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HUBBLE SPACE TELESCOPE WFC3 EARLY RELEASE SCIENCE: EMISSION-LINE GALAXIES FROM INFRARED GRISM OBSERVATIONS

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ABSTRACT

We present grism spectra of emission-line galaxies (ELGs) from 0.6 to 1.6 μm from the Wide Field Camera 3 (WFC3) on the Hubble Space Telescope. These new infrared grism data augment previous optical Advanced Camera for Surveys G800L 0.6–0.95 μm grism data in GOODS-South from the PEARs program, extending the wavelength coverage well past the G800L red cutoff. The Early Release Science (ERS) grism field was observed at a depth of two orbits per grism, yielding spectra of hundreds of faint objects, a subset of which is presented here. ELGs are studied via the Hα, [O iii], and [O ii] emission lines detected in the redshift ranges 0.2 ≲ z ≲ 1.4, 1.2 ≲ z ≲ 2.2, and 2.0 ≲ z ≲ 3.3, respectively, in the G102 (0.8–1.1 μm; R ≃ 210) and G141 (1.1–1.6 μm; R ≃ 130) grisms. The higher spectral resolution afforded by the WFC3 grisms also reveals emission lines not detectable with the G800L grism (e.g., [S iii] and [S ii] lines). From these relatively shallow observations, line luminosities, star formation rates, and grism spectroscopic redshifts are determined for a total of 48 ELGs to mAB(R080M) ≃ 25 mag. Seventeen GOODS-South galaxies that previously only had photometric redshifts now have new grism spectroscopic redshifts, in some cases with large corrections to the photometric redshifts (Δz ≃ 0.3–0.5). Additionally, one galaxy had no previously measured redshift but now has a secure grism-spectroscopic redshift, for a total of 18 new GOODS-South spectroscopic redshifts. The faintest source in our sample has a magnitude mAB(R080M) = 26.9 mag. The ERS grism data also reflect the expected trend of lower specific star formation rates for the highest mass galaxies in the sample as a function of redshift, consistent with downsizing and discovered previously from large surveys. These results demonstrate the remarkable efficiency and capability of the WFC3 NIR grisms for measuring galaxy properties to faint magnitudes and redshifts to z ≃ 2.

Key words: catalogs – galaxies: starburst – techniques: spectroscopic

Online-only material: color figures, figure set

1. INTRODUCTION

Galaxies that are actively star forming make up a distinct population of sources that are involved in ongoing evolution, that is, they are in the very process of converting gas into stars and thereby changing their chemical content and stellar mass. Star-forming galaxies are also often associated with larger-scale galaxy evolution across cosmic time in that galaxy interactions are often found to cause enhanced star formation (e.g., Li et al. 2008; Overzier et al. 2008; Larson & Tinsley 1978) and galaxy evolution as a whole is thought to proceed hierarchically via galaxy interactions and merging (e.g., White & Frenk 1991; Navarro et al. 1997, etc.). These actively star-forming galaxies are therefore important to study within the overall context of
galaxy assembly. Information about star formation activity is revealed in the galaxies’ emission lines, particularly H$_\alpha$, [O III], and [O II] at rest-frame wavelengths $\lambda\lambda 6563, 4959, 5007$, and $3727$, respectively. Many studies have used emission lines to investigate the star-forming properties of galaxies over various redshift ranges (Hammer et al. 1997; Kennicutt 1983; Gallego et al. 1995; Kewley et al. 2004; NICMOS grism study: McCarthy et al. 1999; Yan et al. 1999; WISP grism Survey: Atek et al. 2010).

The installation of the new Wide Field Camera 3 (WFC3) on the Hubble Space Telescope (HST) in mid-2009 has provided a new capability for studying star formation and has already resulted in a variety of scientific discoveries in observational cosmology. Particularly, the increase in sensitivity, field of view, and resolution of the WFC3/IR over previous infrared instrumentation has been used to detect some candidates for the most distant galaxies ever observed (Bouwens et al. 2010a; Yan et al. 2010a; Oesch et al. 2010; McLure et al. 2010; Finkelstein et al. 2010, etc.) from the ultra-deep WFC3 imaging (Illingworth et al. PID GO-11563) of the Hubble Ultra Deep Field (HUDF; Beckwith et al. 2006). The less deep but wider-area broadband data from the Early Release Science (ERS) II (PI O’Connell, PID GO–11359) program have also been used to study high-redshift candidates (Wilkins et al. 2010; Labbe et al. 2010; Bouwens et al. 2010b; Yan et al. 2010b) and UV-dropout galaxies (Hathi et al. 2010). Windhorst et al. (2010) describe the WFC3 ERS program in detail, which we summarize in Section 2.

In addition to the broadband data used for most of these studies, the ERS II program also consists of one field observed with both the G102 (0.8–1.1 $\mu$m; $R \simeq 210$) and G141 (1.1–1.6 $\mu$m; $R \simeq 130$) infrared grisms (described in detail below). van Dokkum & Brammer (2010) report on a bright $z = 1.9$ compact galaxy in the ERS grism data. Here, we present emission-line galaxies (ELGs) from the WFC3 ERS grism observations, demonstrating the unique capability of this instrument for detecting star-forming galaxies in the infrared reaching magnitudes $m_{AB}(F098M) \simeq 25$ mag with only two orbits of HST time. By searching for emission lines in the infrared grism data, we are able to push detection of these galaxies and subsequent measurement of their physical properties to redshifts $z \simeq 2.0$. Grism studies with HST’s Advanced Camera for Surveys (ACS) G800L grism have proven successful at detecting ELGs in the optical (Meurer et al. 2007; Straughn et al. 2008, 2009; Xu et al. 2007; Pirzkal et al. 2006), and here we extend these studies of ELGs to the infrared.

2. DATA

The ERS II program for WFC3 consists of both UV and IR observations of about 30% of the GOODS-South field (Giavalisco et al. 2004). Here we summarize the ERS II program; Windhorst et al. (2010) present the ERS II data reduction effort in detail. Eight pointings were imaged with the UVIS channel (UV filters F225W, F275W, and F336W) at depths of 2 orbits/pointing/filter for F225W and F275W and 1 orbit/pointing for F336W) and ten with the IR channel (filters F098M, F125W, F160W) at 2 orbits/pointing/filter. Grism observations of one WFC3 pointing (cf. Figure 1) were performed using the infrared “blue” G102 grism ($R \simeq 210$) and the “red” ($R \simeq 130$) G141 grism, providing spectral coverage from 0.8 to 1.6 $\mu$m at 2 orbits/grism depth.

The WFC3 IR channel has a field of view of 4.65 arcmin$^2$ at a resolution of 0.19 arcsec pixel$^{-1}$. The ten $5 \times 2$ grid pattern

![Figure 1. ERS II Layout in GOODS-South. Gray area is ACS GOODS-South with tile numbers for that dataset. Yellow areas are the five ACS PEARS grism fields; the black box is ACS HUDF. The WFC3 ERS II UVIS fields are outlined in blue and WFC3 ERS II IR fields are outlined in red. The green box is the WFC3 ERS II IR grism field.](image-url)
include information about the associated errors and contamination by spectra of neighboring objects. The trace and wavelength calibration used by aXe to extract the spectra was based on the first in-orbit calibration observations (Kuntschner et al. 2009a, 2009b).

3.1. Source Selection

We visually examined all emission-line candidate sources located in the ERS grism field; many ELGs with prominent emission lines detected in PEARs with the G800L grism also have lines in the infrared. In addition to previously detected PEARs ELGs, there are also sources in the field in which the strongest emission lines lie exclusively in the infrared and so were not detected in PEARs. We used standard Gaussian fitting techniques to measure emission line fluxes and calculate star formation rates (SFRs) based on the line luminosities, as described in the following Section. ELGs that have line flux measurements with S/N ≥ 2 are retained in the final catalog (Table 1); 83% of the lines have S/N ≥ 3. Whereas the PEARs pre-selected galaxies by definition have more than one line—and therefore line identifications based on the line wavelength ratio are unambiguous and in some cases already determined by the ACS grism spectra—a small number of ERS II ELG candidates only have one emission line. For these sources, spectroscopic and photometric redshift catalogs (Grazian et al. 2006; Wuyts et al. 2008; Balestra et al. 2010; Vanzella et al. 2008) are consulted in order to determine if the source has a previously measured redshift. If it does, line identification is accomplished via this redshift and a grism-spectroscopic redshift (S. H. Cohen et al. 2010, in preparation; Xia et al. 2010) is calculated based on the line identification. If it does not, the line remains unidentified (see Table 1). However, 60% of the ELGs have two or more emission lines, and therefore it is straightforward to assign line identifications based on the emission line wavelength ratio. The fraction of objects with two lines in the spectra is considerably higher than in the PEARs studies (where the fraction of sources with two lines was ≃ 30%) for two main reasons. First, the wavelength range for both the G102 and G141 is longer by a factor of more than 2, and second, the higher spectral resolution afforded by both WFC3 grisms allows detection of lines not previously seen in the G800L observations, namely, [S ii] at λλ 6716 + 6731 Å is now sufficiently resolved from Hα (Figure 2) and [S iii] at λλ 9069, 9532 is detected in several sources as well. Additionally, the higher resolution allows in some cases Hβ and the two [O iii] lines at λ4959 and λ5007 to be detected ([O iii] at λλ 4959, 5007 can be marginally resolved in some cases; see Figure 3). This higher resolution allows, e.g., a line identification in the extremely faint (continuum) Object 397, which has no other significant line detections in the spectrum. Four objects in the sample are also X-ray sources and likely active galactic nucleus (AGN; Szokoly et al. 2004); these are noted in Table 1.

4. RESULTS

4.1. ERS II Emission-line Galaxy Sample

Our final catalog of WFC3 ERS II ELGs contains 48 galaxies with a total of 73 emission lines. Of these, 29 are Hα, 27 [O iii], 6 [O ii], 2 [S ii], 2 [S iii], λ9069, 2 [S iii], 9532, and five unidentified lines (see Table 1). The average redshift of these galaxies is z = 1.200 with a redshift range of z = 0.227−2.315 (Figure 4). The galaxies’ broadband F098M magnitudes span mAB(F098M) = 18.67−26.87 mag with an average magnitude mAB(F098M) = 23.65 mag. The faintest continuum magnitude source is Object 103 (mAB(F098M) = 26.87 mag) at redshift z = 1.680 with both [O ii] and [O iii] detected.

The ERS grism pointing lies completely within PEARs-South Field 4, and a total of 25 PEARs-detected ELGs fall into this field. Thirteen of these have emission lines in the G102/G141 bandpasses with fluxes meeting the S/N ≥ 2

Figure 2. Three example grism spectra for ELGs (Table 1 Objects 370, 258, and 454 from top to bottom) pre-selected from the ACS PEARs grism ELG study of Straughn et al. (2009). The ACS G800L data are shown in green; WFC3 G102 in black, and WFC3 G141 in red. The ACS G800L fluxes have been scaled in black, and WFC3 G141 in red. The ACS G800L fluxes have been scaled for visual purposes to match the WFC3 data. Compared to ACS G800L, the higher-resolution WFC3 grisms allow the detection of the [S ii] and [S iii] lines. (A color version of this figure is available in the online journal.)
### Table 1  
Global Properties of ELGs

| ID      | R.A. (deg) | Decl. (deg) | AB(F098M) (mag) | Wavelength (Å) | Flux $(10^{-18}$ erg s$^{-1}$ cm$^{-2}$) | EW (Å) | Line ID | SFR (M$_\odot$ yr$^{-1}$) | Grism Flag | Redshift |
|---------|------------|-------------|------------------|----------------|----------------------------------------|--------|---------|--------------------------|------------|----------|
| 432     | 53.0484200 | -27.7095337 | 24.45            | 12850          | 94.7 ± 18                              | 114    | [O III] | 19.7 ± 3                 | 1          | 1.573    |
| 499     | 53.0515862 | -27.7047272 | 25.06            | 16226          | 44.5 ± 12                              | 199    | Hα     | 4.8 ± 1                  | 1          | 1.472    |
| 370     | 53.0551300 | -27.7113667 | 19.51            | 8080           | 1140.5 ± 91                            | 62     | [O III] | 23.7 ± 1                 | 1          | 0.610    |
| 1056    | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 1555    | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 186     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 262     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 226     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 316     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 238     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 336     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 186     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 262     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 226     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 316     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 238     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 336     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 186     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 262     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 226     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 316     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 238     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 336     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 186     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 262     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 226     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 316     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 238     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |
| 336     | 53.0555876 | -27.7234249 | 23.23            | 11436          | 129.1 ± 38                             | 189    | [O III] | 16.5 ± 4                 | 1          | 1.294    |

*Note: All values are approximate and subject to measurement errors.*
Table 1 (Continued)

| ID     | R.A. (deg) | Decl. (deg) | AB (F098M) (mag) | Wavelength (Å) | Flux \(10^{-18} \text{erg}^{-1} \text{s}^{-1} \text{cm}^{-2}\) | EW (Å) | Line ID | SFR \(M_\odot \text{yr}^{-1}\) | Grism Redshift |
|--------|------------|-------------|------------------|----------------|----------------------------------|--------|---------|---------------------|----------------|
| 3a     | 53.0825462 | -27.6896439 | 18.67            | 8054           | 858.4 ± 203                      | 40     | Hα      | 1.0 ± 0          | 0.227           |
| 418    | 53.0848389 | -27.7014771 | 24.92            | 14051          | 182.6 ± 31                       | 344    | [OIII]   | 53.9 ± 9         | 1.813           |
| 437    | 53.0855865 | -27.6999226 | 24.70            | 14053          | 88.6 ± 26                        | 501    | [OIII]   | 26.2 ± 7         | 1.814           |
| 258    | 53.0857124 | -27.7113400 | 24.32            | 9998           | 115.9 ± 31                       | 65     | [OIII]   | 7.9 ± 2          | 0.998           |
| 416    | 53.0860062 | -27.7011986 | 24.26            | 13111          | 38.4 ± 10                        | 99     | Hα      | 1.6 ± 0          | 0.998           |
| 146    | 53.0872955 | -27.7184486 | 24.44            | 11539          | 50.2 ± 24                        | 159    | [OIII]   | 6.7 ± 3          | 1.309           |
|        |            |             |                  | 15156          | 46.1 ± 11                        | 138    | Hα      | 3.7 ± 0          | 1.309           |

Notes. No data in the case of fluxes (and EW, SFR) indicate that the spectrum had a high level of contamination, but wavelengths were secure enough to warrant redshift determination. In the case of line IDs, no data indicates that no suitable line ID was found for the given input redshift. "Grism Redshift" column gives recalculated redshift based on the line identification. "Flag" column gives source of input redshift used for line identification, where used: 1—two lines visible in the spectrum, no prior redshift needed; 2—one single line in the spectrum, line ID and grism redshift based on prior spectroscopic redshift; 3—one single line in the spectrum, line ID and grism redshift based on prior photometric redshift.

a CDF-S X-ray sources identified as an AGN by Szokoly et al. (2004).

b New spectroscopic redshift (no previous photometric or spectroscopic redshift measurements).

4.2. Star Formation in ERS II ELGs

The longer wavelength range over which to detect emission lines provides more sources with multiple lines that can be used in calculating SFRs. In particular, Hα—the emission line which yields the most direct and secure SFR estimate (e.g., Kennicutt 1998)—is now observed in 29 sources. Given the low resolution of the grism spectra, some contribution from [NII] λλ6548, 6584 will be present in the measured Hα line fluxes due to the blending of the lines. The strength of this contribution in general galaxy samples varies from a few percent to factors of 0.3–0.5 for particularly massive and metal-rich galaxies (Jansen et al. 2000; Gallego et al. 1997; Kennicutt 1992). Because of this wide variation owing to differences in effective temperature, ionization, and metallicity, we do not adopt a global [NII] correction and instead note that the Hα fluxes presented here are likely overestimates. For each of the ELGs, we calculate SFRs via the prescription of Kennicutt (1998) for Hα and [OIII]. Using the [OIII] line to arrive at an SFR is less secure due to the effects of metallicity and gas temperature (Kennicutt et al. 2000; Kennicutt 1992). For eight of the ELGs in the sample, [OIII] is the only line measured in the spectrum, and thus we use the [OIII] SFR calibration from Straughn et al. (2009), which is derived from ELGs with both Hα and [OIII] in their spectra, and should be considered a lower limit. Figure 5 shows the SFR as a function of redshift for these galaxies, using Hα when available; then [OIII] and [OIII] in order of preference. The detection limit is evident in this plot; we see the expected bias toward higher SFRs at higher redshifts.

The broadband spectral energy distributions (SEDs), using 10 band WFC3 and ACS data from 0.2 to 1.7 μm, were fit to a grid of models using the derived redshifts listed in Table 1, yielding galaxy stellar masses (S. H. Cohen et al. 2010, in preparation). These Bruzual & Charlot (2003) models were generated assuming an exponentially declining star formation history and varying the time scale τ, internal extinction Av, and age. The specific star formation rates (ssSFRs; line-calculated SFR per unit stellar mass) of these galaxies are shown as a function of stellar mass in Figure 6, which is consistent with the general negative trend observed previously for galaxies at...
Figure 3. Three example grism spectra for ELGs with detected emission lines only in the IR grisms. Of note in the sample are intermediate redshift galaxies with extremely faint continuum fluxes and strong emission lines, as exemplified by Objects 402 and 397 here. The higher resolution of the WFC3 grisms allows the detection of the two \([\text{O} \text{ III}]\) \(\lambda \lambda 4959, 5007\) lines (though not resolved) along with \(\text{H} \beta\), providing a line identification for these faint sources with no previously measured redshifts.

(A color version and the complete figure set (42 images) are available in the online journal.)

Figure 4. Grism-spectroscopic redshift distribution of WFC3 ELGs. The \(\text{H} \alpha\), \([\text{O} \text{ III}]\), and \([\text{O} \text{ II}]\) emission lines are visible in the WFC3 grism bandpasses at redshifts \(0.2 \lesssim z \lesssim 1.6\), \(1.2 \lesssim z \lesssim 2.4\), and \(2.0 \lesssim z \lesssim 3.6\), respectively. The majority of galaxies have more than one emission line, allowing secure line identifications and grism redshift determination.

Figure 5. SFR for grism-detected sources as a function of redshift. SFRs are calculated from \(\text{H} \alpha\), \([\text{O} \text{ II}]\), and \([\text{O} \text{ III}]\) line fluxes in order of preference, as described in Section 4.3.

redshifts up to \(z \simeq 2\) (e.g., Feulner et al. 2005; Bauer et al. 2005; Erb et al. 2006; Elbaz et al. 2007; Noeske et al. 2007; Rodighiero et al. 2010, etc.). Since our sample is selected based on the presence of emission lines (and thus ongoing star formation) we do not expect to see the galaxies with much lower SFRs which would likely occupy the lower left area of Figure 6 (detection limits also affect the selection of low–SFR galaxies).

While the sample is clearly small due to the limited volume observed and we would likely miss any rare, high-mass, high-sSFR sources that might occupy the upper right area of Figure 6, previous studies using large galaxy samples including \(\text{Spitzer}\) IRAC 3.6 \(\mu\text{m}\) data indicate that these sources are in fact not missed in these studies, i.e., that the upper limit to the galaxies’ SFR as a function of mass is real (Noeske et al. 2007).

In Figure 7, we show the sSFR as a function of redshift in different mass bins, which is consistent with previous studies showing the trend of lower sSFR for higher mass galaxies as a function of redshift (e.g., Zheng et al. 2007; Damen et al. 2009; Rodighiero et al. 2010). While these previous studies investigating the sSFR as a function of redshift have made use of very large samples of galaxies from an array of large observational programs (COMBO-17, Zheng et al. 2007; SIMPLE-\(\text{Spitzer}\) IRAC and MUSYC, Fazio et al. 2004; Damen et al. 2009; GOODS, Dickinson et al. 2003; see also Martin et al. 2007 and Perez-Gonzalez et al. 2008), we have demonstrated here that the WFC3 IR grism data generally reflect these trends using only two orbits of \(\text{HST}\) time. Future observations of this...
type will serve to investigate these preliminary trends in a more statistically significant way.

5. SUMMARY

We detect a total of 73 emission lines from 48 galaxies in the ERS II grism field, allowing calculation of line fluxes, SFRs, and grism-spectroscopic redshifts. Thirteen of these galaxies had emission lines in the optical ACS G800L grism data and 35 are newly detected star-forming galaxies with emission lines in the infrared. We show the SFRs of these galaxies as a function of redshift and discuss trends involving SFRs and galaxy masses and redshifts. These data are consistent with previous studies showing that the sSFRs of the most massive ($M > 10^{11} M_\odot$) star-forming galaxies are generally lower than their lower mass counterparts as a function of redshift (Zheng et al. 2007; Damen et al. 2009). These data demonstrate the efficiency of the WFC3 grisms in detecting faint star-forming galaxies at $z \simeq 0.2–2.5$. This work sets the stage for larger area and deeper studies of star-forming galaxies with WFC3 in the future, which will serve to greatly increase the sample size and statistics, and will probe even fainter and less massive sources.

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