity scales of approximately $c/R \simeq 930\text{--}9550 \text{ km s}^{-1}$. The appearance, blending, and measured significance of the [Ne V] doublet therefore vary substantially with redshift across the parent sample.

The DJA also combines observations obtained by multiple JWST programs with different exposure times, target-selection functions, observing strategies, and source-specific data quality. Consequently, the sensitivity to [Ne V] emission is non-uniform across the parent catalog and cannot be inferred from the wavelength-dependent spectral resolution alone.

2.2. Automated candidate preselection

We used the automated PRISMATIC emission-line fits to construct an initial list of candidate [Ne V] emitters. The automated measurements were used only for candidate preselection and were not adopted as the final [Ne V] measurements. We selected sources for which the automated fit to [Ne V] $\lambda 3426$ returned a nominal signal-to-noise ratio of $S/N > 4$. This selection produced 187 unique galaxies for visual inspection.

We adopted the $S/N > 4$ preselection following an initial examination of candidates selected at automated $S/N > 3$. Visual inspection showed that many of the lower-significance candidates were associated with noise fluctuations, spectral artifacts, or inaccurate continuum placement, rather than with a convincing emission feature. Raising the automated threshold reduced the number of obvious false positives and produced a tractable candidate set for systematic visual inspection. The automated threshold should therefore be understood as a practical preselection criterion rather than as the final definition of an [Ne V] detection.

The automated measurements were not optimized specifically for weak [Ne V] emission. In particular, the automated fitting procedure did not simultaneously model both members of the [Ne V] $\lambda\lambda 3346, 3426$ doublet, and the continuum was constrained over a comparatively broad wavelength interval. For weak features, the resulting line flux and significance were sensitive to the shape and placement of the fitted continuum. These limitations motivated both visual assessment of the candidates and a subsequent more detailed and rigorous fitting procedure for the visually retained sources.

Because only objects passing the automated $S/N > 4$ preselection were inspected systematically, the sample is not expected to contain every possible [Ne V] emitter in the 9002-galaxy parent catalog. Extending the search to lower automated significance would require the visual inspection and detailed fitting of a substantially larger number of spectra.

2.3. Visual assessment of the candidates

We visually examined the one- and two-dimensional spectra of each of the 187 candidates to determine whether an

emission feature was present near the expected position of the [Ne V] $\lambda 3426$ line. A source was retained for detailed spectral modeling when the feature was clearly apparent by eye and its centroid was located within

$$|\Delta v| < 5000 \text{ km s}^{-1} \quad (1)$$

of the wavelength predicted from the adopted spectroscopic redshift. This deliberately broad interval was used to reject clearly unrelated features while accommodating uncertainties in the automated redshift, continuum fit, and centroid of a weak feature in the low-resolution PRISM spectrum. It was not adopted as a physical constraint on the velocity of the [Ne V]-emitting gas.

Twenty-eight galaxies passed the visual assessment and were carried forward to a more detailed and rigorous spectral-fitting procedure. Visual retention alone did not establish membership in the final sample. Each of the 28 objects was subsequently required to satisfy the same quantitative detection criterion based on the integrated [Ne V] $\lambda 3426$ line flux and its uncertainty.

2.4. Detailed BADASS fitting and the SHINE-[NeV] sample

We reanalysed the 28 visually retained spectra using the Bayesian AGN Decomposition Analysis for SDSS Spectra code (BADASS; [Sexton et al. 2021](#)), following the implementation described in Appendix A. Relative to the automated catalog measurements, this more detailed and rigorous fitting procedure used a narrower local wavelength interval to constrain the continuum and simultaneously included both members of the [Ne V] $\lambda\lambda 3346, 3426$ doublet. This local fitting strategy was adopted to reduce the sensitivity of the weak-line measurements to continuum structure far from the [Ne V] features and to provide a more consistent estimate of the integrated line-flux uncertainty.

The [Ne V] $\lambda 3426$ fluxes obtained from the automated catalog and from the final BADASS fits were generally consistent. The inferred line significances varied somewhat between the two procedures, however, because the BADASS analysis used a different continuum window, a more robust local continuum treatment, and simultaneous modeling of the [Ne V] doublet. We therefore used the BADASS integrated fluxes and uncertainties, rather than the automated catalog values, to define the SHINE-[NeV] sample and to calculate the [Ne V] luminosities used throughout this work.

A galaxy was included in the SHINE-[NeV] sample only if it belonged to the visually retained set and the BADASS fit returned a valid integrated [Ne V] $\lambda 3426$ flux, F_{3426} , and integrated-flux uncertainty, $\sigma_{F_{3426}}$, satisfying

$$\frac{F_{3426}}{\sigma_{F_{3426}}} > 3. \quad (2)$$

We adopted the integrated [Ne V] $\lambda 3426$ flux significance defined in Equation 2 as the quantitative criterion for inclusion

in the SHINE-[NeV] sample. Twenty-five of the 28 visually retained galaxies satisfied this requirement and constitute the SHINE-[NeV] sample used throughout this work.

The significance assigned to a weak emission feature can depend on the continuum interval, continuum parameterization, masking, noise model, and treatment of neighboring features. We therefore applied a single fitting procedure and a common integrated-flux requirement to all 28 visually retained objects. Sources not satisfying Equation 2 are not treated as [Ne V] detections in the subsequent statistical analyses.

Our uniform PRISM selection does not recover every previously published [Ne V] source in the parent catalog. Six previously reported sources in the parent catalog were not among the 28 candidates retained for detailed fitting: five with secure published [Ne V] detections and one with a tentative detection. Four of the five secure sources have [Ne V] detections established with medium- or high-resolution NIRSpec spectroscopy: DJA-329 and DD-111 with G140 grating observations (Valentino et al. 2026), GN 42437 with G235H/F170LP (Chisholm et al. 2024), and JADES-NS-GS-10013609 with G235M/F170LP (Scholtz et al. 2025). UNCOVER 45924 was reported as a secure PRISM detection (Treiber et al. 2025), while GS-81034 shows a tentative feature in the higher resolution G235M/F170LP spectrum (Tang et al. 2025). The SHINE-[NeV] sample should therefore be regarded as a uniformly selected PRISM sample rather than a complete inventory of all previously reported high-redshift [Ne V] emitters.

Table 1 lists the ICRS coordinates, adopted spectroscopic redshift, exact PRISM/CLEAR spectrum used in the analysis, and the apparent BADASS [Ne V] $\lambda 3426$ luminosity and its uncertainty for the full 25 galaxies in the SHINE-[NeV] sample. We list references for sources with previously published [Ne V] emission among our final sample. Three sources lying in a potential lensing field are flagged in Table 1. The magnifications are small. NeV-01: 1.93 NeV-02: 1.94 NeV-03: 1.41 with typical 1-sigma (68% CL) uncertainties of 0.02-0.03.

The additional emission-line measurements used elsewhere in this paper were adopted directly from the DJA automated emission-line catalog. These lines were generally substantially stronger and more clearly detected than [Ne V] $\lambda 3426$, and their measurements were therefore less sensitive to the local continuum choices that motivated our dedicated reanalysis of [Ne V]. We did not refit these other emission lines. Unless stated otherwise, only the [Ne V] $\lambda 3426$ measurements were replaced by the results of the BADASS analysis.

When possible, we derived stellar-mass for the SHINE-[NeV] sample from SED fitting based on the DAWN JWST Archive products. Following the methodology described by

Xiao et al. (2026) (see also: Morel et al. 2026), the fits combine JWST/NIRCam photometry with NIRSpec/PRISM spectroscopy using *Bagpipes* (Carnall et al. 2018), with the spectroscopic redshift fixed. Residual spectrophotometric differences between the PRISM spectra and the imaging are corrected using a polynomial calibration of up to second order. The fits adopt a non-parametric star-formation history, BPASS stellar-population models, variable metallicity (from 0.01 to $2.5 Z_{\odot}$) and ionization parameter (from $\log U = -4$ to -1), and the Salim et al. (2018) dust attenuation curve. We adopt the median of the posterior stellar-mass distribution as the fiducial stellar mass and use the 16th and 84th percentiles to characterize the formal fitting uncertainty. Stellar masses were thus derived for the majority of the sources (20 out of 25).

3. COMPARISON SAMPLES AND CLASSIFICATION FRAMEWORK

We compare the adopted [Ne V] sample with several independently assembled high-redshift populations selected to represent complementary methods for identifying accretion activity. These include published broad-line AGN (BLAGN), galaxies selected using narrow-line AGN diagnostics, and literature-selected little red dots (LRDs). We also include two low-redshift [Ne V] samples—the Coronal Line Activity Spectroscopic Survey (CLASS) and a compilation of local metal-poor [Ne V] emitters—to examine how the high-redshift population compares with [Ne V]-emitting galaxies in the local Universe.

The comparison samples are defined by different observational criteria and are not mutually exclusive. A galaxy may, for example, be both an LRD and a BLAGN, or both a [Ne V] emitter and a source selected by a narrow-line AGN diagnostic. We retain these overlapping classifications throughout the analysis. For figures in which each galaxy is shown only once, galaxies in the adopted [Ne V] sample are shown as [Ne V] emitters; among the remaining sources, published BLAGN are shown as BLAGN rather than a second time as LRDs. This convention is used only to avoid plotting the same galaxy more than once and does not change the classifications that apply to each source.

The classifications of sources and the emission-line measurements used in our diagnostic analyses are treated separately. Published classifications are adopted from the observations on which they were originally based, which may include NIRSpec PRISM or medium- and high-resolution spectroscopy. For uniformity, however, the emission-line fluxes and upper limits used for the high-redshift comparison samples are taken from the automated PRISMATIC measurements from the NIRSpec/PRISM spectra rather than from heterogeneous literature line measurements. Thus, for example, a BLAGN classification may be based on higher-

Table 1. The Adopted High-redshift [Ne V] Emitter Sample

ID	R.A.	Decl.	z_{spec}	Adopted PRISM analysis spectrum	$\log L_{3426}^{\text{app}}$	Lens field?
	(deg)	(deg)			(erg s ⁻¹)	
NeV-01 ^a	3.566920	-30.347271	3.46578	uncover-v4_prism-clear_2561_45092.spec.fits	42.36 ± 0.04	Y
NeV-02	3.617833	-30.404140	6.32973	uncover-61-v4_prism-clear_2561_23409.spec.fits	41.76 ± 0.10	Y
NeV-03 ^b	3.636960	-30.406361	8.51786	uncover-v4_prism-clear_2561_10646.spec.fits	41.58 ± 0.11	Y
NeV-04	34.301147	-5.287817	4.81900	rubies-uds43-v4_prism-clear_4233_19736.spec.fits	42.14 ± 0.10	N
NeV-05	34.322542	-5.171391	3.94516	gto-wide-uds13-v4_prism-clear_1215_3757.spec.fits	41.85 ± 0.06	N
NeV-06	34.391716	-5.115013	6.23485	mom-uds01-v4_prism-clear_5224_164378.spec.fits	41.23 ± 0.06	N
NeV-07	53.063600	-27.848729	4.21594	gds-looser-03-v4_prism-clear_5997_186744.spec.fits	40.83 ± 0.08	N
NeV-08	53.072848	-27.908504	3.47808	jades-gds06-v4_prism-clear_1286_158273.spec.fits	41.40 ± 0.07	N
NeV-09	53.086456	-27.841707	3.47966	gds-looser-03-v4_prism-clear_5997_189618.spec.fits	40.70 ± 0.06	N
NeV-10 ^c	53.112434	-27.774626	9.44391	gds-udeep-v4_prism-clear_3215_265801.spec.fits	40.86 ± 0.13	N
NeV-11	53.121759	-27.797633	5.93873	gds-deep-v4_prism-clear_1210_13176.spec.fits	40.81 ± 0.06	N
NeV-12	53.124447	-27.851707	3.72169	jades-gds-w05-v3_prism-clear_b147.spec.fits	42.86 ± 0.03	N
NeV-13	53.129908	-27.752004	3.44356	jades-gds08-v4_prism-clear_1286_60148771.spec.fits	41.19 ± 0.05	N
NeV-14	53.139351	-27.874542	3.47129	jades-gds-w07-v3_prism-clear_b62.spec.fits	41.86 ± 0.04	N
NeV-15	69.965843	-52.738358	3.34862	borg-0440m5244-v4_prism-clear_1747_384.spec.fits	41.04 ± 0.12	N
NeV-16	150.073944	2.380797	4.54263	glazebrook-cos-obs3-v4_prism-clear_2565_19702.spec.fits	41.52 ± 0.08	N
NeV-17	150.096344	2.425364	3.12566	mom-cos05-v4_prism-clear_5224_318265.spec.fits	41.33 ± 0.08	N
NeV-18	150.139328	2.214673	5.50900	capers-cos01-v4_prism-clear_6368_49388.spec.fits	41.34 ± 0.08	N
NeV-19	189.139572	62.238373	3.42241	goodsn-widel-v4_prism-clear_1211_7185.spec.fits	41.56 ± 0.05	N
NeV-20	214.931473	52.935528	3.05913	ceers-ddt-v4_prism-clear_2750_1636.spec.fits	41.25 ± 0.04	N
NeV-21	214.931625	52.908684	3.43484	ceers-ddt-v4_prism-clear_2750_1034.spec.fits	42.61 ± 0.04	N
NeV-22	214.944199	52.967579	4.47484	capers-egs47-v4_prism-clear_6368_1832.spec.fits	41.46 ± 0.08	N
NeV-23	214.999176	52.973301	4.63750	capers-egs47-v4_prism-clear_6368_223045.spec.fits	41.52 ± 0.06	N
NeV-24	215.031403	52.908157	3.46129	rubies-egs52-v4_prism-clear_4233_19509.spec.fits	41.52 ± 0.07	N
NeV-25	215.132927	53.096295	3.40087	gto-wide-egs1-v4_prism-clear_1213_4369.spec.fits	42.17 ± 0.04	N

^a Published as UNCOVER 45092, with a secure prior [Ne v] detection reported by [Treiber et al. \(2025\)](#).

^b Corresponds to UNCOVER 10646 component 2 (LRD alias UNCOVER 9858). [Treiber et al. \(2025\)](#) discussed a possible [Ne v] feature but did not claim a secure detection.

^c Published as JADES-GS-z9-0 (JADES 10058975), with a tentative prior [Ne v] detection reported by [Curti et al. \(2025\)](#).

NOTE— The table lists the 25 adopted high-redshift [Ne v] emitters in order of increasing right ascension and then declination. Coordinates are ICRS decimal degrees. The listed spectrum is the exact DJA PRISM/CLEAR spectrum adopted for the manuscript analysis. The [Ne v] $\lambda 3426$ luminosities were calculated from the integrated line fluxes obtained with the detailed BADASS fitting procedure described in Section 2.4. Values are reported as $\log L_{3426}^{\text{app}} \pm \sigma_{\log L}$ and rounded to two decimal places in the printed table; full numerical precision is retained in the machine-readable table. The quoted uncertainty reflects the line-flux uncertainty. Redshift and cosmological-parameter uncertainties are not included. The luminosities are apparent and have not been corrected for gravitational magnification. “Lens field?” identifies sources lying in a potential lensing field. The magnifications are small (NeV-01: 1.93 NeV-02: 1.94 NeV-03: 1.41644) with typical 1-sigma (68% CL) uncertainties of 0.02-0.03 Full literature metadata, internal identifiers, and fitting-provenance fields are retained in the machine-readable table.

resolution spectroscopy, while the emission-line ratios used for that source in our diagnostic diagrams are derived from its PRISMATIC line fluxes and upper limits. The treatment of the adopted [Ne V] sample, including the use of the integrated BADASS [Ne V] measurements, is described in Section 2.

The samples defined below form the comparison populations used throughout the paper. The number of galaxies entering a particular analysis can be smaller because of source-specific wavelength coverage, measurement quality, line strength, failed or unconstrained fits, or the absence of

a valid upper limit. The eligibility criteria, treatment of detections and limits, and final sample sizes for each diagnostic are described in Section 4.3.

3.1. Broad-line AGN

The BLAGN comparison sample was assembled from published JWST sources classified as broad-line or Type 1 AGN. Specifically, we include the published BLAGN samples from [Harikane et al. \(2023\)](#); [Greene et al. \(2024\)](#); [Matthee et al. \(2024\)](#); [Pérez-González et al. \(2024\)](#); [Kocevski et al. \(2025\)](#);

Taylor et al. (2025); Hviding et al. (2025); Juodžbalis et al. (2026). Galaxies already included in our adopted [Ne V] sample were excluded from the comparison sample. After matching and de-duplication, the BLAGN comparison sample contains 139 unique galaxies.

The literature classifications are based on heterogeneous observations and analysis methods, including different NIRSpec configurations, spectral resolutions, fitting procedures, broad-line width thresholds, and significance requirements. We therefore adopt the published BLAGN classification for each source rather than attempting to reclassify all of the literature samples using a single broad-line threshold. The BLAGN comparison sample should consequently be regarded as a compilation of published broad-line AGN rather than as a uniformly selected sample. As described above, these published classifications are treated independently of the emission-line measurements used in our diagnostic comparisons, which are taken uniformly from the PRISMATIC measurements of the NIRSpec/PRISM spectra.

BLAGN and LRD classifications are both retained when they apply to the same galaxy. In figures in which each galaxy is shown only once, such sources are shown as BLAGN and are not plotted a second time as LRDs.

3.2. Galaxies selected using narrow-line AGN diagnostics

We construct a second high-redshift comparison sample from galaxies satisfying the adopted secure S2–VO87 AGN criterion using the PRISMATIC emission-line measurements from the JWST/NIRSpec PRISM spectra. We exclude galaxies in the adopted [Ne V] sample, sources with a published BLAGN classification, and sources with a positive PRISM broad-component flag. After de-duplication, the narrow-line-diagnostic comparison sample contains 353 galaxies.

We refer to these objects as galaxies selected using narrow-line AGN diagnostics rather than as confirmed narrow-line AGN. Excluding known or flagged broad-line sources prevents the same galaxy from being included in both the BLAGN and narrow-line-diagnostic comparison samples, but the absence of a broad-line classification does not demonstrate that broad Balmer emission is absent. For many sources, broad lines may be unassessable because of incomplete wavelength coverage, limited spectral resolution, blending, or inadequate sensitivity. These limitations are particularly relevant for PRISM spectroscopy because its spectral resolution varies strongly with wavelength.

The interpretation of conventional optical diagnostic diagrams also becomes less straightforward at high redshift and low metallicity. Hard stellar ionizing spectra and the evolving nebular conditions of high-redshift galaxies can cause star-forming galaxies and AGN to overlap in classical line-ratio diagrams (Scholtz et al. 2025). We therefore treat this as an observationally defined narrow-line-diagnostic com-

parison sample rather than as a complete census of systems demonstrated to host exclusively narrow-line AGN.

3.3. Little Red Dots

The LRD comparison sample was assembled from published photometric and spectroscopic catalogs. Specifically, we include the multi-field compilation of Kocevski et al. (2025), the GOODS/JADES sample of Rinaldi et al. (2025), the SMILES/JADES sample of Pérez-González et al. (2024), the COSMOS-Web catalog of Akins et al. (2025), and compact red sources identified in UNCOVER spectroscopy by Greene et al. (2024).

The LRD and BLAGN samples are not mutually exclusive, and some LRDs also belong to the adopted [Ne V] sample. For figures in which each galaxy is shown only once, galaxies in the adopted [Ne V] sample and galaxies with a published BLAGN classification are not plotted a second time as LRDs. After catalog matching, de-duplication, and these exclusions, 116 galaxies are shown as LRDs in these figures. Galaxies identified as LRDs in the literature are still considered LRDs even when they are displayed under another classification in such figures.

The contributing studies use different combinations of red optical colors, continuum slopes, compactness, morphology, and spectral-energy-distribution criteria. The resulting LRD sample is therefore a heterogeneous literature compilation rather than a uniformly selected physical population. Differences among the adopted LRD definitions can affect the sample’s redshift, luminosity, and emission-line distributions.

Published BLAGN are not shown a second time as LRDs in figures requiring each galaxy to appear only once. This is done solely to avoid duplicate points and does not imply that the remaining LRDs lack broad-line regions. For many LRDs, the available spectroscopy does not provide the wavelength coverage, spectral resolution, or sensitivity needed to determine whether broad Balmer emission is present.

3.4. Local [Ne V] comparison samples

The preceding samples provide high-redshift comparisons selected through broad permitted lines, narrow-line ratios, or compact red continua. We also consider two low-redshift samples selected through [Ne V] emission itself. These samples provide a local reference for galaxies known to produce the same coronal line used to define the JWST sample.

3.4.1. The Coronal Line Activity Spectroscopic Survey

The first low-redshift comparison is drawn from the Coronal Line Activity Spectroscopic Survey (CLASS; Reece et al. 2022), which searched Sloan Digital Sky Survey spectra for a broad range of optical coronal lines. We use the adopted subset of 61 CLASS galaxies with reported [Ne V] $\lambda 3426$ emission.

The CLASS sample provides a local comparison selected through the same high-ionization transition as our JWST sample. We combine the published CLASS [Ne V] and [Ne III] measurements with optical emission-line measurements from the MPA–JHU catalogs where required. For analyses involving nebular [He II], we use the subset matched to the strong-nebular-[He II] catalog of [Shirazi & Brinchmann \(2012\)](#). The measurement and coverage requirements used to define the CLASS subset entering each diagnostic are given in Section 4.3.

3.4.2. Local metal-poor [Ne V] emitters

The second low-redshift comparison contains 15 compact star-forming or blue compact dwarf galaxies with published [Ne V] emission. The adopted line intensities were compiled from [Izotov et al. \(2004\)](#); [Thuan & Izotov \(2005\)](#); [Izotov et al. \(2012, 2021\)](#); [Berg et al. \(2021\)](#). These studies generally report extinction-corrected emission-line intensities normalized to $I(\text{H}\beta) = 100$, which we preserve in the line-ratio comparisons.

We include this sample to investigate whether the high-redshift [Ne V] emitters occupy similar ionization-diagnostic space to low-metallicity galaxies with exceptionally hard radiation fields. The local metal-poor galaxies are not treated as a pure stellar-ionization control. The literature discusses several possible contributors to their [Ne V] emission, including radiative shocks, accretion onto compact objects or massive black holes, and unusually hard stellar ionizing spectra ([Izotov et al. 2004](#); [Thuan & Izotov 2005](#); [Izotov et al. 2012, 2021](#); [Berg et al. 2021](#); [Hatano et al. 2024](#)). They therefore provide a physically informative comparison for low-metallicity, hard-ionization conditions without constituting an unambiguous population free of nonstellar ionization.

All 15 published galaxies are retained in the parent comparison catalog. Requirements involving the availability and quality of additional emission lines are applied separately for each diagnostic in Section 4.3 and do not redefine membership in the underlying literature sample.

4. RESULTS

4.1. Observed Properties of the High-Redshift [Ne V] Sample

4.1.1. Redshift and [Ne V] Luminosity Distribution

In Figure 1(a), we show the apparent [Ne V] $\lambda 3426$ luminosities for the 25 galaxies in the SHINE-[NeV] sample. The sample spans $z = 3.059\text{--}9.444$ (median $z = 3.722$), with apparent line luminosities of $\log_{10}(L_{3426}^{\text{app}}/\text{erg s}^{-1}) = 40.70\text{--}42.86$ (median 41.52). All values reported are apparent luminosities. The UNCOVER DR4 lens models¹ give magnifications

of $\mu = 1.93, 1.94$, and 1.41 for NeV-01, NeV-02, and NeV-03, respectively. These correspond to modest luminosity corrections of $\simeq 0.15\text{--}0.29$ dex and do not alter our conclusions.

The highest-redshift source, NeV-10 ($z = 9.444$), is JADES-GS-z9-0, in which [Curti et al. \(2025\)](#) tentatively identified a $\sim 2.9\sigma$ [Ne V] $\lambda 3426$ feature. We retain NeV-10 in SHINE-[NeV] because it was flagged through our visual inspection and satisfied our uniform integrated-flux signal-to-noise threshold of $F_{3426}/\sigma_{F_{3426}} > 3$ in BADASS.

In Figure 1(b), we compare the SHINE-[NeV] luminosities with those of the low-redshift CLASS [Ne V] emitters ($N = 61$) and the local metal-poor comparison sample ($N = 15$; Section 3.4). The SHINE-[NeV] luminosities substantially overlap those of the CLASS sample. Twenty of the 25 sources fall within the CLASS range of $\log_{10}(L_{3426}/\text{erg s}^{-1}) = 40.50\text{--}41.94$ (median 41.23), while five exceed the CLASS maximum ([Reefe et al. 2022](#)). We note that 57 of the 60 CLASS objects with usable MPA–JHU classifications satisfy both the [Kewley et al. \(2001\)](#) and [Kauffmann et al. \(2003\)](#) BPT criteria. SHINE-[NeV] thus occupies the [Ne V] luminosity regime of a predominantly BPT-classified AGN population.

In contrast, the local metal-poor sample spans $\log_{10}(L_{3426}/\text{erg s}^{-1}) = 36.52\text{--}39.73$ (median 38.86), approximately 2.7 dex below the SHINE-[NeV] median. Every SHINE-[NeV] source is more luminous than the brightest local metal-poor object. This separation is strongly driven by sensitivity limits. Among the 9,002 parent-sample galaxies with usable [Ne V] coverage and valid flux uncertainties, the deepest source-specific 4σ luminosity limit is $\log_{10}(L_{3426,\text{lim}}/\text{erg s}^{-1}) = 40.52$, 0.79 dex above the maximum luminosity of the local sample. Thus, analogous low-luminosity [Ne V] emitters could exist at high redshift but remain undetected in our PRISM-selected sample. The origin of [Ne V] in local metal-poor galaxies also remains uncertain, with contributions from extreme stellar populations, shocks, X-ray binaries, and accretion considered in the literature (e.g., [Izotov et al. 2004](#); [Thuan & Izotov 2005](#); [Izotov et al. 2012](#); [Kehrig et al. 2018](#); [Berg et al. 2021](#); [Izotov et al. 2021](#); [Mingozi et al. 2025](#)).

The most luminous [Ne V] feature reported in the literature, detected at $\log_{10}(L_{3426}/\text{erg s}^{-1}) \simeq 43.5$ in the extreme radio-galaxy/protocluster environment of TN J1338-b, is only a $\sim 2\sigma$ detection and is thus classified as tentative ([Saxena et al. 2024](#)). Because the samples in Figure 1 are subject to distinct selection functions and depth limits, these comparisons are descriptive rather than evidence of intrinsic luminosity evolution. We examine the redshift dependence of [Ne V] incidence among galaxies with [Ne III] detections in Section 4.3.

4.1.2. Spectral and imaging diversity of the Ne V sample

¹ <https://jwst-uncover.github.io/#releases>

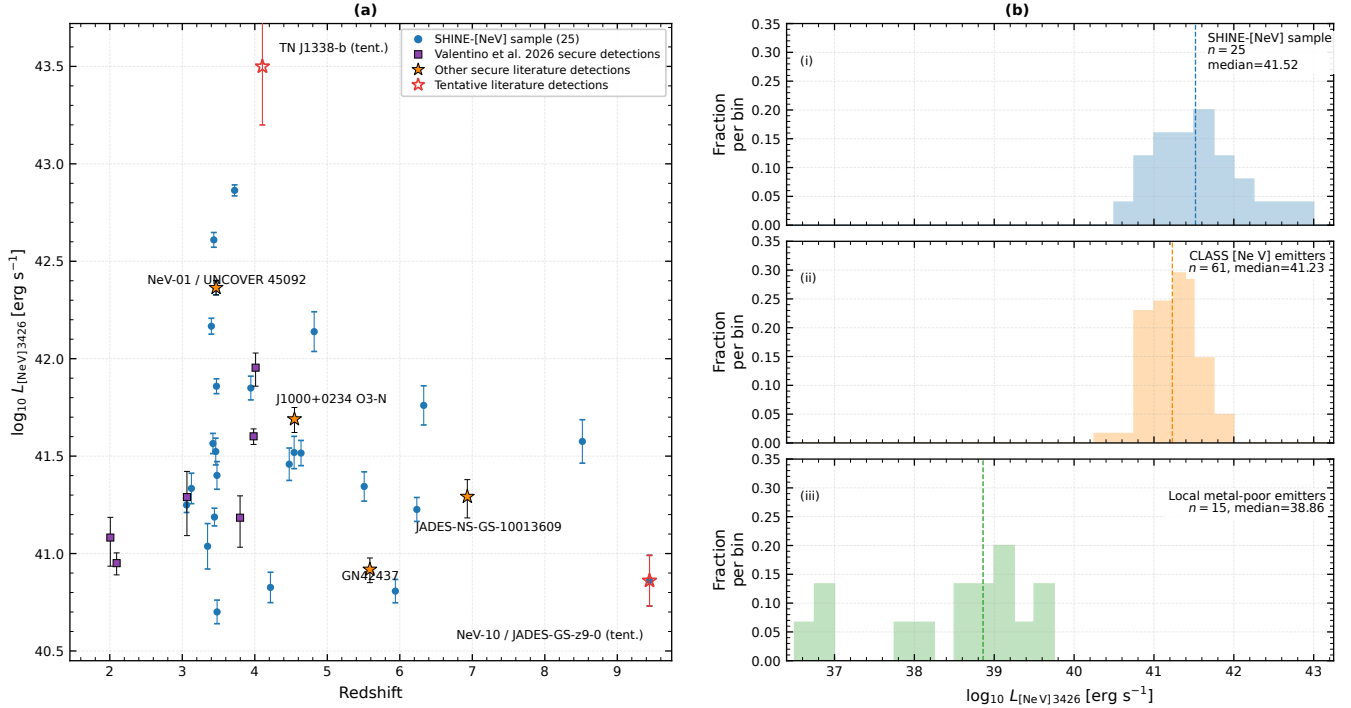


Figure 1. [Ne V] $\lambda 3426$ luminosities of the SHINE-[NeV] and comparison samples. **(a)** Apparent line luminosity versus spectroscopic redshift for the 25 SHINE-[NeV] galaxies, with selected published high-redshift measurements shown for comparison. **(b)** Luminosity distributions for SHINE-[NeV], 61 CLASS emitters, and 15 local metal-poor emitters; dashed lines denote sample medians.

Figure 2 shows the PRISM spectra, [Ne V] fits, and NIRCam cutouts for four sources selected to illustrate the diversity of the SHINE-[NeV] sample. They span $z = 3.466$ – 9.444 and $\log_{10}(L_{3426}^{\text{app}}/\text{erg, s}^{-1}) = 40.86$ – 42.36 . They are illustrative examples rather than a statistically representative subsample. We construct the RGB cutouts from DJA imaging products (Brammer 2023; Heintz et al. 2025; Valentino et al. 2025), with F115W, F277W, and F444W assigned to blue, green, and red, respectively. Because these filters probe different rest-frame wavelengths across the sample, we use the RGB images to illustrate spatial structure and internal color variations without interpreting their physical origin.

NeV-01 and NeV-14 lie at nearly the same redshift ($z = 3.466$ and 3.471) but differ in continuum shape, relative rest-optical emission-line strength, and NIRCam appearance. NeV-01 shows a pronounced Balmer break that is not present at comparable strength in the other three representative spectra. Medium-resolution NIRSpectroscopy also reveals a broad $\text{H}\alpha$ component that is not clearly identifiable in the PRISM spectrum. NeV-01 lies in the Abell 2744/UNCOVER lensing field and has several nearby sources in projection. NeV-14 shows stronger rest-optical emission lines relative to its continuum and appears more compact in the NIRCam image.

NeV-03 and NeV-10 are the two highest-redshift sources in the sample, at $z = 8.518$ and $z = 9.444$, respectively. Both

show prominent rest-optical emission lines, but their continua and apparent [Ne V] luminosities differ. NeV-03 has $\log_{10}(L_{3426}^{\text{app}}/\text{erg, s}^{-1}) = 41.58$, compared with 40.86 for NeV-10. NeV-03 is also classified as an LRD in the multi-field catalog of Kocevski et al. (2025). Its NIRCam image shows a compact central source with a nearby component, whereas NeV-10 appears more elongated and is accompanied by nearby sources.

The full atlas shows substantial variation in continuum shape, rest-optical line strength, and projected image structure. We do not use the NIRCam images as quantitative morphology classifications or assume that nearby sources are physically associated. The remaining 21 SHINE-[NeV] sources are shown in Appendix A.1.

4.2. Broad-Line Properties and Spectroscopic Classification

Three of the 25 SHINE-[NeV] sources are flagged as broad-line galaxies in the PRISMATIC catalog: NeV-04 and NeV-17 in $\text{H}\alpha$, and NeV-21 in both $\text{H}\alpha$ and $\text{H}\beta$. We treat these flags as qualitative indicators rather than uniform intrinsic line-width measurements, as the resolving power of the PRISM spectra varies strongly with wavelength (Ferruit et al. 2022; Jakobsen et al. 2022). The absence of a PRISMATIC flag does not rule out a broad-line region.

Medium- or high-resolution NIRSpectroscopy observations cover $\text{H}\alpha$ and/or $\text{H}\beta$ for eleven sources: ten in $\text{H}\alpha$, nine in $\text{H}\beta$, and eight in both. Publicly available spectra allowed us to inspect

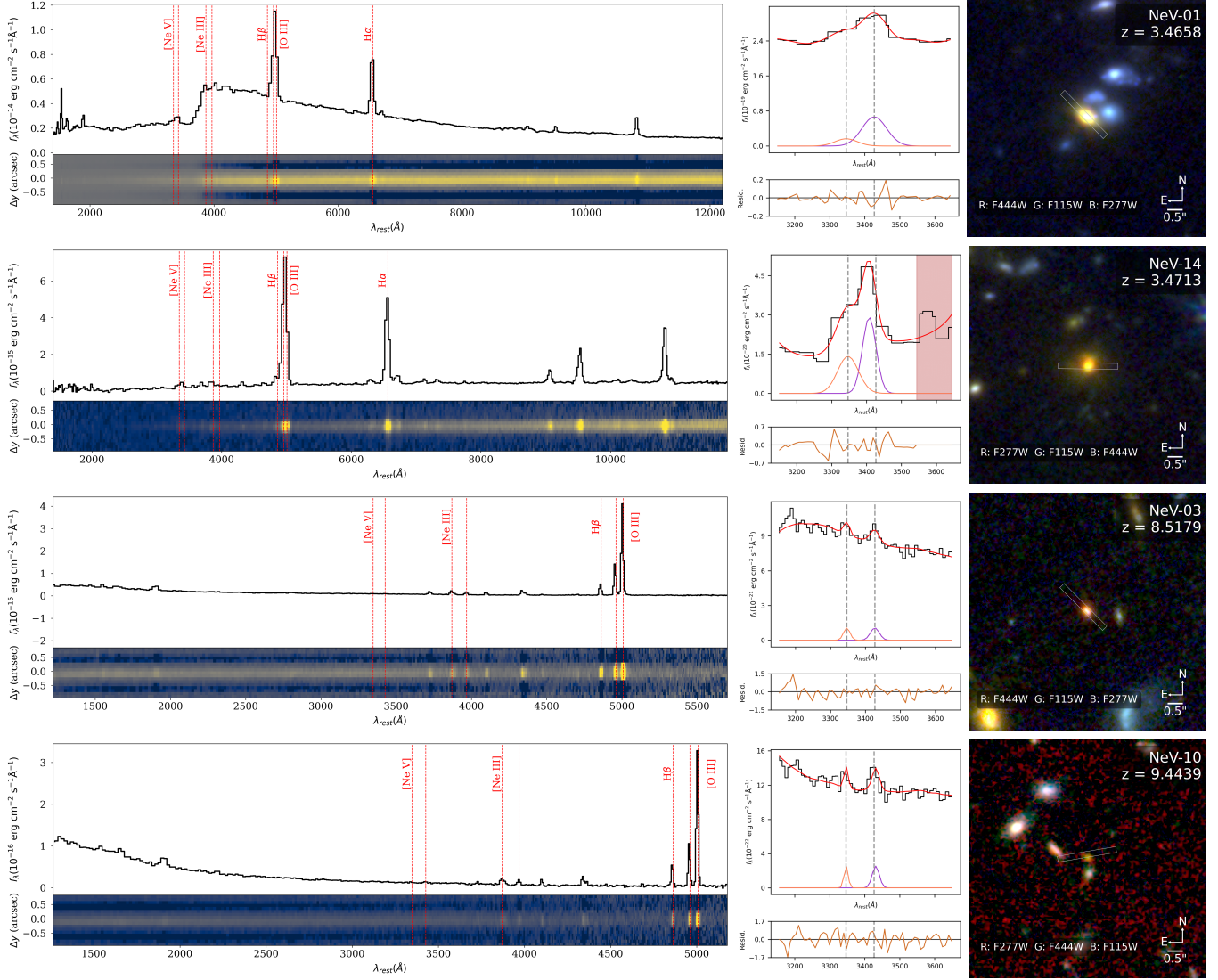


Figure 2. Representative spectra and NIRCcam cutouts for NeV-01, NeV-14, NeV-03, and NeV-10, from top to bottom. The four sources illustrate the range of redshifts, apparent [Ne V] luminosities, continuum shapes, rest-optical emission-line strengths, and projected image structures in the sample. In each row, the left panel shows the rest-frame PRISM one-dimensional spectrum above the corresponding two-dimensional spectrum. Red vertical markers identify selected emission lines. The central panels show the BADASS fit to the [Ne V] $\lambda\lambda 3346, 3426$ region and its residuals; black shows the observed spectrum, red the total model, and the colored curves the fitted line components. Gray dashed lines mark the expected wavelengths of the [Ne V] doublet. The right panel shows the NIRCcam RGB cutout, with F115W, F277W, and F444W assigned to blue, green, and red, respectively. Orientation and angular scale are indicated. The images provide visual context and are not quantitative morphology classifications. The full 25-source atlas is presented in Appendix A.1.

at least one Balmer line in eight sources; data for NeV-08, NeV-12, and NeV-14 remain proprietary. The medium- and high-resolution gratings provide nominal resolving powers of $R \sim 1000$ and $R \sim 2700$, respectively (Ferruit et al. 2022; Jakobsen et al. 2022). Because spectral quality and sensitivity vary across the sample, the lack of a required broad component in a given spectrum does not yield a uniform upper limit on broad-line width or flux.

Higher-resolution spectra reveal two additional broad-line sources that are not flagged by PRISMATIC: NeV-

01 exhibits broad H α in G235M/F170LP, while NeV-05 displays broad H α in G395H/F290LP and broad H β in G235H/F170LP. Figure 3 presents the higher-resolution H α fits for these two additions.

Among the remaining six sources with public higher-resolution spectra, NeV-04 exhibits a blueshifted, asymmetric H α profile indicative of outflowing gas rather than a canonical broad-line region. Although we retain NeV-04 in our broad-line census based on its PRISMATIC classification, we do not count its higher-resolution spectrum as an

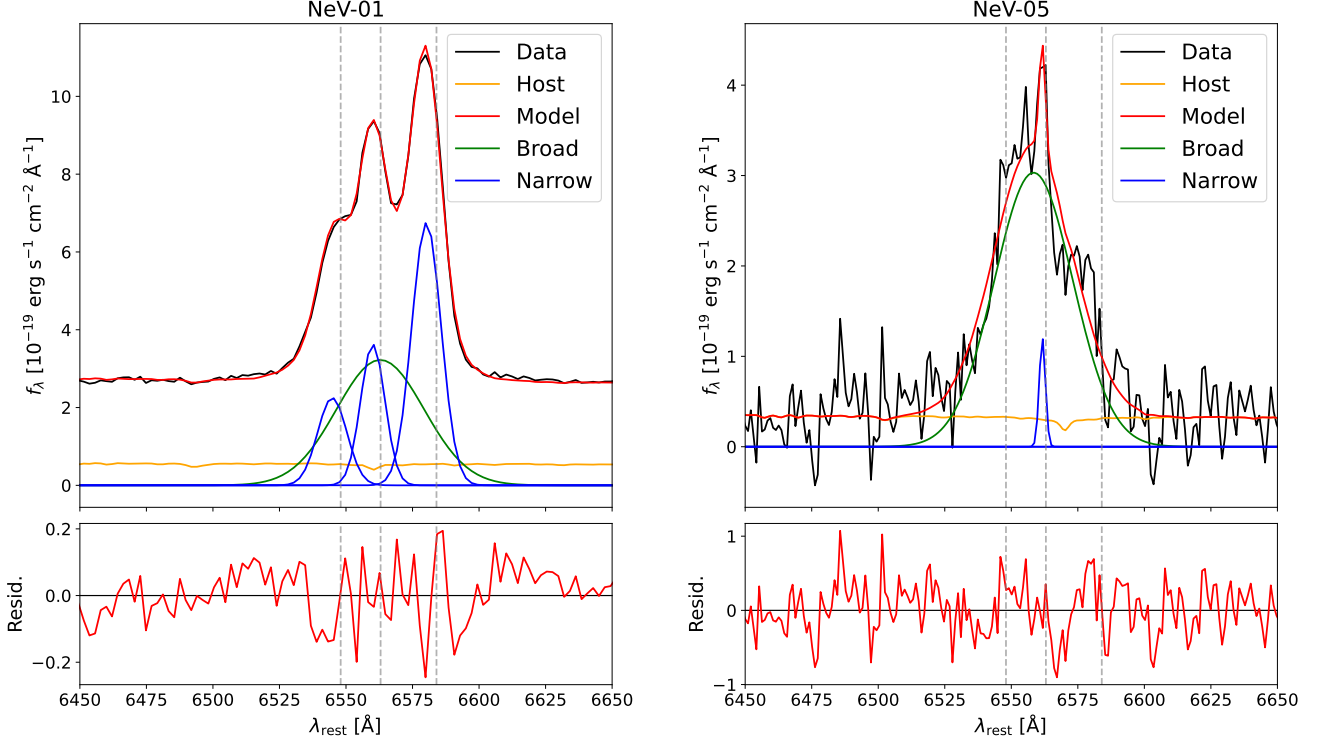


Figure 3. Higher-resolution H α and [N II] fits for (a) NeV-05 (G395H/F290LP) and (b) NeV-01 (G235M/F170LP). Black curves show the observed spectra, orange the fitted continuum/host galaxy component, red the total model, green the broad component, and blue the narrow components. Lower panels display fit residuals. Vertical dashed lines denote the expected rest-frame wavelengths of H α and the neighboring [N II] $\lambda\lambda 6548, 6583$ doublet.

independent broad-line detection. The five remaining inspected sources—NeV-10, NeV-11, NeV-23, NeV-24, and NeV-25—lack PRISMATIC broad-line flags and require no broad Balmer component in higher-resolution data.

Combining PRISMATIC classifications with higher-resolution spectral fits yields a final broad-line census of five sources: NeV-01, NeV-04, NeV-05, NeV-17, and NeV-21 (5/25, or 20% of the SHINE-[NeV] sample). Higher-resolution data contribute NeV-01 and NeV-05, while cross-matching with literature broad-line AGN catalogs yields no further members. Table 2 summarizes source classifications and higher-resolution Balmer-line coverage.

Because higher-resolution coverage and sensitivity remain non-uniform across the sample, this 20% detection fraction represents a lower bound rather than a complete estimate of intrinsic broad-line incidence. Consequently, we refrain from classifying sources without detected broad components as Type 2 or narrow-line AGNs.

4.3. Emission-line Excitation and Diagnostic Properties

The classical BPT and S2–VO87 diagrams use strong rest-optical emission-line ratios to distinguish AGNs from star-forming galaxies (Baldwin et al. 1981; Veilleux & Osterbrock 1987; Kewley et al. 2001). At $z > 3$, however, the lower gas metallicities and higher ionization parameters of galaxies

cause the predicted line ratios of AGNs and star-forming systems to overlap (Feltre et al. 2016; Gutkin et al. 2016; Nakajima & Maiolino 2022; Scholtz et al. 2025). Scholtz et al. (2025) therefore defined conservative high-redshift boundaries intended to identify sources beyond the region occupied by the adopted star-forming models. Sources below these boundaries may still host AGN. For example, GN 42437 exhibits low-ionization line ratios consistent with star formation despite prominent [Ne V] emission and direct evidence for accretion (Chisholm et al. 2024).

High-ionization lines probe the ionizing spectrum at higher energies than the standard optical diagnostics. We define

$$\text{Ne53} \equiv \log_{10} \left(\frac{F_{3426}}{F_{3869}} \right), \quad (3)$$

Because this ratio compares two ionization states of the same element, it has been proposed as a relatively metallicity-insensitive probe of the very-high-ionization spectrum (Abel & Satyapal 2008; Cleri et al. 2023c).

Figure 4(a) compares Ne53 with $\log_{10}([\text{O III}] \lambda 5007 / \text{H}\beta)$. The 25 SHINE-[NeV] galaxies span a broad region of the diagram and overlap with the published JWST broad-line AGNs, LRDs, galaxies selected using the S2–VO87 narrow-line diagnostic, and the low-redshift CLASS [Ne V] emitters. The local metal-poor [Ne V] galaxies have lower measured

Table 2. Broad-line Classification and Higher-resolution Balmer-line Assessment of the SHINE-[NeV] Sample

ID	PRISM	Higher-resolution Balmer-line status		Higher-resolution	Adopted
	broad-line flag	H α	H β	configuration(s)	classification
NeV-01	No flag	Broad	Not public	H α : G235M/F170LP; G395M/F290LP	Broad (higher res.)
NeV-04	H α	Asymmetric/outflow-like ^a	No BLR comp. ^b	H β : G235M/F170LP H α : G395M/F290LP	Broad (PRISM)
NeV-05	No flag	Broad	Broad	H β : not listed H α : G395H/F290LP	Broad (higher res.)
NeV-08	No flag	Not public	Not public	H β : G235H/F170LP H α : G235M/F170LP; G395H/F290LP; G395M/F290LP	Unconstrained
NeV-10	No flag	No coverage	No BLR comp.	H β : G235M/F170LP H α , H β : G395H/F290LP;	No BLR comp. (H β)
NeV-11	No flag	No BLR comp.	No BLR comp.	G395M/F290LP H α : G235H/F170LP; G395H/F290LP	No BLR comp.
NeV-12	No flag	Not public	Not public	H β : G235H/F170LP H α : G235H/F170LP; G395H/F290LP	Unconstrained
NeV-14	No flag	Not public	Not public	H β : G235H/F170LP	Unconstrained
NeV-17	H α	No coverage	No coverage	...	Broad (PRISM)
NeV-21	H α , H β	No coverage	No coverage	...	Broad (PRISM)
NeV-23	No flag	No BLR comp.	No BLR comp.	H α : G395M/F290LP H β : G235M/F170LP H α : G395M/F290LP	No BLR comp.
NeV-24	No flag	No BLR comp.	No BLR comp. ^b	H β : not listed H α : G235H/F170LP; G395H/F290LP	No BLR comp.
NeV-25	No flag	No BLR comp.	No BLR comp. ^c	H β : G235H/F170LP	No BLR comp. adopted

^a The higher-resolution H α profile of NeV-04 is blueshifted and asymmetric and may be associated with outflowing gas rather than a conventional broad-line region. NeV-04 is retained in the broad-line census on the basis of its PRISM H α classification.

^b A higher-resolution inspection result is available for this line, but the corresponding grating/filter is not listed in the source metadata.

^c The H β profile of NeV-25 includes a broad-like component, but its profile was interpreted as more consistent with non-BLR kinematics, such as an outflow, and it is therefore not adopted as a conventional broad-line detection.

NOTE—The table includes all SHINE-[NeV] galaxies with nominal medium- or high-resolution Balmer-line coverage, together with NeV-17 and NeV-21, which are classified as broad-line sources from their PRISM spectra but lack corresponding higher-resolution Balmer-line coverage. The remaining 12 SHINE-[NeV] galaxies have neither a PRISM broad-line flag nor nominal medium- or high-resolution Balmer-line coverage. “Broad” indicates a broad Balmer component identified in the higher-resolution spectrum. “No BLR comp.” indicates that the inspected spectrum did not require a component interpreted as broad-line-region (BLR) emission. “Not public” indicates that higher-resolution spectroscopy with nominal coverage of the line exists but was not publicly available for inspection. “No coverage” indicates that no available medium- or high-resolution configuration nominally covers the corresponding Balmer line. The absence of a PRISM broad-line flag, or the lack of an inspectable higher-resolution spectrum, is not interpreted as evidence that a BLR is absent.

ratios. The local metal-poor galaxies are not a purely stellar control sample, because shocks, accretion, or unusually hard stellar spectra may contribute to their high-ionization emission.

Figure 4(b) compares Ne53 with optical He II $\lambda 4686/H\beta$. He II is sensitive to photons above the second ionization edge of helium and provides another measure of the hardness of the ionizing spectrum (Shirazi & Brinchmann 2012; Chisholm et al. 2024). Twenty-four of the 25 SHINE-[NeV] galaxies can be placed on this diagram. Among the 24 plotted galaxies, 11 have measured He II/H β ratios and 13 have upper limits.

The SHINE-[NeV] sources overlap with the broad-line, S2–VO87-selected, CLASS, LRD, and local metal-poor comparison samples. The large number of upper limits pre-

vents He II/H β from providing a complete classification of the sample. A He II detection provides additional evidence for a hard ionizing spectrum, but its nondetection does not argue against a secure [Ne V] detection. He II $\lambda 4686$ is intrinsically faint, and even deep JWST spectra often provide little constraint from individual upper limits (Scholtz et al. 2025).

In Figure 5, we show the location of the SHINE-[NeV] sample on the S2–VO87 diagram, [O III] $\lambda 5007/H\beta$ versus [S II] $\lambda \lambda 6717, 6731/H\alpha$ (Veilleux & Osterbrock 1987). We show the Kewley et al. (2001) maximal-starburst relation and the conservative high-redshift boundary of Scholtz et al. (2025). The latter was defined to exclude the region reached by the adopted high-redshift star-forming models and therefore provides a more restrictive AGN selection.

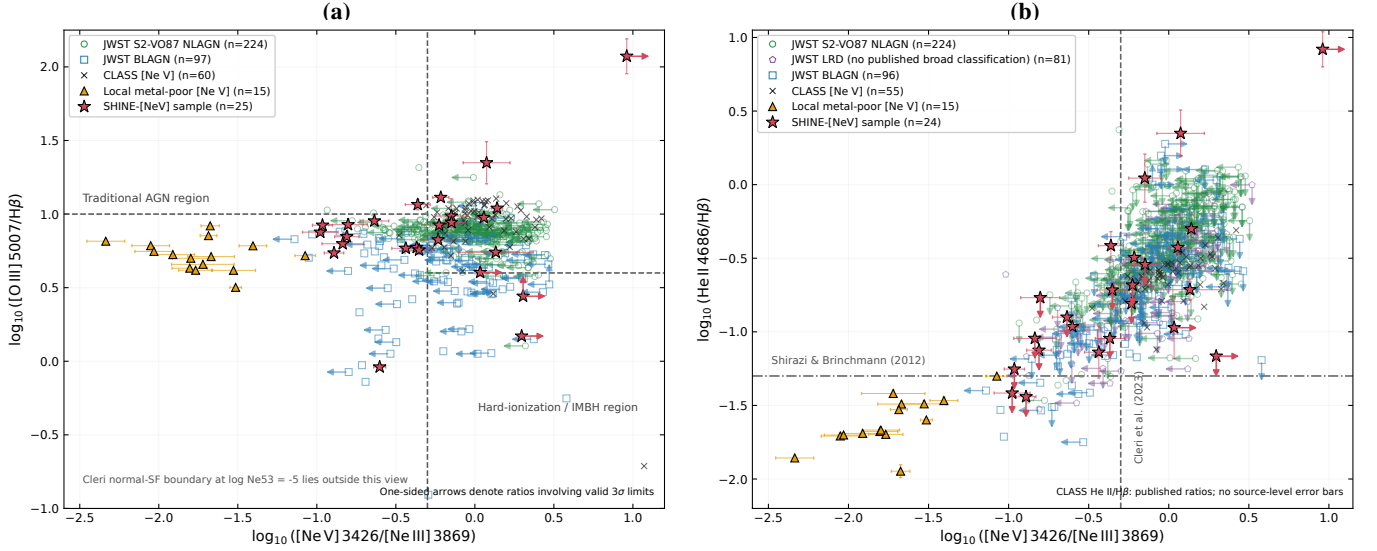


Figure 4. High-ionization emission-line diagnostics for the SHINE-[NeV] sample. (a) $\log_{10}([\text{O III}] \lambda 5007/\text{H}\beta)$ as a function of $\text{Ne53} = \log_{10}([\text{Ne V}] \lambda 3426/[\text{Ne III}] \lambda 3869)$. Red stars show the 25 SHINE-[NeV] galaxies. The comparison samples comprise 97 published JWST broad-line AGNs, 224 galaxies selected using the S2-VO87 narrow-line diagnostic, 60 CLASS [Ne V] emitters, and 15 local metal-poor [Ne V] galaxies. The dashed lines show the reference divisions of Cleri et al. (2023c), including $\text{Ne53} = -0.3$; the normal star-forming reference boundary lies outside the plotted range. (b) $\log_{10}(\text{He II } \lambda 4686/\text{H}\beta)$ as a function of Ne53 . The 24 SHINE-[NeV] galaxies with a usable ratio are compared with 96 published JWST broad-line AGNs, 224 galaxies selected using the S2-VO87 narrow-line diagnostic, 81 literature LRDs without a published broad-line classification, 55 CLASS [Ne V] emitters, and 15 local metal-poor [Ne V] galaxies. NeV-04 is omitted because both He II and $\text{H}\beta$ are represented by limits. The vertical dashed line marks the Cleri et al. (2023c) reference value $\text{Ne53} = -0.3$. The horizontal dash-dotted line at $\log_{10}(\text{He II } \lambda 4686/\text{H}\beta) = -1.3$ marks the low-metallicity He II reference of Shirazi & Brinchmann (2012), as adopted by Chisholm et al. (2024). For the SHINE-[NeV] sample, [Ne V] uses the adopted integrated BADASS flux and uncertainty, while the remaining JWST lines are taken from PRISMATIC. The CLASS ratios in panel (a) combine the CLASS [Ne V] and [Ne III] measurements with MPA-JHU [O III] and $\text{H}\beta$ fluxes. The CLASS sample in panel (b) is restricted to sources matched to the Shirazi & Brinchmann (2012) catalog and is shown without He II/ $\text{H}\beta$ error bars because source-level uncertainties are not available for the published ratios. The local comparison uses published extinction-corrected line intensities. One-sided arrows indicate ratios involving valid 3σ limits. The reference divisions are shown for comparison and are not used to define the SHINE-[NeV] sample. Only one representative spectrum is included for the multiply imaged A2744-QSO1 system.

Twenty-three of the 25 SHINE-[NeV] galaxies have line ratio or upper limits measurements that can be plotted on the S2-VO87 diagnostic diagram. Relative to the Kewley et al. (2001) relation, 14 of 21 (67%) lie above the relation and 7 of 21 (33%) lie below it. For the remaining two plotted galaxies, the allowed ranges defined by their upper limits cross the Kewley relation, preventing a secure classification relative to that boundary. Two additional galaxies lack usable S2-VO87 ratios and are not plotted.

In contrast, only 3 of 22 classifiable SHINE-[NeV] sources (14%) lie above the more conservative Scholtz et al. (2025) boundary, while 19 of 22 (86%) lie below it. Thus, most classifiable SHINE-[NeV] galaxies lie above the Kewley et al. (2001) relation, although 32% of galaxies with constraining [Ne V] nondetections also lie above this boundary. Only a small fraction of the SHINE-[NeV] sample satisfies the more conservative Scholtz et al. (2025) criterion. Sources below this boundary should not be interpreted as non-AGN. Indeed, Scholtz et al. (2025) emphasize the importance of

high-ionization lines, including [Ne V], for identifying AGN at high redshift.

The diagnostic methods identify overlapping but non-identical subsets of the SHINE-[NeV] sample. Five of the 25 galaxies have adopted broad-line classifications, and most sources lie above the Kewley et al. (2001) relation, whereas only a small fraction lie above the more conservative Scholtz et al. (2025) boundary. The SHINE-[NeV] galaxies also overlap with the comparison populations in the high-ionization diagrams rather than occupying a distinct region. [Ne V] therefore provides complementary information on the hard ionizing spectrum rather than reproducing any single broad-line or rest-optical diagnostic selection. Table 3 summarizes the broad-line and emission-line diagnostic classifications for each SHINE-[NeV] galaxy.

4.4. High-ionization Emission in Broad-line AGNs and LRDs

Several studies have reported weak or absent high-ionization emission lines in JWST BLAGNs and LRDs (e.g., Lambrides et al. 2026; Zucchi et al. 2026; Wang et al. 2026),

Table 3. Broad-line Status and Emission-line Diagnostic Regions of the SHINE-[NeV] Sample

ID	Adopted broad-line	Cleri et al. (2023c)	Kewley et al. (2001)	Scholtz et al. (2025)
	status	region	S2–VO87	S2–VO87
NeV-01	Broad (higher res.)	Traditional AGN	Above	Above
NeV-02	Unconstrained	Traditional AGN	Unconstr.	Below
NeV-03	Unconstrained	Composite	No usable ratio	No usable ratio
NeV-04	Broad (PRISM)	AGN or hard-ion. ^a	Unconstr.	Unconstr.
NeV-05	Broad (higher res.)	Traditional AGN	Above	Below
NeV-06	Unconstrained	Composite	Above	Below
NeV-07	Unconstrained	Composite	Below	Below
NeV-08	Unconstrained	Traditional AGN	Above	Above
NeV-09	Unconstrained	Traditional AGN	Above	Below
NeV-10	No BLR comp. ($H\beta$)	Composite	No usable ratio	No usable ratio
NeV-11	No BLR comp.	Composite	Below	Below
NeV-12	Unconstrained	Traditional AGN	Above	Below
NeV-13	Unconstrained	Traditional AGN	Above	Below
NeV-14	Unconstrained	Traditional AGN	Above	Above
NeV-15	Unconstrained	Composite	Above	Below
NeV-16	Unconstrained	Composite	Above	Below
NeV-17	Broad (PRISM)	Hard-ion./IMBH ^b	Below	Below
NeV-18	Unconstrained	Composite	Below	Below
NeV-19	Unconstrained	Traditional AGN	Above	Below
NeV-20	Unconstrained	Traditional AGN	Below	Below
NeV-21	Broad (PRISM)	Composite	Below	Below
NeV-22	Unconstrained	Composite	Below	Below
NeV-23	No BLR comp.	Traditional AGN	Above	Below
NeV-24	No BLR comp.	Composite	Above	Below
NeV-25	No BLR comp. ^c	Traditional AGN	Above	Below

^a For NeV-04, the upper limits place the source at $\text{Ne53} > -0.3$ but do not determine whether $\log_{10}([\text{O III}]/H\beta)$ lies above or below the Cleri et al. (2023c) division at 0.6. The source therefore lies either in the traditional-AGN region or in the hard-ionization/IMBH region.

^b The “Hard-ion./IMBH” label follows the region defined by Cleri et al. (2023c) at $\text{Ne53} > -0.3$ and $\log_{10}([\text{O III}]/H\beta) < 0.6$. This label denotes the location of the source in the Cleri et al. diagnostic diagram and is not a unique AGN classification.

^c The higher-resolution $H\beta$ profile of NeV-25 contains a broad-like component that was interpreted as more consistent with an outflow; no conventional BLR component is adopted. See Table 2 for details.

NOTE— The broad-line column summarizes the adopted broad line classification from Table 2. “Broad (PRISM)” and “Broad (higher res.)” identify the observations supporting the adopted broad-line classification. “No BLR comp.” indicates that the inspected higher-resolution Balmer spectra did not require a component interpreted as broad-line-region emission; when only one Balmer line could be inspected, that line is specified. “Unconstrained” indicates that the available data do not permit a secure broad-line assessment. It does not imply that broad Balmer emission is absent. The Cleri et al. column reports the region containing each source in the $\log_{10}([\text{O III}]/H\beta)$ – Ne53 diagram; these region labels describe diagnostic location rather than a unique physical classification. “Above” and “Below” in the S2–VO87 columns indicate the position relative to the Kewley et al. (2001) maximal-starburst relation and the conservative high-redshift boundary of Scholtz et al. (2025), respectively. A source below either boundary is not classified here as a non-AGN. “Unconstr.” in an S2–VO87 column indicates that the measured upper limits cross the relevant boundary. “No usable ratio” indicates that the source lacks a valid S2–VO87 ratio and is not plotted in Figure 5. Emission line ratios and upper limits use the same PRISMATIC catalog measurements; the SHINE-[NeV] [Ne v] measurements use the adopted integrated BADASS fluxes.

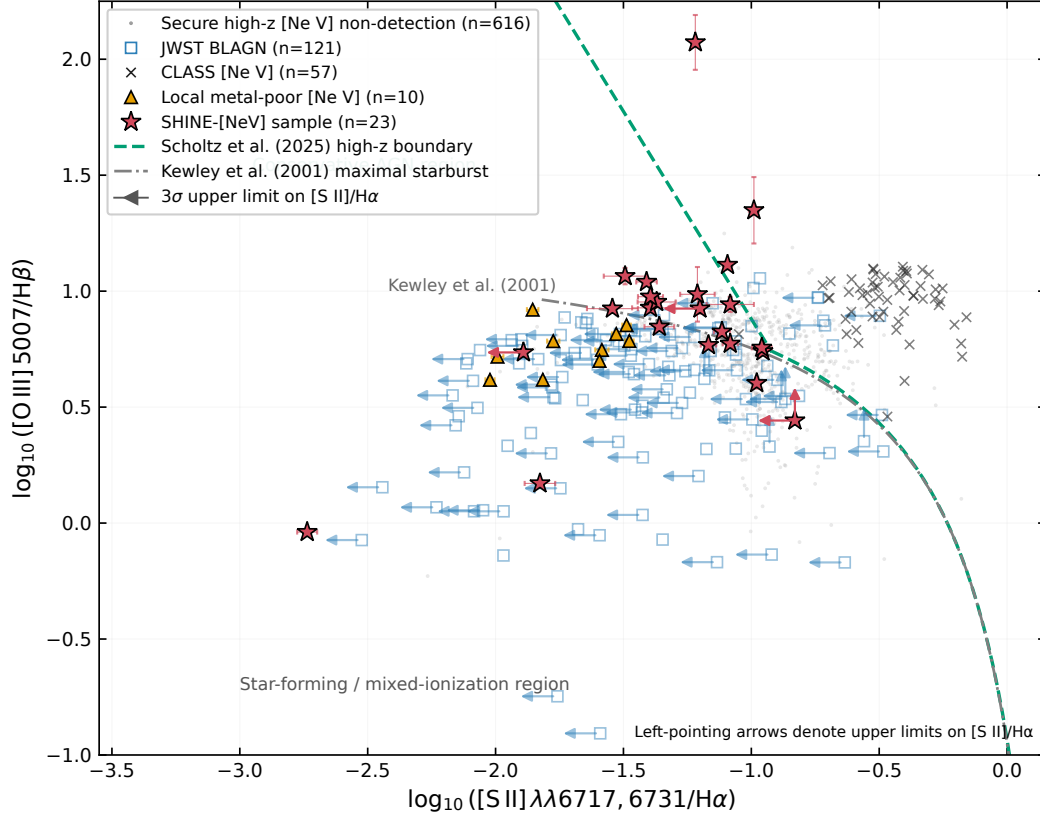


Figure 5. S2–VO87 diagram showing $\log_{10}([\text{O III}] \lambda 5007/\text{H}\beta)$ as a function of $\log_{10}([\text{S II}] \lambda\lambda 6717, 6731/\text{H}\alpha)$. The plotted samples comprise 23 SHINE-[NeV] galaxies, 616 quality-qualified high-redshift [Ne V] nondetections, 121 published JWST broad-line AGNs, 57 CLASS [Ne V] emitters, and 10 local metal-poor [Ne V] galaxies. The qualified nondetection sample consists of JWST sources outside the SHINE-[NeV] sample with nominal [Ne V] coverage, a constrained [Ne V] upper limit, complete S2–VO87 measurements, and $S/N > 3$ in $\text{H}\alpha$, $\text{H}\beta$, $[\text{O III}]$, and $[\text{S II}]$. It is shown as a diagnostic comparison population and not as an unbiased control sample. The green dashed curve is the conservative high-redshift boundary of Scholtz et al. (2025), and the gray dash-dotted curve is the Kewley et al. (2001) maximal-starburst relation. Left-pointing arrows indicate 3σ upper limits on $[\text{S II}] \lambda\lambda 6717, 6731/\text{H}\alpha$. Two SHINE-[NeV] sources lack usable ratios and are not plotted. One of the 23 plotted sources has limits that cross the Scholtz et al. boundary and is not assigned to either side. Only one representative spectrum is included for the multiply imaged A2744-QSO1 system. Sources below the Scholtz et al. boundary are not necessarily free of AGN activity.

although high-ionization lines have been detected in some systems (e.g., Tang et al. 2025). Using PRISMATIC measurements and upper limits for our literature-assembled samples of BLAGNs and LRDs, we systematically test whether the existing [Ne V] nondetections provide evidence that most members of these populations are genuinely deficient in [Ne V] relative to the SHINE sample.

To assess whether the [Ne V] nondetections are sufficiently constraining, we use Ne53 as defined in Equation 3. Because [Ne V] and [Ne III] arise from the same element and are close in wavelength, this ratio reduces sensitivity to abundance, differential attenuation, and absolute flux calibration. We restrict the comparison to galaxies with robust [Ne III] detections and finite 3σ [Ne V] upper limits from PRISMATIC, and test whether those limits exclude the Ne53 values observed in the SHINE-[NeV] sample.

Figure 6 compares the apparent [Ne V] and [Ne III] line luminosities of the SHINE sample with those of the published BLAGNs, LRDs, and S2-VO87-selected AGNs. The dashed and dotted lines mark the median and lowest Ne53 values, respectively, among the 20 SHINE galaxies with robust [Ne III] detections. These provide empirical reference points for determining whether the upper limits exclude [Ne V]/[Ne III] ratios observed in the SHINE sample.

As can be seen from Figure 6, most of the BLAGN and LRD upper limits do not reach below the median SHINE ratio. Of 84 published BLAGNs, only 33 (39%) have 3σ limits below the SHINE median, and only 3 (4%) fall below the lowest ratio observed in SHINE. Similarly, 33 of 103 LRDs (32%) have limits below the SHINE median, and only 2 (2%) fall below the lowest SHINE value. For comparison, 23 of 147 (16%) S2-VO87-selected AGNs have limits below the SHINE median, and none falls below the lowest SHINE ratio. Thus, most existing non-detections do not exclude [Ne V]/[Ne III] ratios already observed in the SHINE sample. The available PRISMATIC data therefore do not establish that most BLAGNs or LRDs have weaker [Ne V] relative to [Ne III] than the SHINE galaxies.

For this comparison, we count only the visually vetted and quantitatively validated SHINE galaxies as [Ne V] detections and treat all other PRISM sources as non-detections. As a reminder, the SHINE search systematically inspected sources passing an automated $S/N > 4$ preselection and subsequently applied detailed BADASS fitting. Sources outside the final sample did not all receive the same level of inspection and may therefore include weaker or borderline [Ne V] emission. This analysis tests whether the available upper limits exclude line ratios observed among the secure SHINE detections; it does not measure the incidence of arbitrarily weak [Ne V] emission.

The SHINE sample itself provides direct counterexamples to a universal absence of high-ionization emission in these

populations. Broad Balmer emission coexists with [Ne V] in five SHINE galaxies (Section 4.2), and one SHINE galaxy is classified as an LRD. Thus, BLAGNs and LRDs can produce [Ne V], while the current upper limits are generally insufficient to determine whether most members of these populations have systematically weaker [Ne V]/[Ne III] ratios. Deeper observations are required to establish such a population-level difference.

4.5. X-ray Properties of the [Ne V] Emitters

JWST-selected AGNs, including both broad- and narrow-line systems, are frequently undetected even in deep *Chandra* imaging, and stacking analyses have found X-ray emission below that expected for standard AGN spectral energy distributions (Maiolino et al. 2025; Mazzolari et al. 2025). Here we examine the X-ray properties of the [Ne V]-selected SHINE sample to explore whether a similar X-ray weakness is found.

Of the 25 SHINE-[NeV] galaxies, six have *Chandra* counterparts, 18 are undetected with valid local catalog detection thresholds, and one, NeV-15, lacks a valid local detection-threshold estimate. The fraction of SHINE-[NeV] detections is $6/25 = 24.0\%$, with a 68% Wilson confidence interval of $16.6\% - 33.4\%$. The detections come from the 7 Ms CDF-S, 2 Ms CDF-N, AEGIS-XD, and X-UDS catalogs (Luo et al. 2017; Xue et al. 2016; Nandra et al. 2015; Kocevski et al. 2018). Because these surveys have different depths, this fraction is not a uniform-sensitivity measure of the X-ray detection rate. For the non-detections, we use the local CSC 2.1 catalog detection threshold at each source position; these values are not formal statistical upper limits on the source flux. Details are given in Appendix B.

We find that the X-ray detections are not restricted to galaxies with identified broad Balmer lines. Two of the five sources with an adopted broad-line classification are X-ray detected. Four additional X-ray detections have no adopted broad-line classification. NeV-25 has higher-resolution spectroscopy available that indicates that there is no broad component, whereas the broad-line status of NeV-12, NeV-14, and NeV-19 remains undetermined.

Figure 7 compares the observed-equivalent rest-frame 2–10 keV luminosity with the apparent [Ne V] luminosity. The six X-ray detections in our sample span $L_{2-10}/L_{[\text{NeV}]} = 15.9 - 979.5$. In local Seyferts, Gilli et al. (2010) found that $L_{2-10}/L_{[\text{NeV}]}$ decreases with increasing X-ray obscuration: $L_{2-10}/L_{[\text{NeV}]} \sim 400$ is characteristic of unobscured systems, while sources with $L_{2-10}/L_{[\text{NeV}]} < 15$ were almost exclusively Compton thick. We treat these values as empirical local reference points rather than formal classification boundaries. None of the six detections has $L_{2-10}/L_{[\text{NeV}]} < 15$; NeV-14 has the lowest ratio, $L_{2-10}/L_{[\text{NeV}]} \simeq 15.9$.

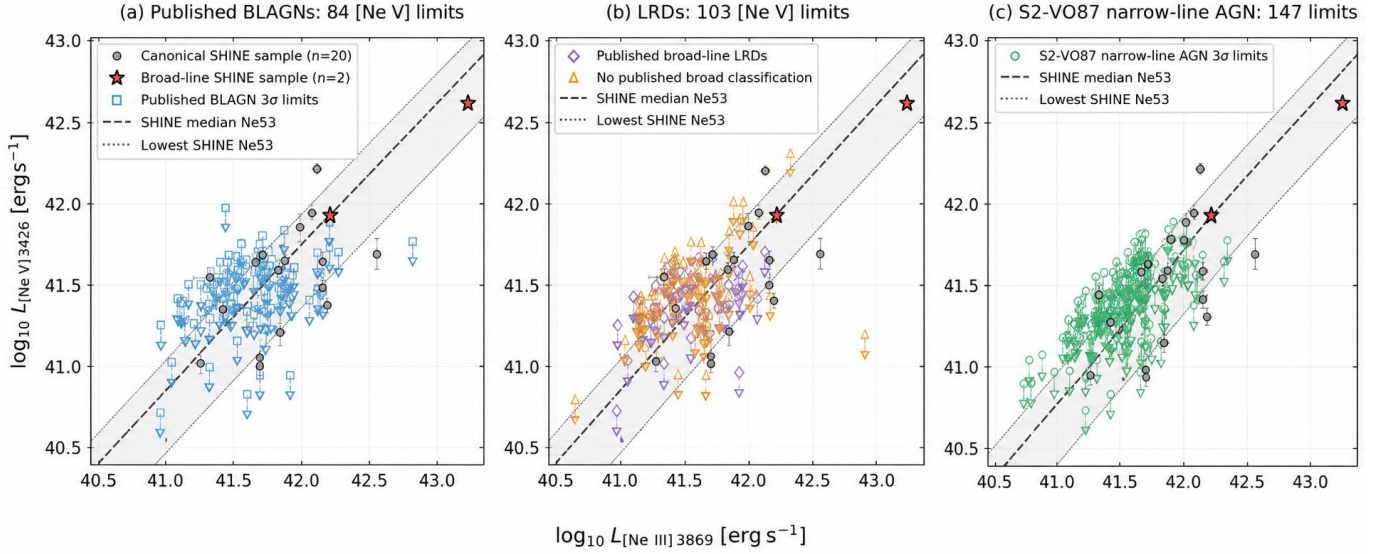


Figure 6. Constraints on the [Ne V] emission relative to the [Ne III] emission in JWST AGN comparison samples. Apparent [Ne V] luminosity versus apparent [Ne III] luminosity for (a) 84 published broad-line AGNs, (b) 103 LRDs, and (c) 147 S2–VO87-selected AGNs with robust [Ne III] detections and finite 3σ [Ne V] upper limits. The 20 SHINE galaxies with robust [Ne III] detections are shown for reference in each panel; stars mark the two broad-line SHINE galaxies that satisfy this requirement. In panel (b), LRDs with and without a published broad-line classification are shown separately. The dashed line marks the median Ne53 ratio of the SHINE sample, and the dotted line marks the lowest observed SHINE ratio. Downward arrows denote 3σ [Ne V] upper limits. Only SHINE galaxies are counted as [Ne V] detections in this comparison; weaker or borderline emission may be present among sources classified here as non-detections. Luminosities are apparent and are not uniformly corrected for extinction or lensing. Class memberships overlap.

Table 4. Secure Chandra Counterparts of the SHINE-[Ne V] Sample

NeV ID	Balmer broad-line status	X-ray catalog	$\Delta\theta$ (")	$\log L_{2-10}$	$\log L_{[\text{Ne V}]}$	$L_{2-10}/L_{[\text{Ne V}]}$
NeV-05 ^a	Broad	X-UDS	0.321	44.840	41.849	979.5
NeV-12	Undetermined	7 Ms CDF-S	0.263	44.190	42.864	21.2
NeV-14	Undetermined	7 Ms CDF-S	0.216	43.060	41.859	15.9
NeV-19	Undetermined	Improved 2 Ms CDF-N	0.101	43.774	41.565	161.9
NeV-21	Broad	AEGIS-XD v4.2	0.113	44.666	42.610	113.7
NeV-25	No broad component required	AEGIS-XD v4.2	0.261	43.813	42.167	44.3

NOTE— $\Delta\theta$ is the angular separation between the NIRSpect source position and the coordinate used to identify the adopted counterpart. For the CDF-S and AEGIS-XD matches, this is the cataloged multiwavelength counterpart position; for the CDF-N and X-UDS matches, it is the X-ray centroid. The luminosities are in units of erg s^{-1} . The listed L_{2-10} values are observed-equivalent rest-frame 2–10 keV luminosities calculated assuming $\Gamma = 1.8$ and are not corrected for intrinsic absorption. The [Ne V] luminosities are the apparent BADASS values adopted in Table 1 and are not uniformly corrected for extinction or gravitational lensing. “Undetermined” means that the available spectroscopy is insufficient to determine the presence or absence of broad Balmer emission. “No broad component required” means that the higher-resolution Balmer-line data did not require a broad component; it is not a uniform upper limit on broad-line width or strength.

^a The X-UDS counterpart is retained as secure, but the corresponding CSC entry carries a confusion flag.

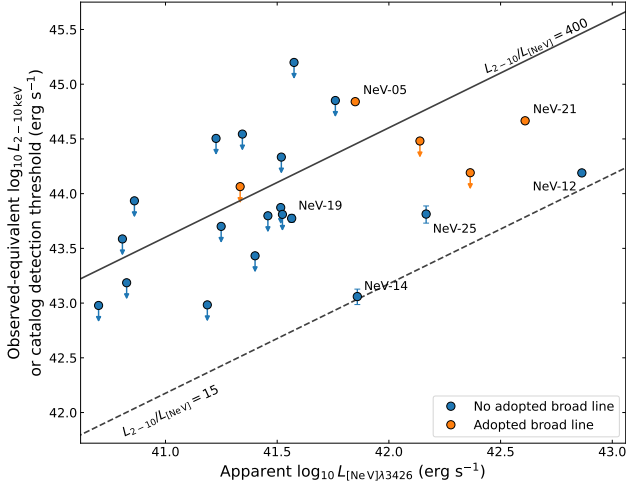


Figure 7. Observed-equivalent rest-frame 2–10 keV luminosity versus apparent [Ne V] $\lambda 3426$ luminosity for the SHINE-[NeV] sample. Blue points have no adopted broad-line classification, while orange points have an adopted broad-line classification; the sources indicated by the blue symbol should not be interpreted as a uniformly confirmed narrow-line population. Vertical error bars show catalog-based statistical uncertainties for the six *Chandra* detections; for several sources, the uncertainties are smaller than the plotted symbols. Downward arrows mark the local CSC 2.1 catalog detection thresholds for 18 nondetections; these thresholds are not formal source-flux upper limits. NeV-15 is not shown because no valid local X-ray detection threshold is available at its position. The solid and dashed lines mark $L_{2-10}/L_{[\text{Ne V}]} = 400$ and 15, respectively. In the local calibration of Gilli et al. (2010), the former is characteristic of unobscured Seyferts, while ratios below the latter are associated predominantly with Compton-thick sources. We show these values as empirical local references rather than classification boundaries. X-ray luminosities assume $\Gamma = 1.8$ and are not corrected for intrinsic absorption.

Valentino et al. (2026) found that all four of their X-ray-detected [Ne V] emitters were broad-line AGNs, whereas the two [Ne V] emitters without broad lines were undetected in X-rays. The SHINE-[NeV] sample shows that X-ray detection is not restricted to broad-line sources. NeV-25 is securely detected at $\log(L_{2-10}/\text{erg s}^{-1}) = 43.81$, although its higher-resolution Balmer-line spectrum does not require a broad component. Three additional X-ray detections, NeV-12, NeV-14, and NeV-19, have no identified broad lines, although their broad-line status remains undetermined. NeV-12 reaches $L_{2-10} > 10^{44} \text{ erg s}^{-1}$, while NeV-19 has $L_{2-10}/L_{[\text{Ne V}]} \simeq 162$.

Thus, the individually detected SHINE-[NeV] sources do not show the pervasive X-ray faintness reported for other JWST-selected broad- and narrow-line AGN samples, in which most sources remain undetected even in deep *Chandra* imaging and in stacked data (Maiolino et al. 2025; Maz-zolari et al. 2025). The SHINE-[NeV] detections instead span both broad-line sources and at least one source, NeV-25,

for which higher-resolution spectroscopy does not require a broad Balmer component.

The 18 SHINE-[NeV] nondetections are less constraining. None of their local catalog detection thresholds reaches $L_{2-10}/L_{[\text{Ne V}]} < 15$, while 10 reach below $L_{2-10}/L_{[\text{Ne V}]} = 400$. We therefore cannot determine whether the nondetected sources include a similarly X-ray-faint population. The X-ray luminosities are not corrected for intrinsic absorption, and the [Ne V] luminosities are not uniformly corrected for extinction or lensing. In addition, the *Chandra* and JWST observations are non-simultaneous, so AGN variability may contribute to the scatter in $L_{2-10}/L_{[\text{Ne V}]}$.

4.6. Rest-frame UV and Optical Continuum Properties

We characterize the rest-frame continuum using the absolute UV magnitude measured near $1600 \text{ \AA}$, the UV continuum slope β , defined by $f_\lambda \propto \lambda^\beta$ over $1350\text{--}3450 \text{ \AA}$, and the catalog Balmer-break strength,

$$B_{\text{Balmer}} = \frac{\langle f_\nu(4150\text{--}4350 \text{ \AA}) \rangle}{\langle f_\nu(3400\text{--}3600 \text{ \AA}) \rangle}. \quad (4)$$

We require a mean continuum signal-to-noise ratio of at least three over the UV fitting interval for M_{UV} and β , and in both continuum windows for B_{Balmer} . These criteria yield reliable M_{UV} and β measurements for 23 of the 25 SHINE-[NeV] galaxies and Balmer-break measurements for 24. The sample spans a broad range of UV luminosity, continuum shape, and Balmer-break strength: $-24.18 \leq M_{\text{UV}} \leq -18.42$, $-2.45 \leq \beta \leq 0.15$, and $0.84 \leq B_{\text{Balmer}} \leq 3.30$, with medians of -20.47 , -1.51 , and 1.22 , respectively. Thus, SHINE-[NeV] includes both UV-faint and UV-luminous galaxies, sources with very blue and comparatively red UV continua, and galaxies with both weak and strong Balmer breaks.

We next ask whether galaxies with prominent [Ne V] emission differ in their UV luminosities, UV slopes, or Balmer-break strengths from galaxies with weaker very-high-ionization emission. A direct comparison with all galaxies lacking a detected [Ne V] line would not provide a meaningful control sample. The spectra come from programs with different depths, and a nondetection may reflect either intrinsically weak [Ne V] emission or insufficient sensitivity. Such a comparison would therefore mix genuinely weak emitters with galaxies in which comparable [Ne V] emission could have remained undetected.

We instead restrict the analysis to galaxies with robust [Ne III] detections and use [Ne V]/[Ne III] as the comparison metric. [Ne III] provides a detected reference line against which the [Ne V] sensitivity can be evaluated for each galaxy. Moreover, [Ne V] $\lambda 3426$ and [Ne III] $\lambda 3869$ are close in wavelength, reducing the effects of differential attenuation and wavelength-dependent flux calibration.

We define strong-ratio sources by

$$\frac{F_{[\text{Ne V}] \lambda 3426}}{F_{[\text{Ne III}] \lambda 3869}} \geq 0.33. \quad (5)$$

The threshold of 0.33 is the lowest measured $[\text{Ne V}]/[\text{Ne III}]$ ratio among BPT-selected AGNs in the local CLASS comparison sample. We use it as an operational, sample-dependent threshold rather than a universal AGN boundary.

The lower-ratio comparison consists of galaxies outside the SHINE-[NeV] sample for which

$$\frac{3\sigma(F_{[\text{Ne V}] \lambda 3426})}{F_{[\text{Ne III}] \lambda 3869}} < 0.33. \quad (6)$$

This criterion requires sufficient sensitivity to detect $[\text{Ne V}]$ at greater than 3σ if the source had a ratio of 0.33. The upper limit determines whether a galaxy enters the comparison; we do not treat it as a measured line ratio. The comparison galaxies are not assumed to be non-AGNs.

Twelve SHINE-[NeV] galaxies satisfy the strong-ratio criterion, eight have measured ratios below 0.33, and five lack robust $[\text{Ne III}]$ measurements. The lower-ratio comparison contains 195 galaxies. After applying the continuum signal-to-noise requirements, the M_{UV} and β comparisons contain 11 strong-ratio and 191 lower-ratio galaxies, while the Balmer-break comparison contains 12 and 190, respectively.

Because the strong-ratio and lower-ratio samples have different redshift distributions, we use a redshift-matched comparison for the statistical analysis. We match each strong-ratio source to the three lower-ratio galaxies closest in redshift within the redshift range shared by the two samples, and compare each continuum property with the mean of the three matched galaxies. We assess whether the matched differences are consistent with zero using a two-sided permutation (randomization) test and adjust the resulting p -values for the three continuum properties tested. Figure 8 shows the full distributions, whereas the statistical results below refer to the redshift-matched comparison.

The strong-ratio and lower-ratio samples have similar UV luminosities. Their full-sample medians are $M_{\text{UV}} = -20.32$ and -20.04 , and the redshift-matched difference is $\Delta M_{\text{UV}} = -0.08$ mag (adjusted $p = 0.62$). In contrast, the strong-ratio sources have redder UV slopes, with median $\beta = -0.89$ compared with -1.83 and a matched difference of $\Delta\beta = 0.63$ (adjusted $p = 0.038$). They also have stronger Balmer breaks: the median ratios are 1.67 and 1.04, and the matched difference is $\Delta \log_{10}(B_{\text{Balmer}}) = 0.183$ dex (adjusted $p = 0.0088$), corresponding to a factor of approximately 1.5.

The redder UV slopes persist when we restrict the lower-ratio comparison to BLAGNs and S2-VO87-selected AGNs, while the Balmer-break difference becomes only suggestive. Because this AGN-restricted comparison is small and the samples remain poorly matched in redshift, we treat it only as a supporting test.

The continuum differences do not uniquely identify their physical origin. Redder UV slopes may reflect dust or differences in the stellar and AGN continua, while stronger Balmer breaks can arise from composite stellar populations rather than a uniformly older population. Similar strong Balmer breaks in high-redshift nitrogen emitters have been interpreted as evidence for young line-emitting regions superposed on older rest-optical stellar populations (Morel et al. 2026). Stellar masses are not available for a sufficiently large fraction of the lower-ratio comparison sample to test whether differences in host stellar mass contribute to these continuum trends.

4.6.1. Low-Stellar-Mass [Ne V] Emitters and the Search for Intermediate-Mass Black Holes

Very-high-ionization emission lines can identify accreting black holes in low-mass galaxies that are missed by standard AGN diagnostics. Hotter accretion disks expected around lower-mass black holes may enhance the high-ionization lines even when optical narrow-line ratios remain consistent with star formation (Cann et al. 2018, 2019). In the local CLASS survey, the highest-ionization coronal lines preferentially occur in lower-mass galaxies, and most coronal-line emitters in dwarf galaxies are not classified as AGNs using conventional optical narrow-line diagnostics (Reefe et al. 2022). Very-high-ionization lines such as $[\text{Ne V}]$ may therefore provide a complementary means of identifying accretion in galaxies where broad-line or standard narrow-line AGN signatures are weak or absent. Stellar-mass estimates are available for 20 of the 25 SHINE-[NeV] galaxies from the SED-fitting products described in the analysis methods. These estimates span $7.39 \leq \log(M_*/M_\odot) \leq 11.09$, with a median of $\log(M_*/M_\odot) = 9.29$. Six sources have $\log(M_*/M_\odot) < 9$, including one with $\log(M_*/M_\odot) < 8$. The SHINE-[NeV] sample therefore extends into the low-stellar-mass galaxy population.

GN 42437 illustrates how high-ionization emission lines can reveal accretion activity in low-mass hosts that traditional diagnostics miss. This compact galaxy at $z = 5.587$ has a reported stellar mass of $\log(M_*/M_\odot) = 7.9 \pm 0.2$ and a significant narrow $[\text{Ne V}]$ detection (Chisholm et al. 2024). Higher-resolution Balmer profiles show no broad component, while conventional narrow-line optical diagnostic diagrams place the source in the star-forming region. Through photoionization modeling of the line ratios, Chisholm et al. (2024) showed that pure stellar ionization fails to reproduce the observed spectrum, pointing instead to an accreting intermediate-mass black hole. NeV-11 provides the closest SHINE-[NeV] comparison in stellar mass. It lies at $z = 5.939$ and has a current stellar-mass estimate of $\log(M_*/M_\odot) = 7.39^{+0.04}_{-0.03}$, 0.51 dex below the published value for GN 42437. Its apparent $[\text{Ne V}]$ luminosity, $\log(L[\text{Ne V}]/\text{erg s}^{-1}) = 40.81$, differs from that of GN 42437

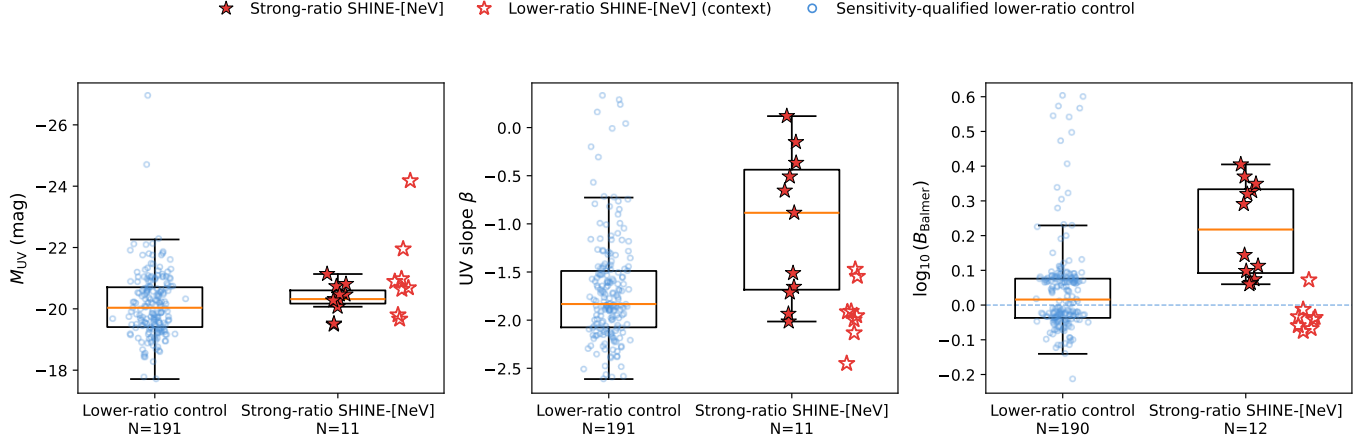


Figure 8. Rest-frame continuum properties of the strong [Ne V]/[Ne III] subsample and the lower-ratio comparison sample. Filled red stars show strong-ratio SHINE-[NeV] galaxies, open red stars show SHINE-[NeV] galaxies with measured ratios below 0.33, and open blue circles show the lower-ratio comparison. Box plots summarize the full distributions; statistical results in the text use the redshift-matched comparison. The dashed line in the right panel marks $B_{\text{Balmer}} = 1$.

by only 0.11 dex. Inspection of the medium- and high-resolution NIRSpect spectra reveal no broad component in either the $H\alpha$ or $H\beta$ profiles. NeV-11 also lies below the adopted S2–VO87 AGN boundary. Thus, [Ne V] identifies highly ionized gas in a low-stellar-mass galaxy that evades AGN classification via both broad Balmer emission and our adopted narrow-line diagnostics. We note also that the mass of NeV-11 is probably fairly uncertain, since it shows a peculiar spectrum with a strong contribution from nebular continuum emission (see Katz et al. 2025). This galaxy, identified previously as GS-NDG-9422 by Cameron et al. (2024), may be dominated by a very young population with a top-heavy IMF (Cameron et al. 2024; Katz et al. 2025), who estimate a lower limit of $\log(M_*/M_\odot) \sim 6.2–6.6$. The quoted uncertainty from our SED fits is only formal, and the fits do not allow for IMF deviations. In any case, even if stellar masses for individual objects can be fairly uncertain, the relative ranking of all NeV emitters in $M_*/M_\odot$ should be meaningful, at least on average. UV faintness does not provide an equivalent proxy for low stellar mass. NeV-09 is the UV-faintest SHINE-[NeV] source, with $M_{\text{UV}} = -18.42$, and has an apparent [Ne V] luminosity comparable to GN 42437. Its current stellar-mass estimate is $\log(M_*/M_\odot) = 9.34$, more than an order of magnitude larger than the published stellar mass of GN 42437. We therefore use stellar mass, rather than M_{UV} , to identify possible low-mass analogs of GN 42437. Figure 9 shows apparent [Ne V] luminosity as a function of stellar mass for the 20 SHINE-[NeV] galaxies with available stellar-mass estimates. NeV-11 lies close to GN 42437 in this plane, while the SHINE-[NeV] sample spans nearly four orders of magnitude in stellar mass. These measurements establish that SHINE-[NeV] includes [Ne V] emitters with very low inferred stellar masses. They do not establish that NeV-11 or any other SHINE-[NeV] source hosts an intermediate-

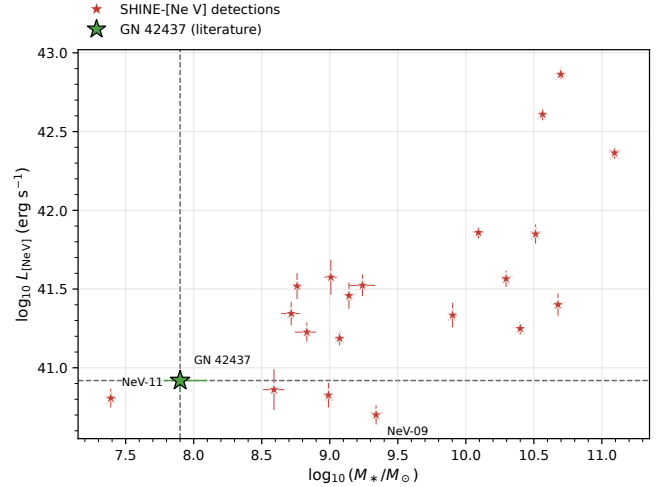


Figure 9. Apparent [Ne V] luminosity as a function of stellar mass for the 20 SHINE-[NeV] galaxies with available stellar-mass estimates. Red stars show the SHINE-[NeV] sources using the validated integrated BADASS [Ne V] luminosities, and the green star shows GN 42437 using its published stellar mass and apparent [Ne V] luminosity (Chisholm et al. 2024). Dashed lines mark the GN 42437 stellar mass and [Ne V] luminosity. Horizontal error bars show the 16th–84th percentile intervals from the current SED fits and do not include systematic modeling uncertainties; vertical error bars show the statistical [Ne V] luminosity uncertainties. SHINE-[NeV] luminosities are apparent values.

mass black hole. No direct black-hole mass measurements are available, and any black-hole mass inferred from [Ne V] depends on assumptions about the ionizing spectral energy distribution, bolometric correction, and accretion rate. Stellar masses are also available for only 20 of the 25 SHINE-[NeV] galaxies and not for a uniformly selected parent sample. We therefore do not infer either the incidence of [Ne V] emission

in low-mass galaxies or the frequency of intermediate-mass black holes from the present sample.

4.7. Incidence and Redshift Dependence of [Ne V] Emission

To compare the [Ne V] emitters with the underlying galaxy population and provide a first estimate of their relative incidence, we used the full unique-galaxy PRISMATIC parent catalog described in Section 2. We restricted the denominator to sources at $z \geq 3$ for which [Ne V] $\lambda 3426$ falls within the adopted PRISM wavelength range and for which the catalog provides a finite, positive line-flux uncertainty. This yields 8980 galaxies included in the [Ne V] incidence calculation. The resulting fraction of [Ne V] emitters as a function of redshift is shown in the left panel of Figure 10. Error bars throughout this section show 68% Wilson score confidence intervals.

The observed [Ne V] fraction displays no systematic trend with redshift and remains consistent with a constant value within uncertainties. At $3 \leq z < 5$, we identify 19 [Ne V] emitters among 5873 galaxies in the parent sample (0.324%), compared with $6/3107 = 0.193\%$ at $z \geq 5$. Although the value of the fraction is lower in the higher-redshift subsample, the difference is not statistically significant according to Fisher’s exact test ($p = 0.30$). We therefore find evidence for neither an increase nor a decrease in the observed incidence of [Ne V] emission.

For comparison, the left panel of Figure 10 also shows the increasing N-emitter fraction reported by Morel et al. (2026) and the increasing LRD fraction at $M_{UV} = -20$ derived by Tanaka et al. (2025). Unlike these populations, the [Ne V] emitters show no evidence for a similarly pronounced increase toward high redshift. However, these curves have different operational definitions: the N-emitter fraction is measured relative to the available PRISM galaxy population, whereas the LRD fraction is derived from the ratio of the LRD and total-galaxy luminosity functions at fixed UV magnitude. The comparison is therefore qualitative.

The raw [Ne V] fraction is not measured above a common line-flux or luminosity threshold, and its redshift dependence may be affected by variations in spectral depth and line sensitivity. We therefore repeated the calculation above using the median apparent [Ne V] luminosity of the emitter sample, $\log_{10}(L_{\text{thr}}/\text{erg s}^{-1}) = 41.52$, restricting the denominator to spectra capable of detecting a line at that luminosity. The numerator includes the 13 [Ne V] emitters with $L_{[\text{Ne V}]} \geq L_{\text{thr}}$. The denominator includes all 25 [Ne V] emitters, whose line luminosities are measured, together with nonemitters whose catalog 4σ [Ne V] luminosity limit is at or below L_{thr} . Because the number of emitters above the threshold is small, we show this luminosity-thresholded fraction in three broad redshift intervals in the right panel of Figure 10. The fractions are $11/2100 = 0.524\%$ at $3 \leq z < 5$, $1/633 = 0.158\%$

at $5 \leq z < 7$, and $1/161 = 0.621\%$ at $7 \leq z < 15$. Combining the two higher-redshift bins gives $2/794 = 0.252\%$, compared with $11/2100 = 0.524\%$ at $3 \leq z < 5$; this difference is also not statistically significant ($p = 0.53$). Restricting the denominator to sufficiently sensitive spectra reduces the influence of nonuniform line-detection limits, but does not provide a full completeness correction.

To examine whether the absence of an increasing [Ne V] fraction could simply reflect a general decline in the detectability of rest-optical emission lines, we also measured the fraction of galaxies with robust [Ne III] $\lambda 3869$ emission (Figure 17). The [Ne III] line lies close in wavelength to [Ne V] $\lambda 3426$ and is therefore affected by broadly similar wavelength-dependent PRISM coverage and sensitivity, although its intrinsic strength and astrophysical origin differ. We define robust [Ne III] emitters as sources with $F_{[\text{Ne III}]} / \sigma_{F_{[\text{Ne III}]}} > 4$. Their fraction increases from $783/5871 = 13.3\%$ at $3 \leq z < 5$ to $762/3097 = 24.6\%$ at $z \geq 5$. Thus, the absence of a corresponding increase in the [Ne V] fraction is not accompanied by a general decline in the detection of this nearby rest-optical line.

We also calculated the fraction of robust [Ne III] emitters that are [Ne V] emitters. This conditional fraction decreases from $13/783 = 1.66\%$ at $3 \leq z < 5$ to $6/762 = 0.79\%$ at $z \geq 5$, although the difference is not statistically significant ($p = 0.17$). This calculation includes 19 of the 25 SHINE-[Ne V] galaxies because six do not satisfy the adopted robust [Ne III] criterion. The plotted quantity is a conditional population fraction rather than the source-level [Ne V]/[Ne III] line ratio. These [Ne III] calculations are treated as selection diagnostics rather than direct measurements of intrinsic evolution. The raw [Ne III] fraction is not defined above a common line-flux, luminosity, or equivalent-width threshold and may therefore reflect both astrophysical evolution and changes in survey targeting and sensitivity. Moreover, because the [Ne III]-selected population itself evolves with redshift, the conditional [Ne V] fraction does not provide a fixed parent population against which to measure AGN evolution.

Taken together, the raw and luminosity-thresholded calculations provide no statistically significant evidence for either an increase or a decrease in the observed incidence of [Ne V] emission with redshift. The data therefore do not show the pronounced rise reported for N-emitters and LRDs, although differences in selection and denominator definitions limit the comparison to a qualitative one. The increasing robust [Ne III] fraction further indicates that the absence of an [Ne V] increase is not simply associated with a general decline in nearby rest-optical line detections. Nevertheless, the current sample size and heterogeneous PRISM sensitivity remain insufficient to determine whether the intrinsic incidence of [Ne V]-selected AGN evolves over this redshift range.

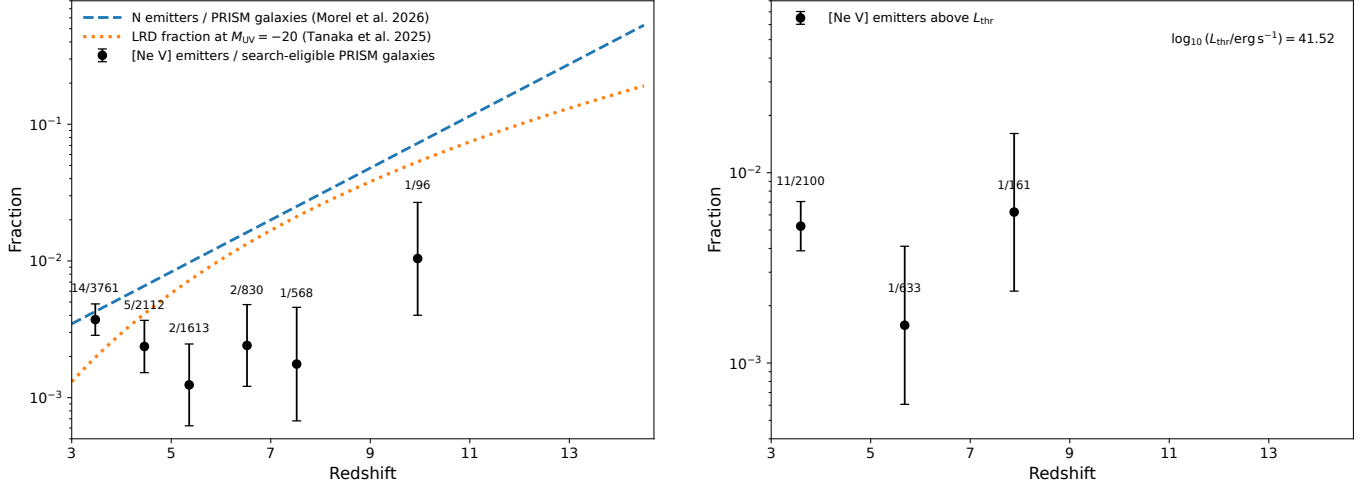


Figure 10. Observed [Ne V] fractions as a function of redshift. *Left:* black points show the number of visually validated and BADASS-confirmed [Ne V] emitters divided by the number of unique search-eligible NIRSpect/PRISM galaxies in each redshift bin. The dashed curve shows the N-emitter fraction among PRISM galaxies reported by Morel et al. (2026), and the dotted curve shows the LRD fraction at fixed $M_{\text{UV}} = -20$ from Tanaka et al. (2025). *Right:* black points show the fraction of [Ne V] emitters above the median apparent [Ne V] luminosity threshold, $\log_{10}(L_{\text{thr}}/\text{erg s}^{-1}) = 41.52$, restricting the denominator to unique NIRSpect/PRISM galaxies capable of detecting a line at that luminosity. The numerator is the number of [Ne V] emitters with $L_{[\text{Ne V}]} \geq L_{\text{thr}}$. The denominator includes all [Ne V] emitters, whose line luminosities are measured, and nonemitters whose catalog 4σ luminosity limit is at or below L_{thr} . Because fewer emitters lie above the threshold, the right panel uses three broader redshift bins: $3 \leq z < 5$, $5 \leq z < 7$, and $7 \leq z < 15$. In both panels, vertical error bars show 68% Wilson score confidence intervals, and labels give the exact numerator and denominator. The N-emitter and LRD curves have different operational definitions and are shown for qualitative comparison. Apparent luminosities are computed using the adopted cosmology and are not corrected for lensing. The left panel traces the observed archive fraction and is not defined above a common luminosity threshold. The right panel repeats the calculation above a fixed luminosity threshold using only sufficiently sensitive spectra, but is not a completeness-corrected measurement of the intrinsic incidence.

5. DISCUSSION

The systematic detection of [Ne V] in 25 galaxies at $3.06 < z < 9.44$ provides a view of high-redshift black-hole accretion complementary to the broad-line, narrow-line, X-ray, and photometric AGN populations that have been the focus of many recent JWST studies. The SHINE-[NeV] galaxies do not define a homogeneous class of AGN: they span a broad range of spectroscopic, continuum, X-ray, stellar-mass, and morphological properties. All show luminous [Ne V] emission, which requires photons with energies above 97.1 eV. Although [Ne V] $\lambda 3426$ has a high critical density for an optical forbidden line, $n_{\text{crit}} \simeq 1.8 \times 10^7 \text{ cm}^{-3}$ at $T_e = 1.5 \times 10^4 \text{ K}$ (Holden & Tadhunter 2023), this density is well below the $n_{\text{H}} \gtrsim 10^9\text{--}10^{10} \text{ cm}^{-3}$ characteristic of the classical broad-line region, where forbidden emission is collisionally suppressed (e.g., Peterson 2006; Netzer 2013). Detectable [Ne V] therefore requires the hard ionizing radiation to reach lower-density gas outside the classical broad-line region. This emission may arise in a coronal-line region or the inner narrow-line region.

In the following sections, we discuss the implications of this population for AGN selection at high redshift, the origin and escape of the hard ionizing radiation field, the connection between high-ionization emission and the host-galaxy con-

tinuum, and the incidence of luminous [Ne V] emission over the redshift range probed by the current NIRSpect archive.

5.1. [Ne V] as a Complementary View of the High-redshift AGN Population

The location of the SHINE-[NeV] galaxies on the S2–VO87 diagram depends strongly on the adopted AGN boundary. Among sources that can be securely classified relative to the Kewley et al. (2001) maximal-starburst relation, 67% lie above it. However, 32% of galaxies with constraining [Ne V] nondetections and high-significance measurements of all four S2–VO87 lines also lie above this relation, showing that this region is not restricted to [Ne V] emitters. In contrast, only 14% of the securely classifiable SHINE-[NeV] galaxies lie above the more conservative high-redshift boundary of Scholtz et al. (2025). This low fraction should not be interpreted as evidence against AGN activity in the remaining sources. Scholtz et al. (2025) designed this boundary as a conservative AGN selection and themselves use high-ionization lines, including [Ne V], to identify AGN that are not cleanly separated by conventional optical diagnostics. Sources below the Scholtz et al. boundary therefore cannot be classified as non-AGN on the basis of S2–VO87 alone.

The SHINE-[NeV] sample also spans different broad-line classifications. Five of the 25 galaxies have an adopted

broad-line classification. For the remaining sources, no broad-line classification is adopted; some higher-resolution spectra do not require a component associated with the broad-line region, while other sources remain unassessable with the available data. The coexistence of broad Balmer emission and [Ne V] in several galaxies shows that a visible broad-line region and luminous forbidden high-ionization emission can occur simultaneously. Most SHINE-[NeV] galaxies, however, do not have an adopted broad-line classification. Broad-line and [Ne V] selection therefore identify overlapping but non-identical populations.

The diversity of the SHINE-[NeV] sample is also apparent in the NIRC*am* imaging. Only one source is identified as an LRD in our adopted literature compilation, while the images span compact, extended, elongated, structured, and apparently multi-component systems. We have not performed a quantitative morphological analysis, and projected companions cannot be assumed to lie at the same redshift. The available imaging nevertheless shows that luminous [Ne V] emission is not restricted to a single obvious host-galaxy morphology. This contrasts with several JWST-selected AGN populations initially identified in part through compact morphologies or unusual continuum colors (Matthee et al. 2024; Greene et al. 2024; Kocevski et al. 2025).

The complementarity of [Ne V] selection should not be confused with completeness. In the local Universe, the CLASS survey searched nearly one million SDSS galaxy spectra without an initial AGN preselection and detected at least one optical coronal line in only $\sim 0.03\%$ of the sample (Reefe et al. 2022). Among dwarf-galaxy coronal-line emitters, $\sim 80\%$ lacked optical narrow-line ratios indicative of nuclear activity (Reefe et al. 2022). Thus, coronal-line selection can identify systems missed by standard optical narrow-line criteria, but detectable coronal-line emission itself represents a rare subset of the galaxy population.

Photoionization calculations provide a natural physical explanation for at least part of this rarity. In particular, McKaig et al. (2024) demonstrated that dust strongly suppresses optical coronal-line emission via two mechanisms: refractory element depletion onto grains and direct absorption of the ionizing continuum. The latter mechanism affects non-refractory species like neon by absorbing ionizing photons before they can photoionize the gas that powers [Ne V]. Strong coronal-line emission therefore depends not only on the presence of an AGN and a sufficiently hard ionizing continuum, but also on the dust content, density, ionization parameter, and geometrical distribution of the gas (e.g., Ferguson et al. 1997; Cann et al. 2018; McKaig et al. 2024). Recent photoionization calculations further predict that [Ne V] can become stronger toward lower metallicity as the declining dust-to-gas ratio increases fraction of ionizing photons available to ionize the gas (Matzko et al., submitted).

The SHINE-[NeV] sample should therefore not be interpreted as a complete census of high-redshift AGN. Instead, it selects systems in which a sufficiently hard radiation field is both produced and able to illuminate gas under conditions favorable for [Ne V] emission. This distinction is important when comparing the incidence of [Ne V] with the incidence of AGN selected using broad lines, X-rays, or other diagnostics. An AGN can be present without a detectable coronal-line region, and differences in [Ne V] incidence may reflect differences in circumnuclear gas and radiative transfer as well as differences in the underlying black-hole population.

The presence of [Ne V] alone does not uniquely identify the ionizing source, since sufficiently extreme stellar populations, accreting stellar remnants, and fast radiative shocks can in principle produce photons at these energies (e.g., Shirazi & Brinchmann 2012; Izotov et al. 2012; Olivier et al. 2022; Garofali et al. 2024). However, the hard-ionization line ratios in the SHINE-[NeV] sample are difficult to reproduce with ordinary stellar photoionization. The photoionization calculations of Cleri et al. (2023d) predict negligible [Ne V] from normal stellar populations using BPASS, with $\log([\text{Ne V}]/[\text{Ne III}]) \sim -5$ across a broad range of metallicity and ionization parameter, far below the ratios measured for the SHINE-[NeV] galaxies. The He II/H β measurements provide complementary evidence for a hard ionizing spectrum relative to the stellar-photoionization reference of Shirazi & Brinchmann (2012), although the available upper limits prevent this diagnostic from classifying every source.

The local metal-poor [Ne V] emitters illustrate a second limitation of the diagnostic. These galaxies generally have much lower [Ne V] luminosities and substantially lower [Ne V]/[Ne III] ratios than the SHINE-[NeV] sample. However, the physical origin of their hard ionizing radiation remains uncertain in several cases, and contributions from shocks, compact accreting sources, or unusually hard stellar populations have been considered (Izotov et al. 2004; Thuan & Izotov 2005; Izotov et al. 2012, 2021; Berg et al. 2021). Recent mid-infrared observations of the extremely metal-poor galaxy I Zw 18 provide a particularly useful reminder that Ne⁴⁺ can be produced in a star-forming galaxy without an established massive AGN, with spatially extended [Ne V] emission detected on galactic scales (Arroyo-Polonio et al. 2025; Hunt et al. 2025). The mechanism responsible for such hard ionizing radiation, however, is not necessarily ordinary stellar photoionization. More generally, the origin of the hard radiation in local metal-poor [Ne V] emitters remains uncertain in several cases, with unusually hard stellar populations, X-ray binaries or ultraluminous X-ray sources, shocks, and accreting intermediate-mass black holes all having been considered (Izotov et al. 2004; Thuan & Izotov 2005; Izotov et al. 2012, 2021; Berg et al. 2021; Garofali et al. 2024;

Mingozzi et al. 2025; Hunt et al. 2025). The local metal-poor sample therefore provides an important comparison with systems lacking an established classical AGN, but it should not be interpreted as a control sample in which [Ne V] is known to be powered solely by normal massive stars.

The absolute luminosity scale of the [Ne V] emission provides an important additional constraint. Known stellar-remnant and shock-powered nebulae producing optical [Ne V] are orders of magnitude fainter than the SHINE-[NeV] galaxies. For example, the entire shock-excited LMC supernova remnant N49 radiates only $1.2 \times 10^{36} \text{ erg s}^{-1}$ in [Ne V] $\lambda 3426$ (Rakowski et al. 2007), while the [Ne V]-emitting nebula surrounding the ultraluminous X-ray source NGC 5408 X-1 has $L_{[\text{Ne V}]} \simeq 10^{36} \text{ erg s}^{-1}$ (Kaaret & Corbel 2009). Even the faintest SHINE-[NeV] source is therefore more than four orders of magnitude more luminous in the same transition. The local metal-poor [Ne V] emitters considered here are likewise substantially less luminous than SHINE-[NeV]. Their luminosities lie below the regime that can be probed for most galaxies in the current high-redshift NIRSpc archive. Our survey is consequently only sensitive to a luminous [Ne V] population and cannot determine the abundance of much fainter [Ne V] emitters analogous to the local metal-poor systems.

Fast radiative shocks provide another possible origin for high-ionization emission. Published shock+precursor calculations can reproduce some of the observed high-ionization line ratios (e.g., Allen et al. 2008; Izotov et al. 2012; Flury et al. 2025). However, agreement in line-ratios does not by itself demonstrate that shocks can supply the observed absolute line luminosities. As an order-of-magnitude energetic check, we normalized the public MAPPINGS V shock+precursor grids of Flury et al. (2025) to the kinetic-energy flux through the shock. Even the most [Ne V]-efficient model across the full grid converts only $\simeq 2 \times 10^{-3}$ of the incoming shock power into [Ne V] $\lambda 3426$. The median SHINE-[NeV] luminosity would therefore require $\gtrsim 1.6 \times 10^{44} \text{ erg s}^{-1}$ in radiative shocks even under this deliberately [Ne V]-efficient model, rising to $\sim 5 \times 10^{44} \text{ erg s}^{-1}$ for the 300–500 km s^{-1} shock velocities commonly invoked for [Ne V]-emitting star-forming systems. At the luminous end of the SHINE-[NeV] sample, the corresponding requirements rise to $\gtrsim 3.5 \times 10^{45}$ and $\sim 10^{46} \text{ erg s}^{-1}$, respectively.

For comparison, stellar-population models predict a mechanical energy injection from supernovae and stellar winds of order $6.5 \times 10^{41} \text{ erg s}^{-1}$ per $M_{\odot} \text{ yr}^{-1}$ of continuous star formation (Leitherer et al. 1999; Strickland & Heckman 2009). Even if this mechanical power were converted into radiative shocks with 100% efficiency, the shock powers required at the luminous end of SHINE-[NeV] would correspond to star-formation rates of $\sim 5 \times 10^3$ – $1.5 \times 10^4 M_{\odot} \text{ yr}^{-1}$. As an empirical benchmark, the exceptionally powerful $\sim$

300 $M_{\odot} \text{ yr}^{-1}$ compact starburst Makani has an asymptotic stellar mechanical power of only $\sim 8 \times 10^{43} \text{ erg s}^{-1}$ based on Starburst99 (Rupke et al. 2023), approximately 40–125 times below the shock power required for the most luminous SHINE-[NeV] sources. These estimates are conservative because the [Ne V] luminosities are not corrected for internal extinction. Thus, while shocks or stellar-remnant accretion may contribute in individual systems, reproducing the characteristic SHINE-[NeV] luminosities without massive-black-hole accretion requires increasingly extreme energetic conditions.

The selection based on [Ne V] may nevertheless be particularly useful at the low-mass end of the high-redshift galaxy population. Accretion disks around lower-mass black holes are expected, under standard thin-disk assumptions, to peak at higher energies and can produce enhanced high-ionization emission (Cann et al. 2018, 2019). GN 42437 provides an important example: high-resolution JWST spectroscopy revealed strong [Ne V] in a compact galaxy with $\log(M_{*}/M_{\odot}) \simeq 7.9$, despite narrow Balmer lines and rest-optical diagnostic ratios that would not by themselves have identified the source as an AGN (Chisholm et al. 2024).

NeV-11 provides a particularly interesting comparison. This source, previously studied as GS-NDG-9422 (JADES 1210_13176), has an inferred stellar mass of only $\log(M_{*}/M_{\odot}) = 7.39$. Detailed analyses of its unusually nebular-dominated spectrum have previously favored a stellar origin for its ionizing radiation. Cameron et al. (2024) showed that, when considering the ensemble of UV and optical emission-line ratios, the source is consistent with ionization by a young, metal-poor stellar population and found no strong evidence that an AGN is required. Some individual diagnostics are more ambiguous, however: the source lies near or overlaps the star-forming/AGN transition in parts of diagnostic space and had previously been included in a narrow-line AGN selection based on its He II/H β ratio (Cameron et al. 2024; Scholtz et al. 2025). Katz et al. (2025) subsequently showed that its continuum can be dominated by nebular emission, with hot, massive stars providing a plausible explanation, and described the existing nebular diagnostics as consistent with a source that is not AGN dominated, or at most composite.

The secure [Ne V] detection reported here adds a qualitatively different constraint on the ionizing spectrum of this galaxy. NeV-11 has $\log(L_{[\text{Ne V}]} / \text{erg s}^{-1}) = 40.81$, demonstrating the presence of a substantial radiation field above the 97.1 eV ionization threshold in a remarkably low-mass host. Its available higher-resolution Balmer spectra do not require an adopted broad component, and the source lies below the S2–VO87 AGN boundary. The combination of luminous [Ne V] emission with otherwise largely star-forming-like nebular diagnostics illustrates why high-ionization selec-

tion can provide information that is missed by conventional diagnostic diagrams.

We caution, however, against associating the low stellar mass of the host directly with a low black-hole mass. Indeed, [Trakhtenbrot et al. \(2025\)](#) argued that the similarly luminous [Ne V] emission in GN 42437 implies a luminous AGN and, under an Eddington-limited interpretation of an empirical $L_{[\text{Ne V}]}-L_{\text{bol}}$ relation, a black-hole mass well above the conventional intermediate-mass regime. Even strongly super-Eddington accretion substantially weakens, but does not remove, this constraint. The applicability of locally calibrated [Ne V]-to-bolometric luminosity relations to low-metallicity galaxies at high redshift remains uncertain, and we do not use such a scaling to estimate a black-hole mass for NeV-11 here. The present data therefore establish that very luminous high-ionization emission can occur in an exceptionally low-mass galaxy, but they do not establish that NeV-11 hosts an intermediate-mass black hole or distinguish among black-hole seeding scenarios.

5.2. The Production and Escape of Hard Ionizing Radiation in JWST AGNs

A growing number of JWST studies have found that many high-redshift broad-line AGN and LRDs differ substantially from classical low-redshift Type 1 AGN. In addition to their unusual continuum properties, many show weak X-ray emission and weak or absent high-ionization UV lines ([Maiolino et al. 2025](#); [Zucchi et al. 2026](#); [Lambrides et al. 2026](#)). These observations have motivated several related explanations. One possibility is that high accretion rates produce an intrinsically softer ionizing spectral energy distribution, with a weak corona and a reduced relative number of EUV and X-ray photons ([Pacucci & Narayan 2024](#); [Lambrides et al. 2026](#)). Alternatively, dense gas with a large covering factor may absorb or reprocess the ionizing continuum before it reaches the line-emitting gas ([Rusakov et al. 2026](#)). A third possibility is that the radiation field is strongly anisotropic, so that different regions surrounding the black hole are exposed to very different ionizing spectra ([Madau 2026](#)). These possibilities are not mutually exclusive.

The [Ne V] detections provide a useful additional constraint because they probe a different physical component from many of the high-ionization lines reported thus far in broad-line AGN studies. C IV and N V are permitted resonance transitions, while He II is a recombination line. They can therefore remain strong in gas at densities at which forbidden transitions are collisionally suppressed. In contrast, [Ne V] $\lambda 3426$ requires both photons above the 97.1 eV ionization threshold and gas with densities low enough for the forbidden transition to be emitted efficiently. A detection of [Ne V] thus demonstrates that very hard radiation has reached a lower-density coronal or narrow-line gas phase; it does

not simply demonstrate that hard photons are present within the broad-line region ([Gilli et al. 2010](#); [Cann et al. 2018](#); [Chisholm et al. 2024](#)).

This distinction is important when considering recent claims for weak high-ionization emission in JWST broad-line AGN. [Zucchi et al. \(2026\)](#) find a marked deficit of several high-ionization emission lines in their high-redshift Type 1 AGN sample and show that standard sub-Eddington SEDs have difficulty reproducing the observed line spectrum. [Lambrides et al. \(2026\)](#) similarly find no X-ray detections and weak high-ionization UV emission in their selected sample of broad-line AGN and argue that accretion near or above the Eddington limit can naturally soften the ionizing SED. These results provide strong evidence that such conditions occur in at least some JWST AGN. They do not, however, require that all high-redshift broad-line AGN lack photons capable of producing [Ne V].

Indeed, five SHINE-[NeV] galaxies have broad Balmer emission while also showing secure [Ne V] detections. These galaxies demonstrate directly that broad-line emission and the escape of radiation above 97 eV to a lower-density gas phase can coexist. The comparison with the larger BLAGN and LRD samples is also instructive. Although [Ne V] is generally not detected in those samples, most of the available limits are not sufficiently deep to exclude line ratios typical of SHINE-[NeV]. Only 6 of 84 BLAGN [Ne V] upper limits and 4 of 103 LRD upper limits fall below the lower quartile of the SHINE-[NeV] Ne53 distribution. The current data therefore do not establish that BLAGN or LRDs as populations have systematically weaker [Ne V] relative to [Ne III].

This sensitivity issue is important in interpreting the emerging high-ionization-line literature. For example, [Tang et al. \(2025\)](#) identified narrow high-ionization emission in only a small fraction of LRDs, but also emphasized that many individual spectra do not provide stringent constraints on intrinsically weak lines. The presence of narrow high-ionization emission in some LRDs led Tang et al. to suggest that dense neutral gas may not cover the central source uniformly. Our results extend this argument specifically to the much higher ionization potential traced by [Ne V]. The SHINE-[NeV] detections are difficult to reconcile with a universal geometry in which an optically thick envelope completely encloses the ionizing source and prevents EUV photons from reaching lower-density gas in all directions. They are fully consistent, however, with clumpy or partially covering gas in which hard photons escape along some sightlines.

A similar conclusion follows from models in which super-Eddington accretion produces a geometrically thick accretion flow. Super-Eddington accretion need not imply that the ionizing spectrum is soft in every direction. Thick-disk models can produce strong shadowing in equatorial directions while collimating radiation through a polar funnel ([Madau 2026](#)).

In such a configuration, the broad-line region could receive a softer or filtered radiation field while gas along less obscured directions is exposed to a much harder continuum. Weak broad C IV or He II emission and detectable narrow [Ne V] are therefore not necessarily contradictory. The SHINE-[NeV] sample does not rule out super-Eddington accretion; rather, it argues against treating a globally soft, isotropic ionizing spectrum as a universal description of the high-redshift AGN population.

The X-ray properties reinforce this picture of diversity. Six of the 25 SHINE-[NeV] galaxies have secure Chandra counterparts. Their observed-equivalent rest-frame 2–10 keV luminosities span a wide range relative to their [Ne V] luminosities, and none of the secure detections falls clearly below the empirical $L_X/L_{[\text{Ne V}]} = 15$ reference associated with the most heavily obscured systems in the local calibration of Gilli et al. (2010). Thus, at least some luminous high-redshift [Ne V] emitters are not extremely X-ray faint relative to their coronal-line emission. This is consistent with the existence of X-ray-bright exceptions among other JWST AGN samples and with the luminous [Ne V]-detected systems reported by Valentino et al. (2026).

The absence of an X-ray counterpart for the remaining SHINE-[NeV] galaxies cannot be interpreted in the same way. The available constraints are heterogeneous, and for 18 galaxies the adopted values are local catalog source-detection thresholds rather than formal source-flux upper limits. None reaches below the local $L_X/L_{[\text{Ne V}]} = 15$ reference. We therefore cannot determine from the current data what fraction of the SHINE-[NeV] population is intrinsically X-ray weak or Compton thick. This distinction is especially relevant in light of recent stacking results. Maiolino et al. (2025) find widespread X-ray weakness among both broad- and narrow-line JWST AGN, while Comastri et al. (2026) report a hard-band stacked signal for Type 2 sources consistent with heavy obscuration but no corresponding detection for the Type 1 sample. The mechanisms responsible for X-ray faintness may therefore not be identical in every spectroscopic class.

These observations suggest that the emerging JWST AGN population cannot be described by a single ionizing SED or circumnuclear geometry. Some sources may be characterized by intrinsically soft ionizing continua associated with high accretion rates, some may be obscured by high-column-density gas, and some may permit hard radiation to escape anisotropically through a clumpy or funnel-like structure. The SHINE-[NeV] sample selects systems in which, regardless of the underlying accretion state or geometry, hard EUV radiation has reached lower-density gas capable of producing [Ne V]. Because the sample is selected on the presence of [Ne V], it cannot establish how common this state is among all AGN. It does establish that complete suppression of es-

caping hard ionizing radiation is not a universal property of high-redshift AGN, including broad-line systems.

5.3. Strong High-ionization Emission and the Continuum State of the Host

A second unexpected result of this work is the connection between the relative strength of [Ne V] and the continuum properties of the host. The strong [Ne V]/[Ne III] sources do not differ significantly in M_{UV} from the sensitivity-qualified lower-ratio comparison sample. They do, however, have redder UV slopes and stronger measured Balmer breaks. In the redshift-matched comparison, the differences are $\Delta\beta = 0.63$ and $\Delta\log_{10}(B_{\text{Balmer}}) = 0.183$ dex, corresponding to a Balmer break approximately 1.5 times stronger on average. The association is therefore with continuum shape rather than simply with UV luminosity.

Several aspects of the analysis argue against this trend being produced by a simple [Ne V] detectability bias. First, [Ne V] $\lambda 3426$ and [Ne III] $\lambda 3869$ are separated by only $\simeq 440$ Å in the rest frame. Their ratio is therefore relatively insensitive to large-scale continuum shape, differential attenuation, and changes in instrumental sensitivity compared with ratios involving lines widely separated in wavelength. Second, the lower-ratio comparison contains only galaxies for which the source-specific [Ne V] uncertainty is small enough that a line at the adopted ratio threshold would have been detected. The comparison is therefore not simply between line detections and arbitrarily shallower nondetections. Finally, we find no evidence that the continuum signal-to-noise relevant to the UV slope or Balmer-break measurements systematically tracks the [Ne V]/[Ne III] strength. These considerations make it unlikely that the observed continuum differences are produced solely by the way the [Ne V] sample was detected.

The physical interpretation of the association between the relative strength of [Ne V] and the continuum properties of the host is not straightforward. A Balmer break is naturally produced by stellar populations after the contribution of the youngest massive stars declines, and the combination of strong emission lines with a measurable break can arise from composite populations containing both a young line-emitting component and an older stellar population.

Such Balmer break objects have, e.g., been observed by Kuruvanthodi et al. (2024); Witten et al. (2025) and also found among some high-redshift nitrogen emitters (Morel et al. 2026).

An interesting complementary result comes from Valentino et al. (2026), who began with a sample of massive quenched galaxies and subsequently searched their spectra for [Ne V]. They found the strongest [Ne V] emission preferentially in the youngest post-starburst systems, with weak or absent [Ne V] in the oldest quenched galaxies. Al-

though their galaxies occupy a very different stellar-mass and evolutionary regime from much of SHINE-[NeV], both studies suggest that strong high-ionization activity may preferentially occur during a transitional phase rather than exclusively in either the youngest star-forming systems or the oldest passive populations.

This interpretation is also consistent with previous evidence at lower redshift that [Ne V] activity can be associated with galaxies in or shortly following a shutdown of star formation (Vergani et al. 2018; Barchiesi et al. 2024, 2026). In this picture, the redder UV slopes and stronger Balmer breaks in the strong-Ne53 population could reflect an increasing contribution from an evolved stellar population while substantial black-hole accretion remains active. Such an interpretation is appealing, but the Balmer-break measurement used here does not provide a unique age or star-formation history, and a redder UV slope does not uniquely imply increased dust attenuation. Stellar population modeling will therefore be required to determine whether the strong-Ne53 galaxies have systematically different recent star-formation histories.

An alternative interpretation has become particularly relevant with the discovery of LRDs with very strong Balmer discontinuities. In objects such as the “Cliff,” (de Graaff et al. 2025) the observed break is too extreme to be reproduced easily by conventional stellar populations, and dense hydrogen gas surrounding an accreting black hole has been proposed as the origin of both the break and other unusual spectral features (de Graaff et al. 2025). Related dense-cocoon and “black-hole star” models can substantially reprocess the intrinsic AGN continuum and, in some cases, alter the apparent widths and strengths of the Balmer lines (Rusakov et al. 2026). The Balmer breaks in SHINE-[NeV] are generally more moderate than the extreme cases that motivated these models, and most of the SHINE-[NeV] sample is not selected as LRDs.

We therefore do not regard the continuum trend as evidence that the strong-Ne53 galaxies are related to black-hole stars or contain dense cocoons.

There is nevertheless an interesting connection between the two phenomena. If dense nuclear gas contributes significantly to the Balmer break in some SHINE-[NeV] galaxies, the simultaneous presence of strong [Ne V] requires that this gas cannot prevent hard ionizing photons from reaching lower-density material in every direction. A nearly closed, optically thick envelope would naturally suppress the formation of an external coronal-line region. A clumpy or anisotropic envelope, in contrast, could both reprocess a large fraction of the continuum and permit hard radiation to escape through lower-column-density channels. The association between stronger Balmer breaks and stronger Ne53 may therefore ultimately provide a useful constraint on the geometry of

the gas surrounding rapidly growing black holes, but the current continuum measurements alone cannot distinguish this possibility from a stellar-population origin.

The diversity of the NIRCarn morphologies provides an additional reason for caution in assigning a single interpretation. Strong [Ne V] is present in both compact and visibly structured systems rather than being restricted to the compact systems characteristic of the LRD population. The simplest interpretation of the present data is therefore that the continuum correlations identify a connection between the conditions that favor strong high-ionization emission and the state of the surrounding galaxy or nuclear environment, without yet determining whether the relevant continuum is dominated by stellar evolution, dust, dense nuclear gas, or some combination of these components.

5.4. Incidence, Cosmic Evolution, and Implications for Early Black-hole Growth

The large parent PRISM sample also allows us to ask whether the observed incidence of luminous [Ne V] emission changes over the redshift interval probed by this work. For both the raw and luminosity-thresholded measurements presented in this paper, we find no statistically significant difference between the lower- and higher-redshift bins. The same is true when considering [Ne V] emission among galaxies with robust [Ne III] detections. Thus, within the range $z > 3$ probed here, there is no evidence for a strong rise or fall in the observed fraction of galaxies exhibiting luminous [Ne V] emission.

This result should not be interpreted as evidence that the intrinsic AGN population does not evolve. The parent NIR-Spec archive combines programs with different target selections, exposure times, and sensitivities, and [Ne V] visibility itself depends on the ionizing SED and physical state of the coronal-line gas. In addition, our survey begins at $z \simeq 3$ and therefore does not constrain possible evolution between the local Universe, cosmic noon, and the redshift range studied here. The appropriate conclusion is more limited: over $z > 3$, the current data provide no evidence for a dramatic change in the observed incidence of luminous [Ne V] emitters with redshift.

The behavior of [Ne III] provides an interesting contrast. The raw robust-[Ne III] detection fraction increases from approximately 13% at $3 \leq z < 5$ to approximately 25% at $z \geq 5$. Although the raw [Ne III] detection fraction is not measured above a common intrinsic luminosity or equivalent-width threshold, its increase toward higher redshift provides an important empirical check on redshift-dependent sensitivity. In particular, the absence of a corresponding increase in the [Ne V] detection fraction cannot be explained simply by a general loss of sensitivity to rest-frame optical emission lines at higher redshift, since the nearby [Ne III] $\lambda 3869$ line is de-

tected in an increasing fraction of the parent sample. Instead, an increasing fraction of the observed galaxies enters a strong [Ne III]-emitting population without a proportional increase in the fraction showing luminous [Ne V].

One possible interpretation is that increasingly bursty or high-excitation phases become more common toward high redshift, increasing the fraction of galaxies with strong intermediate-ionization nebular emission. Related rapid evolution has been reported for other unusual emission-line populations. For example,

the fraction of extreme emission lines galaxies increases with redshift (Boyett et al. 2024), and Morel et al. (2026) find that the fraction of nitrogen emitters rises strongly with redshift and discuss an increasing prevalence of young, compact star-forming systems as one possible origin. The [Ne III] trend in our sample does not establish the same physical mechanism. It does, however, suggest that whatever controls the visibility of luminous [Ne V] is not simply the increasing frequency of strong emission-line phases in the galaxy population. The production and escape of photons above 97 eV appears to impose an additional requirement.

This point may also be relevant when comparing SHINE-[NeV] with the LRD population. The abundance of LRDs evolves strongly over the redshift interval probed by JWST, with a broad maximum around the epoch $z \sim 5\text{--}6$ under commonly adopted selections (Matthee et al. 2024; Kocevski et al. 2025; Tanaka et al. 2025). We do not observe a similarly dramatic evolution in luminous [Ne V] incidence. This difference does not imply that LRDs and [Ne V] emitters represent unrelated black-hole populations. Rather, the observability of the two phenomena may depend on different combinations of accretion rate, gas covering fraction, orientation, host-galaxy contrast, and dust. An LRD-like continuum and a visible [Ne V]-emitting region need not occur at the same time or along the same line of sight.

The detection of [Ne V] in very low-mass galaxies adds a further dimension to this picture. Traditional AGN searches become increasingly difficult in low-mass hosts because star formation can dominate the integrated optical spectrum, the broad-line region may be weak or difficult to identify, and X-ray emission from stellar populations becomes increasingly important (Cann et al. 2018; Reines & Comastri 2016). High-ionization forbidden lines therefore provide an attractive complementary method for identifying accretion in this regime. GN 42437 demonstrated this potential at $z = 5.59$ (Chisholm et al. 2024), and the low inferred stellar mass of NeV-11 extends the population of high-redshift [Ne V] emitters into an even lower host-mass regime.

These objects are potentially important for understanding early black-hole growth, but their implications for black-hole seeding should remain limited at present. Stellar mass is not a black-hole mass measurement, and both virial and line-ratio

estimates of black-hole mass carry large model dependencies in the physical regimes now being uncovered by JWST. Moreover, the current [Ne V] luminosity limits do not allow us to determine the abundance of much fainter accreting black holes in low-mass galaxies. The most robust conclusion is that [Ne V] provides a means of finding accretion activity in host galaxies where many conventional AGN diagnostics fail. Uniform deeper spectroscopy, together with higher-resolution line profiles and independent constraints on the stellar and black-hole masses, will be required before this population can be used to distinguish among black-hole seed models.

The results from this work suggest that high-redshift AGN should not be viewed as a single spectroscopic or photometric class. The SHINE-[NeV] galaxies span broad-line and non-broad-line classifications, X-ray detections and nondetections, compact and structured morphologies, and a wide range of stellar masses and continuum properties. Their common feature is that hard ionizing radiation is able to reach gas capable of producing luminous [Ne V]. The diversity within this population, together with the weak constraints on [Ne V] in many independently selected BLAGN and LRDs, suggests that the emerging differences among JWST AGN may reflect not only differences in black-hole accretion rate, but also differences in how the ionizing radiation is generated, filtered, and allowed to escape. A complete census of black-hole growth in the early Universe will therefore require combining [Ne V] and other coronal lines with broad-line, narrow-line, continuum, and multiwavelength AGN diagnostics rather than relying on any single selection method.

6. CONCLUSIONS

We have presented the first systematic SHINE search for [Ne V] $\lambda 3426$ emission in public *JWST*/NIRSpec PRISM spectroscopy at $z > 3$. Starting from our new PRISMATIC emission line flux catalog of more than 9000 PRISM spectra from the DJA archive (see Heintz et al. 2025, Sawarkar et al., in prep.), we identify a SHINE-[NeV] sample of 25 visually vetted and quantitatively validated [Ne V] emitters and use their emission-line, continuum, broad-line, X-ray, stellar-mass, and imaging properties to determine what population is recovered when very-high-ionization emission defines the selection.

Our main conclusions are as follows:

1. The SHINE-[NeV] sample spans $z = 3.059\text{--}9.444$ and more than two orders of magnitude in apparent [Ne V] luminosity, $40.70 \leq \log(L_{[\text{Ne V}]}/\text{erg s}^{-1}) \leq 42.86$. The galaxies also span a wide range of UV luminosities, UV slopes, Balmer-break strengths, stellar masses, and projected morphologies. The NIRCам imaging includes compact sources as well as extended, elongated, and structured systems, demonstrating that luminous

- [Ne V] emission is not restricted to any specific morphological class.
2. The SHINE-[NeV] sample's [Ne V] luminosities overlap with those of the local CLASS [Ne V] emitters: 20/25 SHINE-[NeV] galaxies lie within the CLASS luminosity range and five are more luminous than the most luminous CLASS source. Among the CLASS objects with usable optical classifications, 57/60 are identified as AGNs from their BPT ratios. In contrast, the 15 local metal-poor [Ne V] emitters span only $36.52 \leq \log(L_{[\text{NeV}]}/\text{erg s}^{-1}) \leq 39.73$, and all are less luminous than the SHINE-[NeV] galaxies. The luminosity overlap with the predominantly AGN-classified CLASS sample, together with the separation from the local metal-poor population, supports an AGN origin for the luminous [Ne V] emission in SHINE-[NeV]. However, the current PRISM data are not sensitive to [Ne V] luminosities characteristic of the local metal-poor population, so a fainter high-redshift [Ne V] population could remain undetected.
 3. [Ne V] selection overlaps only partly with other AGN diagnostics. Among SHINE-[NeV] galaxies securely classifiable in S2-VO87, 67% lie above the Kewley et al. (2001) maximal-starburst relation, whereas only 14% lie above the more conservative high-redshift boundary of Scholtz et al. (2025). However, 32% of galaxies with constraining [Ne V] nondetections also lie above the Kewley relation, showing that this region is not specific to [Ne V] emitters. Five of the 25 SHINE-[NeV] galaxies have adopted broad-line classifications; for the remainder, broad emission is either not required in the assessable spectra or cannot be determined from the available data. Broad-line, narrow-line, and [Ne V] selection therefore provide complementary views of the high-redshift AGN population. Stellar masses are available for 20 sources and span approximately $\log(M_*/M_\odot) \sim 7.4\text{--}11$, including one exceptionally low-mass source at $\log(M_*/M_\odot) \sim 7.4$. Luminous very-high-ionization emission can therefore occur in low-mass hosts, although low stellar mass alone does not imply the presence of an intermediate-mass black hole.
 4. The current data do not establish a population-wide [Ne V] deficit in independently selected broad-line AGNs or LRDs. When the comparison is restricted to galaxies with robust [Ne III] detections and constraining [Ne V] upper limits, only 6 of 84 broad-line AGN limits and 4 of 103 LRD limits reach below the lower quartile of the SHINE-[NeV] Ne53 distribution. Most available spectra are not deep enough to exclude

[Ne V]/[Ne III] ratios found within the SHINE-[NeV] sample. In addition, broad Balmer emission and narrow [Ne V] coexist in five SHINE-[NeV] galaxies. These results demonstrate that the escape of photons capable of producing [Ne V] is not universally suppressed in high-redshift broad-line systems.

5. X-ray weakness is likewise not universal among luminous high-redshift [Ne V] emitters. Six of the 25 SHINE-[NeV] galaxies have secure *Chandra* counterparts, spanning $L_{2-10}/L_{[\text{NeV}]} = 15.9\text{--}979.5$, with none below the empirical $L_X/L_{[\text{NeV}]} = 15$ reference associated with the most heavily obscured local systems. The detected galaxies therefore do not show uniformly low X-ray/[Ne V] ratios. For most non-detections, however, the available constraints are catalog detection thresholds rather than formal source-flux upper limits and are not deep enough to determine the intrinsic X-ray-weak fraction. The combined X-ray and high-ionization results argue against a universal picture in which high-redshift AGNs lack both observable X-rays and escaping very hard ionizing radiation.
6. The relative strength of [Ne V] is associated with continuum shape. Compared with a sensitivity-qualified, redshift-matched lower-ratio population, the strong [Ne V]/[Ne III] galaxies show no significant difference in M_{UV} but have systematically redder UV slopes ($\Delta\beta = 0.63$) and stronger Balmer breaks ($\Delta\log_{10} B_{\text{Balmer}} = 0.183$ dex). The comparison is constructed so that galaxies in the lower-ratio sample have spectra capable of excluding the adopted strong-ratio threshold, and the continuum trends are not associated with systematically higher continuum signal-to-noise. These differences therefore do not appear to arise from a simple [Ne V] detection bias. Their physical origin remains uncertain. One possibility is that strong [Ne V] emission preferentially occurs during or shortly after a decline in star formation, potentially in a phase associated with AGN feedback. However, the present continuum measurements do not establish that these galaxies are recently quenched or that AGN feedback caused a decline in their star formation. Differences in stellar populations, dust, dense circumnuclear gas, or continuum reprocessing could also contribute.
7. We find no statistically significant evidence for evolution in the observed incidence of luminous [Ne V] emission over $z > 3$. The raw [Ne V] fraction is 0.324% at $3 \leq z < 5$ and 0.193% at $z \geq 5$, and the luminosity-thresholded calculation likewise shows no significant difference between the lower- and higher-redshift samples. In contrast, the robust [Ne III] detection fraction increases from approximately 13% to

25% over the same two redshift intervals. Because [Ne III] lies close in wavelength to [Ne V], this increase argues against a general loss of rest-optical emission-line sensitivity as the origin of the different trends. The current heterogeneous archive and small [Ne V] sample do not provide a completeness-corrected measurement of intrinsic evolution, but they show no evidence for the pronounced rise toward high redshift reported for some other JWST-selected populations.

The SHINE-[NeV] sample therefore does not define a single new spectroscopic or morphological class of high-redshift AGN. Rather, it isolates systems in which photons

above the 97.1 eV ionization threshold reach gas capable of producing luminous forbidden [Ne V] emission. These systems span broad-line and non-broad-line classifications, X-ray states, host morphologies, stellar masses, and continuum properties. At the same time, [Ne V] selection is necessarily incomplete: an accreting black hole can lack detectable coronal-line emission if the ionizing continuum, dust content, gas density, or covering geometry is unfavorable. A complete census of early black-hole growth will therefore require combining high-ionization lines with broad-line, narrow-line, continuum, and multiwavelength diagnostics.

APPENDIX

A. DETAILED FITTING OF THE [NE V] EMISSION

As described in Section 2.4, we performed a detailed reanalysis of the 28 visually validated [Ne V] candidates using the Bayesian AGN Decomposition Analysis for SDSS Spectra code (BADASS; [Sexton et al. 2021](#)). BADASS has been used in our previous systematic searches for optical coronal-line emission ([Reefe et al. 2022](#); [Doan et al. 2025](#)). The fitting procedure first determines a maximum-likelihood solution and then uses Markov Chain Monte Carlo sampling to determine the parameter uncertainties and covariances. In the general BADASS framework, emission lines are modeled simultaneously with the underlying continuum, and individual coronal lines are represented by Gaussian profiles with their line parameters allowed to vary ([Sexton et al. 2021](#); [Reefe et al. 2022](#); [Doan et al. 2025](#)).

The weak [Ne V] emission in the PRISM spectra required particular care in defining the local continuum. The inferred properties of a weak line can depend strongly on the wavelength interval used to constrain the continuum and on the adopted continuum model ([Reefe et al. 2022](#); [Doan et al. 2025](#)). We found this effect to be important for the present sample. Fits over broader wavelength intervals were more sensitive to large-scale continuum curvature and to spectral structure unrelated to [Ne V], whereas very restricted intervals provide less information with which to constrain the continuum. For several of the weakest candidates, changes in the fitting interval or continuum prescription produced appreciable changes in the inferred [Ne V] flux uncertainty and hence in the formal line significance.

We therefore adopted a local fitting procedure centered on the [Ne V] $\lambda\lambda 3346, 3426$ doublet. Both members of the doublet were included simultaneously in the model, and the continuum was constrained using the same local fitting prescription for every visually retained candidate. This approach follows a general strategy in which restricted spectral regions are used to obtain a reliable estimate of the local continuum rather than allowing distant portions of the spectrum to drive the fit ([Reefe et al. 2022](#); [Doan et al. 2025](#)). The final fitting regions for each source were constrained and masked in order to disregard erroneous emission features that could potentially bias the underlying continuum, without needing to unnecessarily complicate the model with an extra set of Gaussian fit parameters.

The line measurements used throughout this paper are the integrated fluxes and uncertainties from these final local fits. In particular, we define the [Ne V] significance as

$$S/N_{\text{int}} = \frac{F_{3426}}{\sigma_{F_{3426}}}, \quad (\text{A1})$$

where F_{3426} is the integrated [Ne V] $\lambda 3426$ flux and $\sigma_{F_{3426}}$ is its integrated-flux uncertainty. This quantity is distinct from a peak-amplitude signal-to-noise ratio. A source was included in the SHINE-[NeV] sample only when this integrated significance exceeded three, as defined in Equation 2.

The dependence of the formal significance on the local continuum treatment is particularly relevant near the adopted threshold. The line flux itself was generally consistent between the automated catalog measurements and the detailed BADASS fits, but the uncertainty on the integrated flux could change as the continuum interval and continuum model were changed. Consequently, a candidate with a visually apparent feature could move above or below a nominal 3σ threshold under different reasonable fitting choices. We therefore do not interpret small differences in formal significance between fitting prescriptions as evidence that the

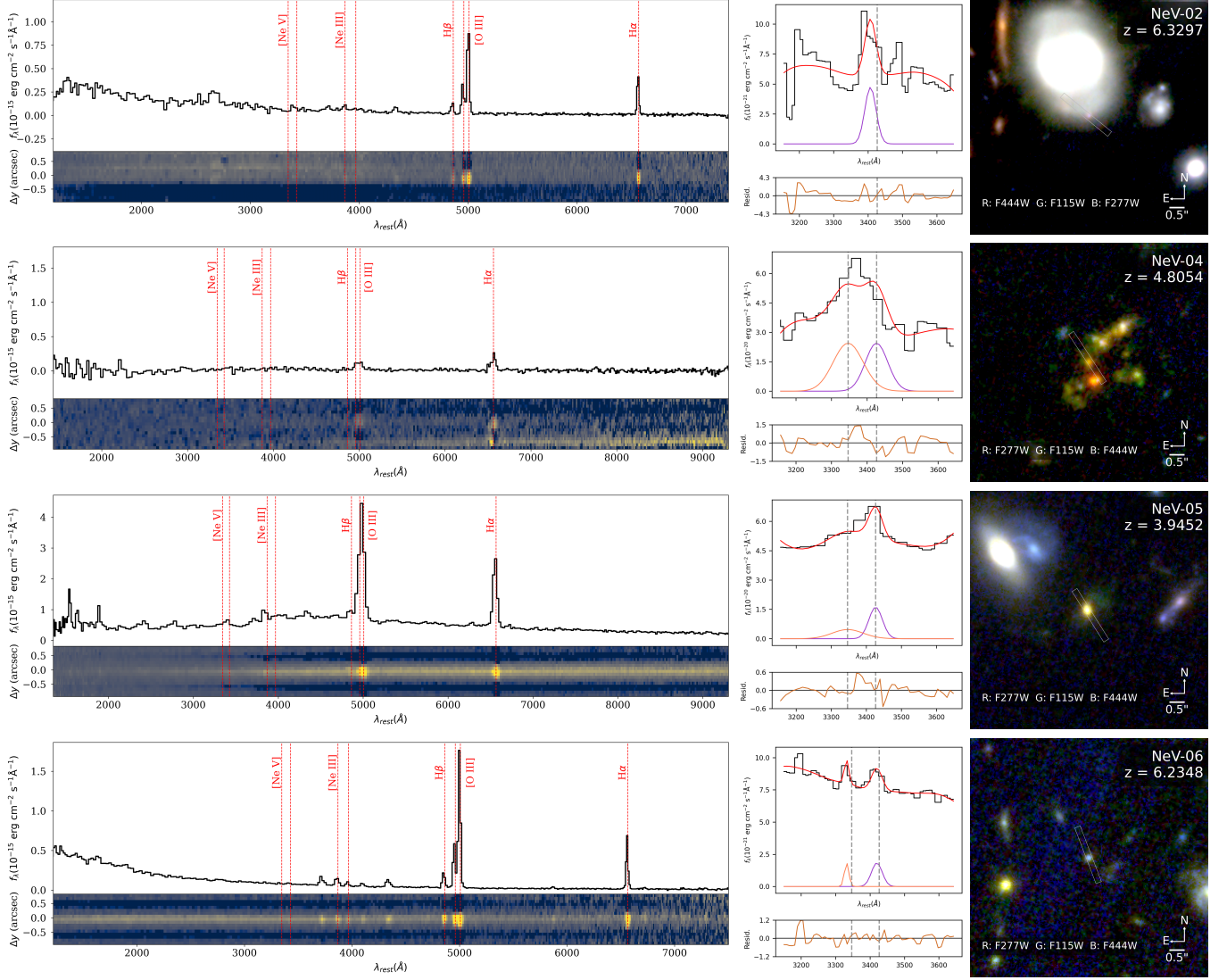


Figure 11. Spectral and imaging atlas for NeV-02, NeV-04, NeV-05, and NeV-06, shown from top to bottom. In each row, the left panel shows the full rest-frame PRISM one-dimensional spectrum in black above the associated two-dimensional spectrum, with red vertical markers identifying selected emission lines. The upper central panel shows the detailed BADASS fit around the [Ne V] $\lambda\lambda 3346, 3426$ doublet, and the lower central panel shows the residuals. Black shows the observed spectrum, red shows the total fitted model, the colored curves show the fitted emission-line components, and gray dashed lines mark the expected doublet wavelengths. The right panel shows the NIRCcam RGB cutout, with F115W ($1.154 \mu\text{m}$), F277W ($2.776 \mu\text{m}$), and F444W ($4.402 \mu\text{m}$) assigned to blue, green, and red, respectively. The plotting conventions are the same as in Figure 2.

underlying spectral feature has appeared or disappeared. Instead, the $F_{3426}/\sigma_{F_{3426}} > 3$ requirement defines a uniform operational threshold based on the single fitting prescription adopted for the SHINE-[Ne V] sample.

Twenty-five of the 28 visually retained candidates satisfy this criterion and comprise the SHINE-[Ne V] sample. The spectra and final [Ne V] fits for these sources are shown in Figure 2 and Appendix A.1. These fits are also the source of the [Ne V] fluxes and apparent luminosities reported in Table 1. Other emission lines used in this work were adopted from the DJA emission-line catalog and were not refitted with BADASS.

A.1. Spectral and imaging atlas of the remaining Ne V emitters

Figures 11–16 show the PRISM spectra, detailed [Ne V] fits, and NIRCcam image cutouts for the 21 SHINE-[Ne V] sources not included in Figure 2. The sources are ordered by publication identifier. The spectral plotting conventions and the F115W–F277W–F444W RGB mapping are the same as in the main-text figure. The cutouts are included for visual comparison and are not used as quantitative morphology measurements.

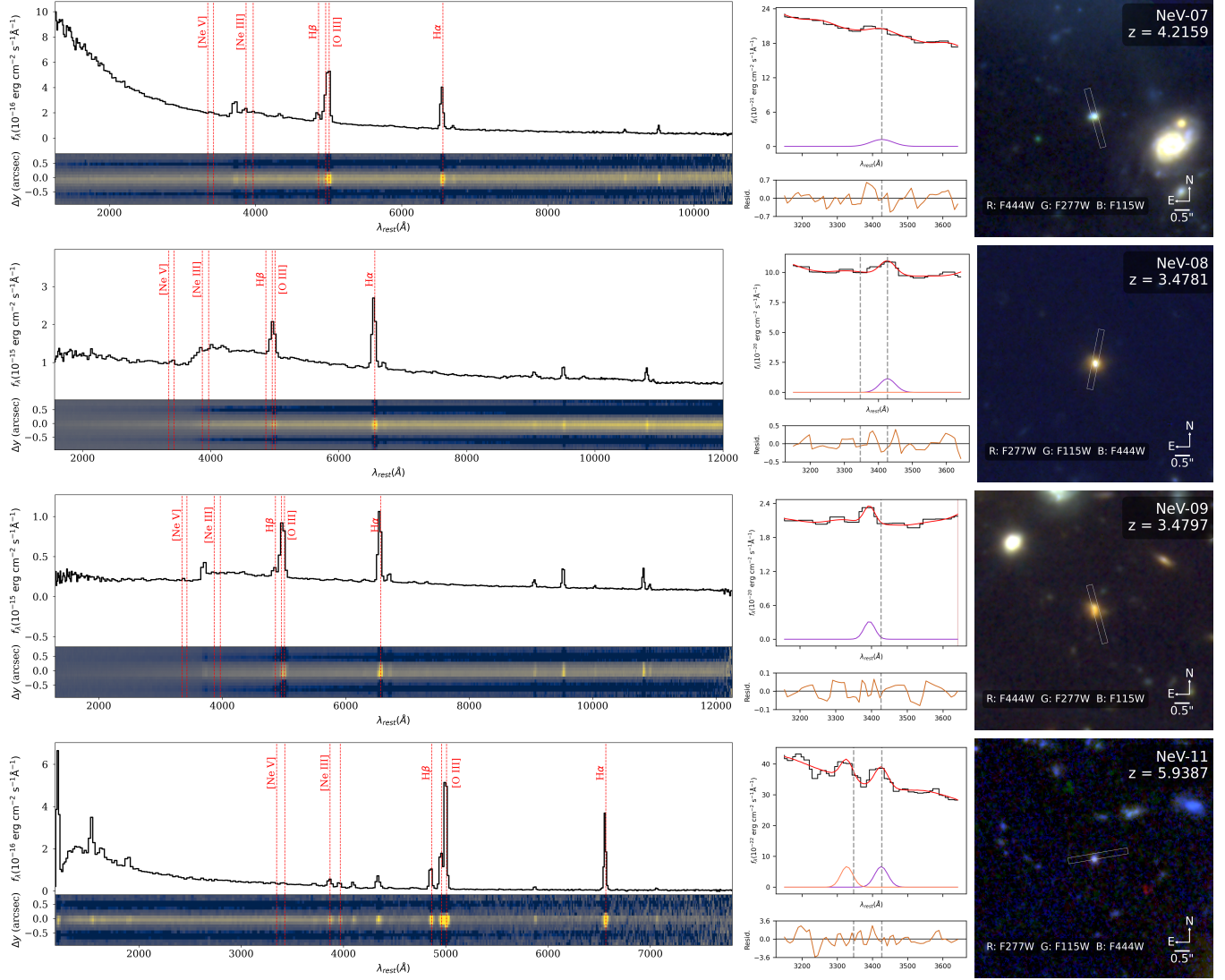


Figure 12. Spectral and imaging atlas for NeV-07, NeV-08, NeV-09, and NeV-11, shown from top to bottom. The plotting conventions are the same as in Figures 2 and 11.

B. CHANDRA CATALOG MATCHING AND X-RAY CONSTRAINTS

B.1. X-ray Catalog Searches and Counterpart Identification

We searched for X-ray counterparts to the 25 SHINE-[NeV] galaxies using the published *Chandra* point-source catalog appropriate to each field: the 7 Ms CDF-S catalog for GOODS-S, the improved 2 Ms CDF-N catalog for GOODS-N, the AEGIS-XD catalog for the Extended Groth Strip, and the X-UDS catalog for the UDS field (Luo et al. 2017; Xue et al. 2016; Nandra et al. 2015; Kocevski et al. 2018). We also searched the Chandra Source Catalog Release 2 series (CSC 2.1) at all source positions (Evans et al. 2024).

We first identified candidate catalog entries within $3''$ of each NIRSpect position. Candidate counterparts were then evaluated using the separation from the X-ray centroid or, where available, the cataloged multiwavelength counterpart position, together with the catalog positional uncertainty. The adopted field-specific criteria are summarized in Table 5. When more than one catalog measurement was available, we adopted the measurement from the deeper field-specific catalog and retained the relevant quality and confusion flags.

B.2. Constraints for Sources without Catalog Counterparts

For sources without a secure X-ray counterpart, we used the CSC 2.1 TRUE-class broad-band source-detection

threshold evaluated at the NIRSpect position. A usable coordinate-specific threshold was available for 18 galaxies. NeV-15 had no usable source-specific X-ray constraint.

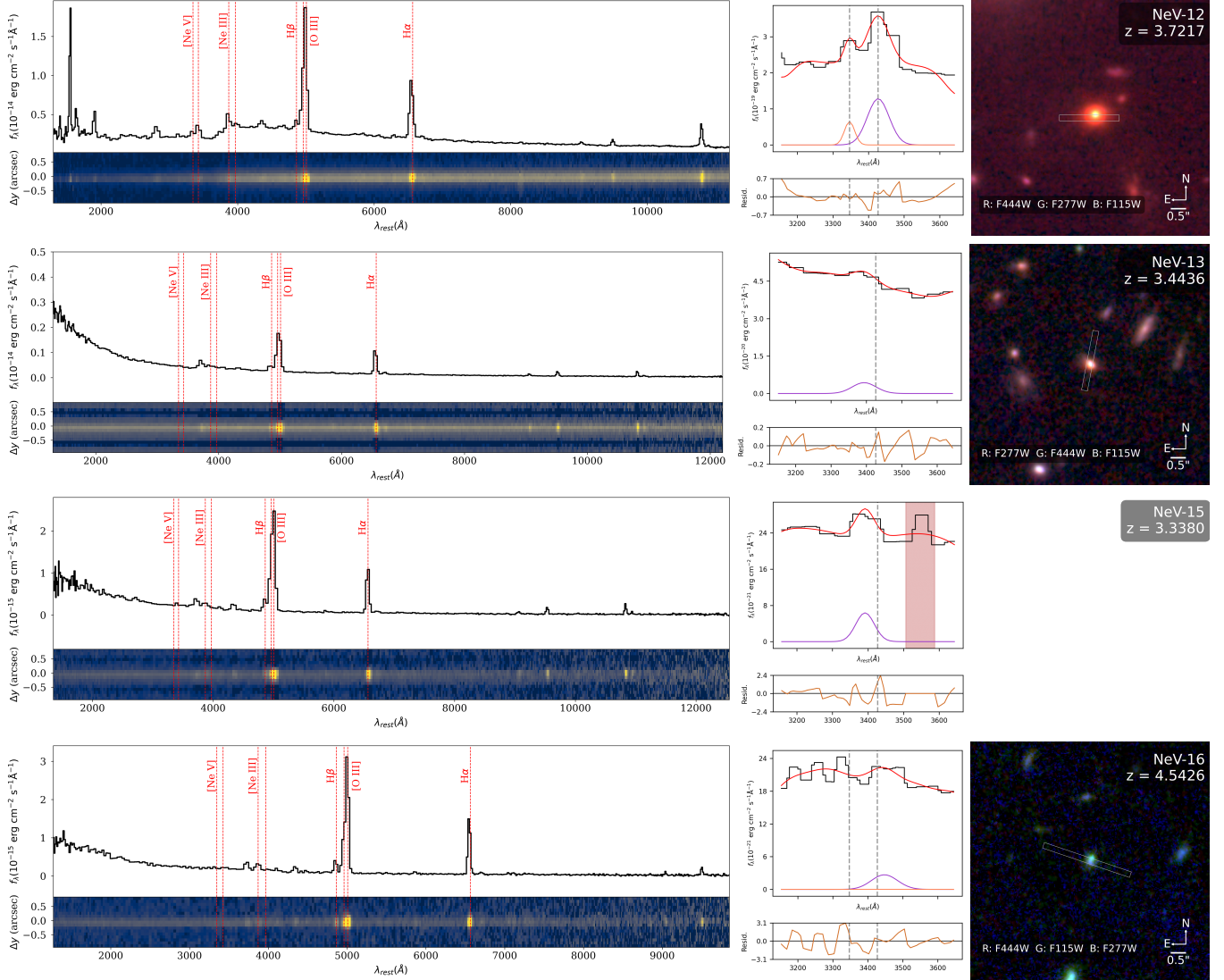


Figure 13. Spectral and imaging atlas for NeV-12, NeV-13, NeV-15, and NeV-16, shown from top to bottom. The plotting conventions are the same as in Figures 2 and 11.

Table 5. Adopted X-ray Catalogs and Matching Criteria

Field or purpose	Catalog	Band (keV)	Coordinate used	Adopted criterion	Reference
GOODS-S / CDF-S	7 Ms CDF-S	0.5–7	MW counterpart	$\Delta\theta < 0''.5$	Luo et al. 2017
GOODS-N / CDF-N	Improved 2 Ms CDF-N	0.5–7	X-ray centroid	$\Delta\theta < 0''.5$ and $\Delta\theta < 2\sigma_{\text{pos}}$	Xue et al. 2016
EGS / AEGIS-XD	AEGIS-XD v4.2	0.5–10	MW counterpart	$\Delta\theta < 0''.5$	Nandra et al. 2015
UDS / X-UDS	X-UDS	0.5–10	X-ray centroid	$\Delta\theta < 1''$ and $\Delta\theta < 2\sigma_{\text{pos}}$	Kocevski et al. 2018
Catalog nondetections	CSC 2.1	0.5–7	NIRSpec position	TRUE-class coordinate detection threshold	Evans et al. 2024

NOTE— Candidate catalog entries were initially collected within $3''$ of each NIRSpec position. “MW counterpart” denotes the multiwavelength counterpart coordinate provided by the field catalog. When multiple catalog measurements were available, the deeper field-specific catalog measurement was adopted. The CSC TRUE-class value is a coordinate-specific catalog detection threshold, not a statistical source-flux upper limit.

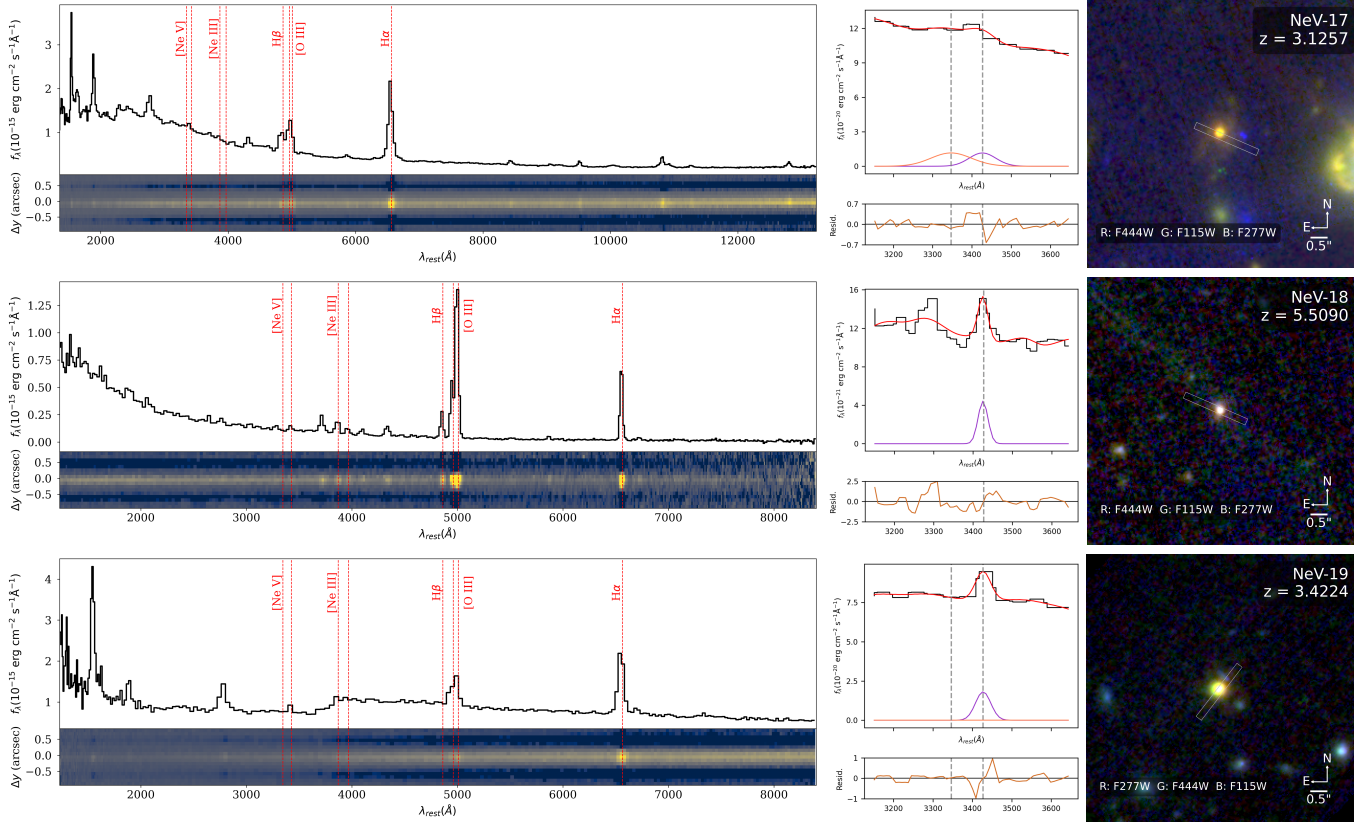


Figure 14. Spectral and imaging atlas for NeV-17, NeV-18, and NeV-19, shown from top to bottom. The plotting conventions are the same as in Figures 2 and 11.

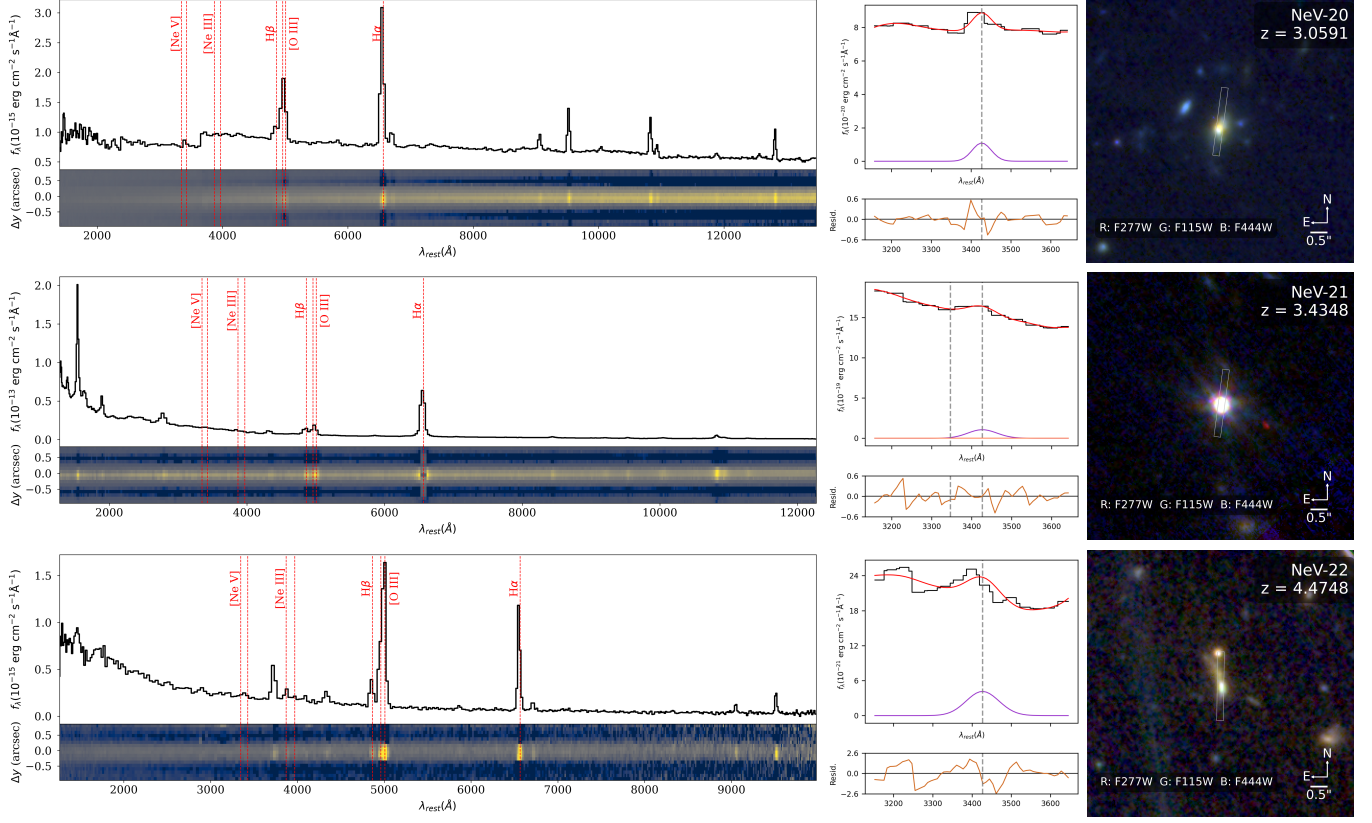


Figure 15. Spectral and imaging atlas for NeV-20, NeV-21, and NeV-22, shown from top to bottom. The plotting conventions are the same as in Figures 2 and 11.

These values describe the local sensitivity of the source catalog. They estimate the flux at which a source at the specified coordinate would meet the catalog detection criterion. They are not measurements of the galaxy flux and are not statistical confidence upper limits on an undetected source. We did not perform forced X-ray photometry or construct a new field-specific sensitivity map. The threshold-derived luminosities are therefore shown as downward arrows and are not treated as measured source luminosities.

B.3. X-ray Luminosities

We converted the adopted catalog fluxes and coordinate-specific detection thresholds to observed-equivalent rest-frame 2–10 keV luminosities. For a catalog flux measured over the observed band E_1 – E_2 , we assumed a power-law spectrum with photon index $\Gamma = 1.8$. The catalog flux convention was adopted, and we applied no additional Galactic or intrinsic absorption correction. The resulting luminosities are therefore observed-equivalent quantities rather than intrinsic, absorption-corrected luminosities. The [Ne V] luminosities are the apparent BADASS values adopted in Table 1 and are not uniformly corrected for extinction or gravitational lensing. The reported $L_{2-10}/L_{[\text{Ne V}]}$ values should therefore be interpreted as observed ratios.

Flux uncertainties were retained when suitable catalog uncertainties were available. Because their definitions and availability differ among the adopted catalogs, a common uncertainty is not assigned to every counterpart. The complete machine-readable X-ray catalog records the available asymmetric uncertainties and identifies cases for which a directly comparable catalog uncertainty was unavailable.

Table 6 lists the adopted X-ray state for all 25 emitters. For threshold rows, the tabulated flux, luminosity, and ratio are detection-threshold quantities and are not formal upper limits.

C. ADDITIONAL EMISSION-LINE INCIDENCE DIAGNOSTICS

We used [Ne III] $\lambda 3869$ as an additional diagnostic of redshift-dependent line detectability. Because [Ne III] lies close in wavelength to [Ne V] $\lambda 3426$, the two lines are affected by broadly similar wavelength-dependent PRISM coverage and instrumental sensitivity. We define robust [Ne III] emitters as sources with $F_{[\text{Ne III}]} / \sigma_{F_{[\text{Ne III}]}} > 4$.

The left panel of Figure 17 shows the fraction of [Ne III]-assessable PRISM galaxies satisfying this criterion. The right panel shows the fraction of robust [Ne III] emitters that are also [Ne V] emitters. The latter is a conditional popula-

Table 6. X-ray Detections and Catalog Detection Thresholds for the SHINE-[NeV] Sample

NeV ID	Field	X-ray state	Catalog	Band	f_X or f_{det}	$\log L_{2-10}$ or $\log L_{\text{det}}$	$L_{2-10}/L_{[\text{NeV}]}$ or $L_{\text{det}}/L_{[\text{NeV}]}$	Balmer status
NeV-01	A2744	Threshold	CSC 2.1	0.5-7	2.540	44.191	67.1	Broad
NeV-02	A2744	Threshold	CSC 2.1	0.5-7	3.113	44.851	1231.9	Undetermined
NeV-03	A2744	Threshold	CSC 2.1	0.5-7	3.690	45.199	4201.2	Undetermined
NeV-04	UDS	Threshold	CSC 2.1	0.5-7	2.410	44.484	221.3	Broad
NeV-05 ^a	UDS	Detection	X-UDS	0.5-10	10.030	44.840	979.5	Broad
NeV-06	UDS	Threshold	CSC 2.1	0.5-7	1.448	44.505	1898.0	Undetermined
NeV-07	CDF-S	Threshold	CSC 2.1	0.5-7	0.163	43.186	228.9	Undetermined
NeV-08	CDF-S	Threshold	CSC 2.1	0.5-7	0.439	43.432	107.4	Undetermined
NeV-09	CDF-S	Threshold	CSC 2.1	0.5-7	0.154	42.978	189.6	Undetermined
NeV-10	CDF-S	Threshold	CSC 2.1	0.5-7	0.162	43.935	1184.8	No broad comp.
NeV-11	CDF-S	Threshold	CSC 2.1	0.5-7	0.194	43.586	601.2	No broad comp.
NeV-12	CDF-S	Detection	7 Ms CDF-S	0.5-7	2.160	44.190	21.2	Undetermined
NeV-13	CDF-S	Threshold	CSC 2.1	0.5-7	0.160	42.984	62.6	Undetermined
NeV-14	CDF-S	Detection	7 Ms CDF-S	0.5-7	0.187	43.060	15.9	Undetermined
NeV-15	Other	No constraint	...	...	...	...	...	Undetermined
NeV-16	COSMOS	Threshold	CSC 2.1	0.5-7	1.942	44.334	653.8	Undetermined
NeV-17	COSMOS	Threshold	CSC 2.1	0.5-7	2.389	44.064	537.1	Broad
NeV-18	COSMOS	Threshold	CSC 2.1	0.5-7	2.072	44.544	1585.4	Undetermined
NeV-19	CDF-N	Detection	Improved 2 Ms CDF-N	0.5-7	1.000	43.774	161.9	Undetermined
NeV-20	AEGIS-XD	Threshold	CSC 2.1	0.5-7	1.085	43.701	282.8	Undetermined
NeV-21	AEGIS-XD	Detection	AEGIS-XD v4.2	0.5-10	9.122	44.666	113.7	Broad
NeV-22	AEGIS-XD	Threshold	CSC 2.1	0.5-7	0.584	43.798	218.6	Undetermined
NeV-23	AEGIS-XD	Threshold	CSC 2.1	0.5-7	0.642	43.873	227.7	No broad comp.
NeV-24	AEGIS-XD	Threshold	CSC 2.1	0.5-7	1.060	43.810	193.6	No broad comp.
NeV-25	AEGIS-XD	Detection	AEGIS-XD v4.2	0.5-10	1.310	43.813	44.3	No broad comp.

NOTE.—The observed band is in keV. Fluxes and detection thresholds are in units of $10^{-15} \text{ erg s}^{-1} \text{ cm}^{-2}$, and luminosities are in erg s^{-1} . Rows labeled “Detection” contain an adopted catalog flux and observed-equivalent rest-frame 2–10 keV luminosity. Rows labeled “Threshold” contain the CSC 2.1 TRUE-class coordinate-specific catalog detection threshold, its luminosity equivalent, and its ratio to the apparent [Ne V] luminosity. These threshold values are not direct source measurements or formal confidence upper limits, and no inequality sign is assigned to them. “No broad comp.” means that adequate higher-resolution Balmer-line data did not require a broad component. “Undetermined” means that the presence or absence of broad Balmer emission could not be determined from the available data.

^a The X-UDS counterpart is retained as secure, but the corresponding CSC entry carries a confusion flag.

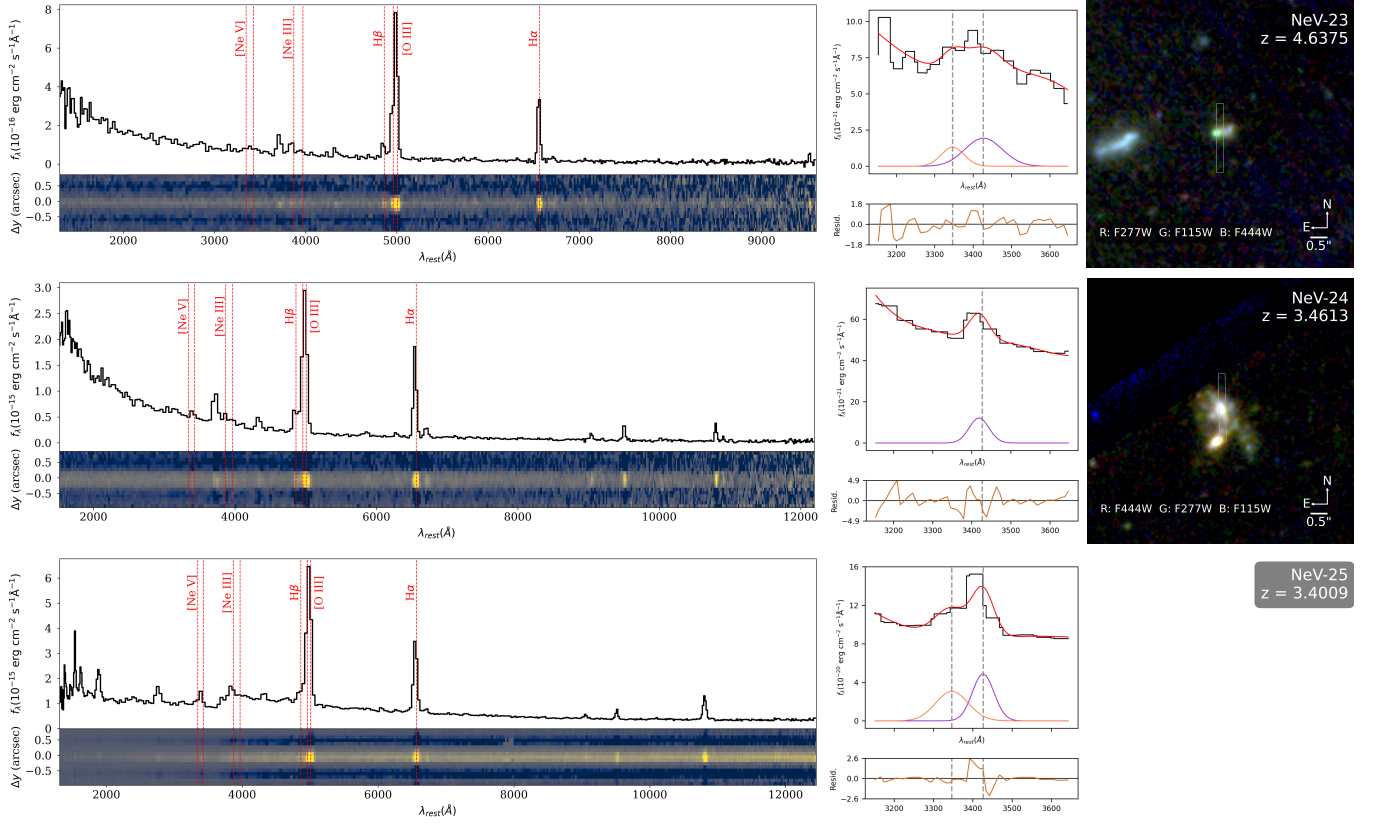


Figure 16. Spectral and imaging atlas for NeV-23, NeV-24, and NeV-25, shown from top to bottom. The plotting conventions are the same as in Figures 2 and 11.

tion fraction and should not be confused with the source-level $[\text{Ne V}]/[\text{Ne III}]$ emission-line ratio.

These calculations are intended as selection diagnostics rather than measurements of intrinsic redshift evolution. The $[\text{Ne III}]$ fraction is not measured above a common line-flux, luminosity, or equivalent-width threshold and may reflect both astrophysical evolution and variations in survey targeting and sensitivity. Moreover, the $[\text{Ne III}]$ -selected denominator itself changes with redshift and excludes six $[\text{Ne V}]$ emitters that do not satisfy the adopted robust $[\text{Ne III}]$ criterion.

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REFERENCES

- Abel, N. P., & Satyapal, S. 2008, *ApJ*, **678**, 686
- Akins, H. B., Casey, C. M., Lambrides, E., et al. 2025, *The Astrophysical Journal*, **991**, 37
- Allen, M. G., Groves, B. A., Dopita, M. A., Sutherland, R. S., & Kewley, L. J. 2008, *ApJS*, **178**, 20
- Ananna, T. T., Bogdán, Á., Kovács, O. E., Natarajan, P., & Hickox, R. C. 2024, *The Astrophysical Journal Letters*, **969**, L18
- Arroyo-Polonio, A., Kehrig, C., Vílchez, J. M., et al. 2025, *ApJL*, **987**, L36
- Astropy Collaboration, Robitaille, T. P., Tollerud, E. J., et al. 2013, *Astronomy & Astrophysics*, **558**, A33
- Baldwin, J. A., Phillips, M. M., & Terlevich, R. 1981, *PASP*, **93**, 5
- Barchiesi, L., Vignali, C., Pozzi, F., et al. 2024, *Astronomy & Astrophysics*, **685**, A141
- . 2026, *Monthly Notices of the Royal Astronomical Society*, **545**, staf2076, citation key retained from the 2025 preprint
- Barro, G., Pérez-González, P. G., Kocevski, D. D., et al. 2026, *The Astrophysical Journal*, **997**, 48
- Begelman, M. C., & Dexter, J. 2026, *ApJ*, **996**, 48
- Berg, D. A., Chisholm, J., Erb, D. K., et al. 2021, *ApJ*, **922**, 170
- Boyet, K., Bunker, A. J., Curtis-Lake, E., et al. 2024, *MNRAS*, **535**, 1796
- Brammer, G. 2023, Dawn JWST Archive
- Burke, C. J., Stone, Z., Shen, Y., et al. 2026, *The Astrophysical Journal*, **1004**, 16
- Cameron, A. J., Katz, H., Witten, C., et al. 2024, *Monthly Notices of the Royal Astronomical Society*, **534**, 523
- Cann, J. M., Satyapal, S., Abel, N. P., et al. 2018, *The Astrophysical Journal*, **861**, 142
- . 2019, *The Astrophysical Journal Letters*, **870**, L2
- Carnall, A. C., McLure, R. J., Dunlop, J. S., & Davé, R. 2018, *Monthly Notices of the Royal Astronomical Society*, **480**, 4379
- Casey, C. M., Akins, H. B., Finkelstein, S. L., et al. 2025, *The Astrophysical Journal Letters*, **990**, L61
- Chisholm, J., Berg, D. A., Endsley, R., et al. 2024, *Monthly Notices of the Royal Astronomical Society*, **534**, 2633
- Cleri, N. J., Olivier, G. M., Hutchison, T. A., et al. 2023a, *The Astrophysical Journal*, **953**, 10

² <http://www.astropy.org>

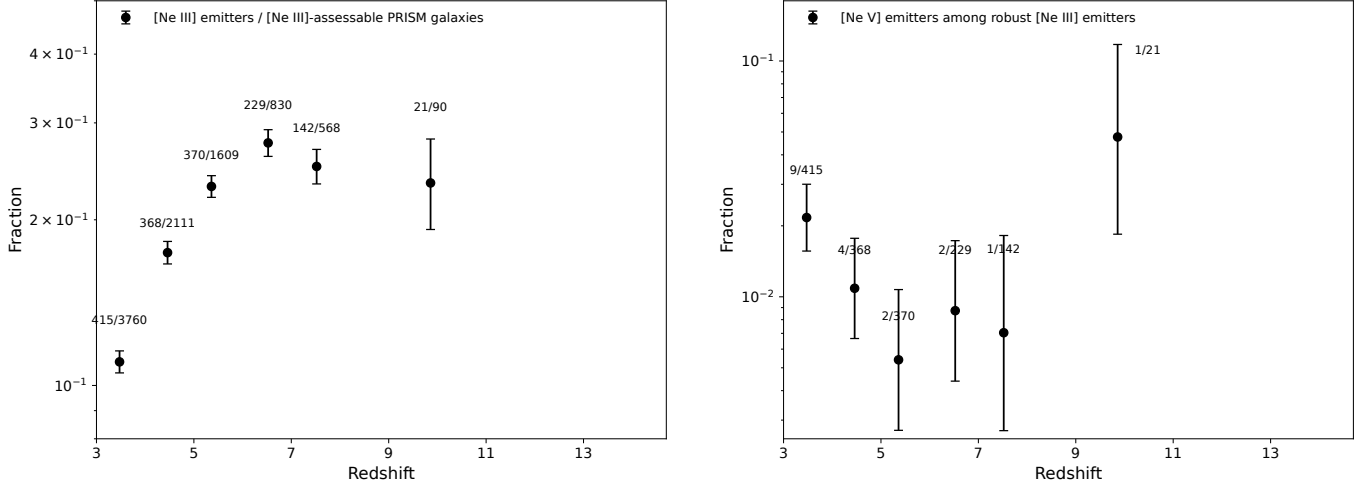


Figure 17. Diagnostic fractions involving [Ne III] as a function of redshift. *Left:* black points show the fraction of unique NIRSpec/PRISM galaxies with robust catalog [Ne III] emission, defined by $F_{[\text{Ne III}]} / \sigma_{F_{[\text{Ne III}]}} > 4$. *Right:* black points show the fraction of robust [Ne III] emitters that are also [Ne V] emitters. Vertical error bars indicate 68% Wilson score confidence intervals, and labels give the exact numerator and denominator in each redshift bin. The [Ne III] fraction is not defined above a common intrinsic line-strength threshold and may therefore reflect both astrophysical differences and heterogeneous survey sensitivity and targeting. The quantity in the right panel is a conditional population fraction, not a source-level [Ne V]/[Ne III] line ratio. Because the [Ne III]-selected denominator evolves with redshift and excludes [Ne V] emitters without robust [Ne III] detections, both panels should be interpreted as selection diagnostics rather than direct measurements of intrinsic AGN evolution.

- Cleri, N. J., Papovich, C., Yang, G., et al. 2023b, *The Astrophysical Journal*, 948, 112
- Cleri, N. J., Olivier, G. M., Hutchison, T. A., et al. 2023c, *ApJ*, 953, [arXiv:2301.07745 \[astro-ph.GA\]](#)
- . 2023d, *ApJ*, 953, [arXiv:2301.07745 \[astro-ph.GA\]](#)
- Cleri, N. J., Olivier, G. M., Backhaus, B. E., et al. 2025, *ApJ*, 994, 146
- Comastri, A., Lanzuisi, G., Vito, F., et al. 2026, *Astronomy & Astrophysics*, 706, A302
- Curti, M., Witstok, J., Jakobsen, P., et al. 2025, *A&A*, 697, [arXiv:2407.02575 \[astro-ph.GA\]](#)
- de Graaff, A., Setton, D. J., Brammer, G., et al. 2025, *Astronomy & Astrophysics*, 701, A168
- del Valle-Espinosa, M. G., Mingozzi, M., James, B., et al. 2026, *ApJL*, 998, L45
- Delvecchio, I., Daddi, E., Magnelli, B., et al. 2025, *Astronomy & Astrophysics*, 704, A313
- Doan, S. M., Satyapal, S., Reece, M., et al. 2025, *The Astrophysical Journal Supplement Series*, 280, 57
- Evans, I. N., Evans, J. D., Martinez-Galarza, J. R., et al. 2024, *ApJS*, 274, 22
- Feltre, A., Charlot, S., & Gutkin, J. 2016, *MNRAS*, 456, 3354
- Ferguson, J. W., Korista, K. T., & Ferland, G. J. 1997, *The Astrophysical Journal Supplement Series*, 110, 287
- Ferruit, P., Jakobsen, P., Giardino, G., et al. 2022, *Astronomy & Astrophysics*, 661, A81
- Feuillet, L. M., Meléndez, M., Kraemer, S., et al. 2024, *ApJ*, 968, 91
- Flury, S. R., Arellano-Córdova, K. Z., Moran, E. C., & Einsig, A. 2025, *MNRAS*, 543, 3367
- Garofali, K., Basu-Zych, A. R., Johnson, B. D., et al. 2024, *ApJ*, 960, 13
- Gilli, R., Vignali, C., Mignoli, M., et al. 2010, *A&A*, 519, A92
- Gloudemans, A. J., Duncan, K. J., Eilers, A.-C., et al. 2025, *The Astrophysical Journal*, 986, 130
- Greene, J. E., Labbe, I., Goulding, A. D., et al. 2024, *The Astrophysical Journal*, 964, 39
- Groves, B. A., Heckman, T. M., & Kauffmann, G. 2006, *Monthly Notices of the Royal Astronomical Society*, 371, 1559
- Gutkin, J., Charlot, S., & Bruzual, G. 2016, *MNRAS*, 462, 1757
- Harikane, Y., Zhang, Y., Nakajima, K., et al. 2023, *The Astrophysical Journal*, 959, 39
- Hatano, S., Ouchi, M., Umeda, H., et al. 2024, *ApJ*, 966, 170
- Heintz, K. E., Brammer, G. B., Watson, D., et al. 2025, *Astronomy & Astrophysics*, 693, A60
- Hickox, R. C., & Alexander, D. M. 2018, *Annual Review of Astronomy and Astrophysics*, 56, 625
- Holden, L. R., & Tadhunter, C. N. 2023, *MNRAS*, 524, 886
- Hunt, L. K., Aloisi, A., Navarro, M. G., et al. 2025, *ApJ*, 992, 48
- Hviding, R. E., de Graaff, A., Brammer, G., et al. 2025, *Astronomy & Astrophysics*, 702, A57
- Inayoshi, K., & Maiolino, R. 2025, *The Astrophysical Journal Letters*, 980, L27
- Izotov, Y. I., Noeske, K. G., Guseva, N. G., et al. 2004, *A&A*, 415, L27

- Izotov, Y. I., Thuan, T. X., & Guseva, N. G. 2021, *MNRAS*, **508**, 2556
- Izotov, Y. I., Thuan, T. X., & Privon, G. 2012, *MNRAS*, **427**, 1229
- Jakobsen, P., Ferruit, P., Alves de Oliveira, C., et al. 2022, *Astronomy & Astrophysics*, **661**, A80
- Juodžbalis, I., Maiolino, R., Baker, W. M., et al. 2026, *Monthly Notices of the Royal Astronomical Society*, **546**, stag086
- Kaaret, P., & Corbel, S. 2009, *ApJ*, **697**, 950
- Katz, H., Cameron, A. J., Saxena, A., et al. 2025, *The Open Journal of Astrophysics*, **8**
- Kauffmann, G., Heckman, T. M., Tremonti, C., et al. 2003, *MNRAS*, **346**, 1055
- Kehrig, C., Vílchez, J. M., Guerrero, M. A., et al. 2018, *MNRAS*, **480**, 1081
- Kewley, L. J., Dopita, M. A., Sutherland, R. S., Heisler, C. A., & Trevena, J. 2001, *ApJ*, **556**, 121
- Kocevski, D. D., Finkelstein, S. L., Barro, G., et al. 2025, *ApJ*, **986**, [arXiv:2404.03576 \[astro-ph.GA\]](#)
- Kocevski, D. D., Onoue, M., Inayoshi, K., et al. 2023, *The Astrophysical Journal Letters*, **954**, L4
- Kocevski, D. D., Hasinger, G., Brightman, M., et al. 2018, *ApJS*, **236**, 48
- Kokorev, V., Caputi, K. I., Greene, J. E., et al. 2024, *The Astrophysical Journal*, **968**, 38
- Kokubo, M., & Harikane, Y. 2025, *The Astrophysical Journal*, **995**, 24
- Kubota, A., & Done, C. 2018, *Monthly Notices of the Royal Astronomical Society*, **480**, 1247
- Kuruvanthodi, A., Schaerer, D., Marques-Chaves, R., et al. 2024, *A&A*, **691**, A310
- Labbe, I., Greene, J. E., Bezanson, R., et al. 2025, *The Astrophysical Journal*, **978**, 92
- Lambrides, E., Larson, R. L., Garofali, K., et al. 2026, *Nature Astronomy*, **10**, 868
- Leitherer, C., Schaerer, D., Goldader, J. D., et al. 1999, *ApJS*, **123**, 3
- Luo, B., Brandt, W. N., Xue, Y. Q., et al. 2017, *ApJS*, **228**, 2
- Madau, P. 2026, *Astronomy & Astrophysics*, **708**, A116
- Maiolino, R., & Rieke, G. H. 1995, *The Astrophysical Journal*, **454**, 95
- Maiolino, R., Risaliti, G., Signorini, M., et al. 2025, *Monthly Notices of the Royal Astronomical Society*, **538**, 1921
- Maiolino, R., Scholtz, J., Witstok, J., et al. 2024, *Astronomy & Astrophysics*, **691**, A145
- Matthee, J., Naidu, R. P., Brammer, G., et al. 2024, *The Astrophysical Journal*, **963**, 129
- Matthews Acuña, O. S., Tremonti, C. A., Cleri, N. J., et al. 2026, The [Ne V] AGN Diagnostic in SDSS-IV/eBOSS: An Anticorrelation Between Ionization State and AGN Luminosity in Low-Redshift Coronal-Line Galaxies, [arXiv:2608.21280 \[astro-ph.GA\]](#), arXiv preprint
- Mazzolari, G., Übler, H., Maiolino, R., et al. 2024, *Astronomy & Astrophysics*, **691**, A345
- Mazzolari, G., Scholtz, J., Maiolino, R., et al. 2025, *Astronomy & Astrophysics*, **700**, A12
- McKaig, J. D., Satyapal, S., Laor, A., et al. 2024, *The Astrophysical Journal*, **976**, 130
- Mingozzi, M., Garcia Del Valle-Espinosa, M., James, B. L., et al. 2025, *ApJ*, **985**, 253
- Molina, M., Reines, A. E., Greene, J. E., Darling, J., & Condon, J. J. 2021, *The Astrophysical Journal*, **910**, 5
- Morel, I., Schaerer, D., Marques-Chaves, R., et al. 2026, *A&A*, **710**
- Naidu, R. P., Matthee, J., Katz, H., et al. 2025, [arXiv e-prints, arXiv:2503.16596 \[astro-ph.GA\]](#)
- Nakajima, K., & Maiolino, R. 2022, *MNRAS*, **513**, 5134
- Nakajima, K., & Maiolino, R. 2022, *MNRAS*, **513**, 5134
- Nandra, K., Laird, E. S., Aird, J. A., et al. 2015, *ApJS*, **220**, 10
- Negus, J., Comerford, J. M., Müller-Sánchez, F., et al. 2023, *The Astrophysical Journal*, **945**, 127
- Netzer, H. 2013, *The Physics and Evolution of Active Galactic Nuclei* (Cambridge: Cambridge University Press)
- Olivier, G. M., Berg, D. A., Chisholm, J., et al. 2022, *ApJ*, **938**, 16
- Pacucci, F., & Narayan, R. 2024, *The Astrophysical Journal*, **976**, 96
- Peca, A., Koss, M. J., Oh, K., et al. 2025, *ApJ*, **990**, 3
- Pérez-González, P. G., Barro, G., Rieke, G. H., et al. 2024, *The Astrophysical Journal*, **968**, 4
- Peterson, B. M. 2006, in *Lecture Notes in Physics*, Vol. 693, *Physics of Active Galactic Nuclei at all Scales*, ed. D. Alloin, R. Johnson, & P. Lira (Springer), 77
- Rakowski, C. E., Raymond, J. C., & Szentgyorgyi, A. H. 2007, *ApJ*, **655**, 885
- Reefe, M., Satyapal, S., Sexton, R. O., et al. 2022, *ApJ*, **936**, 140
- Reines, A. E., & Comastri, A. 2016, *Publications of the Astronomical Society of Australia*, **33**, e054
- Reiss, T., Trakhtenbrot, B., Ricci, C., et al. 2025, *ApJ*, **989**, 88
- Richardson, C. T., Simpson, C., Polimera, M. S., et al. 2022, *The Astrophysical Journal*, **927**, 165
- Rinaldi, P., Bonaventura, N., Rieke, G. H., et al. 2025, *The Astrophysical Journal*, **992**, 71
- Rupke, D. S. N., Coil, A. L., Perrotta, S., et al. 2023, *ApJ*, **947**, 33
- Rusakov, V., Watson, D., Nikopoulos, G. P., Brammer, G., et al. 2026, *Nature*, **649**, 574
- Salim, S., Boquien, M., & Lee, J. C. 2018, *The Astrophysical Journal*, **859**, 11

- Satyapal, S., Böker, T., & McAlpine, W. 2009, *The Astrophysical Journal*, 704, 439
- Satyapal, S., Kamal, L., Cann, J. M., Secrest, N. J., & Abel, N. P. 2021, *The Astrophysical Journal*, 906, 35
- Satyapal, S., Vega, D., Dudik, R. P., Abel, N. P., & Heckman, T. 2008, *The Astrophysical Journal*, 677, 926
- Saxena, A., Overzier, R. A., Villar-Martín, M., et al. 2024, *MNRAS*, 531, 4391
- Scholtz, J., Maiolino, R., D'Eugenio, F., et al. 2025, *Astronomy & Astrophysics*, 697, A175
- Setton, D. J., Greene, J. E., Spilker, J. S., et al. 2025, *The Astrophysical Journal Letters*, 991, L10
- Sexton, R. O., Matzko, W., Darden, N., Canalizo, G., & Gorjian, V. 2021, *Monthly Notices of the Royal Astronomical Society*, 500, 2871
- Shirazi, M., & Brinchmann, J. 2012, *MNRAS*, 421, 1043
- Strickland, D. K., & Heckman, T. M. 2009, *ApJ*, 697, 2030
- Tanaka, T. S., Akins, H. B., Harikane, Y., et al. 2025, *The Astrophysical Journal*, 995, 21
- Tang, M., Stark, D. P., Plat, A., et al. 2025, *ApJ*, 991, [arXiv:2505.06359 \[astro-ph.GA\]](https://arxiv.org/abs/2505.06359)
- Taylor, A. J., Finkelstein, S. L., Kocevski, D. D., et al. 2025, *The Astrophysical Journal*, 986, 165
- Taylor, M. B. 2005, in *Astronomical Society of the Pacific Conference Series*, Vol. 347, *Astronomical Data Analysis Software and Systems XIV*, 29
- Thuan, T. X., & Izotov, Y. I. 2005, *ApJS*, 161, 240
- Trakhtenbrot, B., Ricci, C., Treister, E., et al. 2025, *The Astrophysical Journal Letters*, 992, L27
- Treiber, H., Greene, J. E., Weaver, J. R., et al. 2025, *ApJ*, 984, [arXiv:2409.12232 \[astro-ph.GA\]](https://arxiv.org/abs/2409.12232)
- Valentino, F., Heintz, K. E., Brammer, G., et al. 2025, *Astronomy & Astrophysics*, 699, A358
- Valentino, F., Ito, K., Farcy, M., et al. 2026, *arXiv e-prints*, [arXiv:2605.30424](https://arxiv.org/abs/2605.30424), submitted to A&A
- Veilleux, S., & Osterbrock, D. E. 1987, *ApJS*, 63, 295
- Vergani, D., Garilli, B., Polletta, M., et al. 2018, *Astronomy & Astrophysics*, 620, A193
- Wang, B., Leja, J., Katz, H., et al. 2026, *The Astrophysical Journal*, 1003, 10
- Witten, C., McClymont, W., Laporte, N., et al. 2025, *MNRAS*, 537, 112
- Xiao, M., Oesch, P. A., Bing, L., et al. 2026, *arXiv e-prints*, [arXiv:2606.30802](https://arxiv.org/abs/2606.30802)
- Xue, Y. Q., Luo, B., Brandt, W. N., et al. 2016, *ApJS*, 224, 15
- Yue, M., Eilers, A.-C., Simcoe, R. A., et al. 2024, *The Astrophysical Journal Letters*, 974, L26
- Zhang, Z., Jiang, L., Liu, W., & Ho, L. C. 2025, *The Astrophysical Journal*, 985, 119
- Zucchi, G., Ji, X., Madau, P., et al. 2026, *Astronomy & Astrophysics*, 707, A52