The cosmological evolution of AGN host galaxies to redshift z~4 with ZFOURGE

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1 Abstract

We present a new catalog of active galactic nuclei (AGN) candidates from the FourStar Galaxy Evolution Survey (ZFOURGE). To perform a thorough and unbiased investigation of AGN evolution, we make use of high-quality multi-wavelength photometry, resulting in the identification of 221 mass-limited AGN host galaxies in the UDS, COSMOS and CDFS legacy fields. This high-quality catalog will serve as a robust basis to conduct a detailed study of the relationship between AGN and their hosts to redshifts z ~ 4.

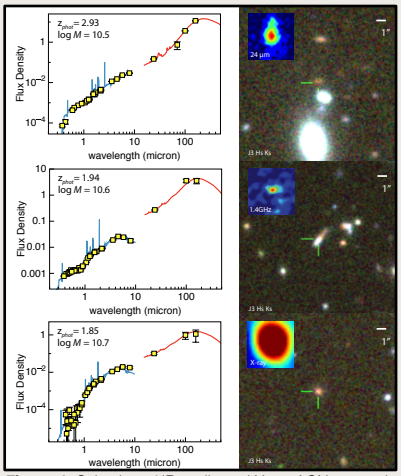

Figure 1: Selection of IR, radio and X-ray AGN spectral energy distributions and associated images

2 ZFOURGE Survey

ZFOURGE uniquely depends on deep near-infrared images taken with innovative medium-bandwidth filters equipped on the FourStar imager (Persson et al. 2013) on the 6.5m Magellan Baade telescope. These filters allow for more accurate wavelength sampling that bracket the rest-frame 4000Å/Balmer breaks, leading to more well constrained photometric redshifts than with broadband filters alone. The 5σ AB mag depths in these fields are ~26 in J_1, J_2 and J_3 and ~25 in H_s, H_l and K_s. More details of the ZFOURGE catalog will be provided in the forthcoming work of Straatman et al. (in prep).

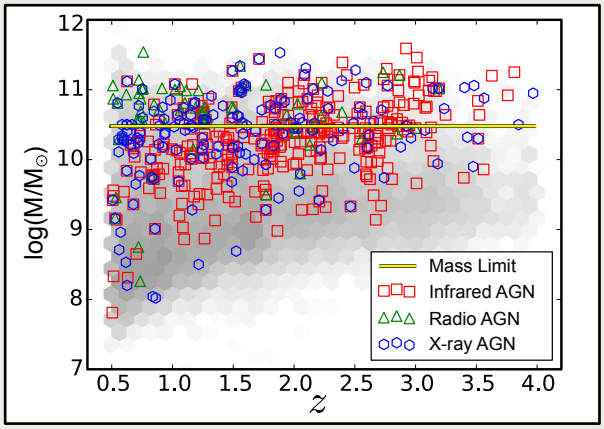

Figure 2: Preliminary galaxy stellar mass as a function of redshift for all ZFOURGE sources. The mass-completeness limit for ZFOURGE is shown as a yellow line.

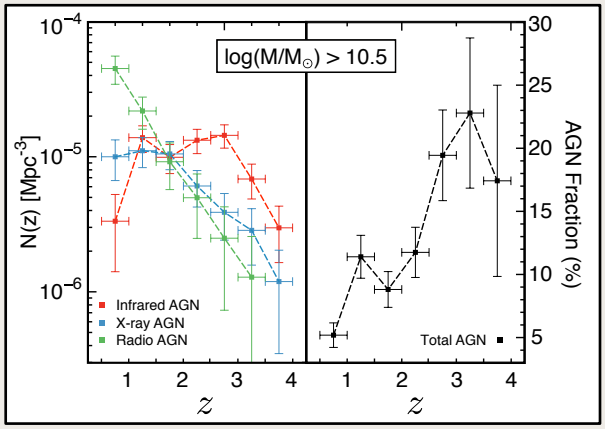

Figure 3: The comoving number density of our mass-limited AGN sample and the total AGN fraction as a function of redshift. Horizontal errors represent the redshift bin size, while the vertical errors are derived from Poisson statistics.

3 AGN Sample Selection

To mitigate selection bias, we adopt the latest AGN selection criteria and cross-match with multi-wavelength data sets. We briefly describe our methodology below:

Infrared AGN: A source within the colour-colour spaces defined by Messias et al. (2012) is identified as an infrared AGN.

Radio AGN: A source with $SFR_{Radio}/(SFR_{UV} + SFR_{MIPS}) > 3$ is identified as a radio AGN (Schinnerer et al. 2010; Miller et al. 2013; Rees et al. 2014; in prep)

X-ray AGN: A source with an X-ray luminosity of $L_{0.5\text{-}8}$ keV ≥ 10^{42} ergs s^{-1} is identified as a X-ray AGN (Ueda et al. 2008; Civano et al. 2012; Xue et al. 2011).

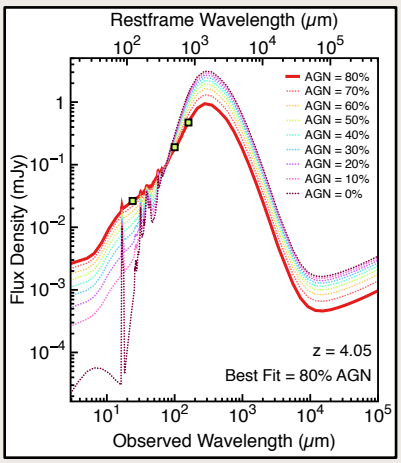

Figure 4: Best fit FIR SED template for a ZFOURGE AGN (Dale et al. 2014). The dotted lines portray different AGN contributions, normalised to 75μm.

4 Future Work

By combining ZFOURGE with new Herschel data, we will extend our sample out to z ~ 6 and analyse the far-infrared (FIR) properties of galaxies. The benefits are twofold: 1) ensuring AGN contamination does not impact other areas of high-redshift research, 2) allowing an in-depth study of the evolution and effects of AGN in the early Universe. Preliminary techniques involve the fitting of FIR data to AGN Spectral Energy Distribution (SED) templates (Dale et al. 2014) and decomposing AGN and starburst emissions to determine the total AGN contribution to a galaxy's SED. Figure 4 shows preliminary fits to FIR data for a z = 4.05 AGN. The fits are greatly aided by the high-quality ZFOURGE photometric redshifts.

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ZFOURGE Publications

1. FIRST RESULTS FROM ZFOURGE: DISCOVERY OF A CANDIDATE CLUSTER AT z = 2.2 IN COSMOS, Spitler, L.R., et al. 2012, ApJ, 748, L21
2. DISCOVERY OF LYMAN BREAK GALAXIES AT z ~ 7 FROM THE ZFOURGE SURVEY, Tilvi, V., et al. 2013, ApJ, 768, 56
3. GALAXY STELLAR MASS FUNCTIONS FROM ZFOURGE/CANDELS: AN EXCESS OF LOW-MASS GLAXIES SINCE z = 2 AND THE BUILDUP OF QUIESCENT GALAXIES, Tomczak A.R., et al. 2014, ApJ, 783, 85
4. A SUBSTANTIAL POPULATION OF MASSIVE QUIESCENT GALAXIES AT z ~ 4 FROM ZFOURGE, Straatman, C.M.S., et al. 2014, ApJ, 783, L14
5. EXPLORING THE z = 3 – 4 MASSIVE GALAXY POPULATION WITH ZFOURGE: THE PREVALENCE OF DUSTY AND QUIESCENT GALAXIES, Spitler, L.R., et al. 2014, ApJ, in press