The Evolution of Massive AGN Host Galaxies to z ~ 4 with ZFOURGE

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1 Abstract

We present preliminary measurements of the comoving space density of massive AGN host galaxies using a sample of 183 AGN identified in the UDS, COSMOS and CDFS legacy fields. Our mass-complete sample is constructed using deep near-infrared imaging from the Four Star Galaxy Evolution Survey (ZFOURGE), complemented with far infrared, radio and X-ray data. We find radio-selected AGN are more prevalent at z < 1.5 than X-ray and IR-selected AGN, of which the latter shows a steep decline towards the present epoch.

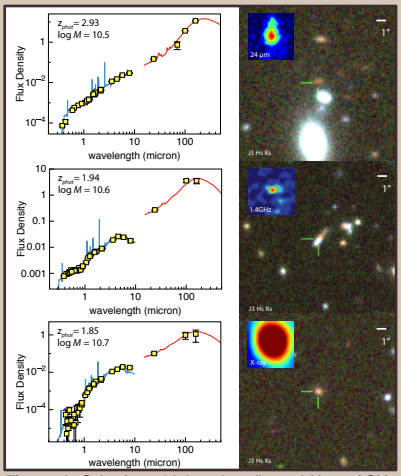

Figure 1: Selection of infrared, radio and X-ray AGN spectral energy distributions and associated images.

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 by bracketing 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 ZFOURGE will be provided in the forthcoming work of Straatman et al. (in prep).

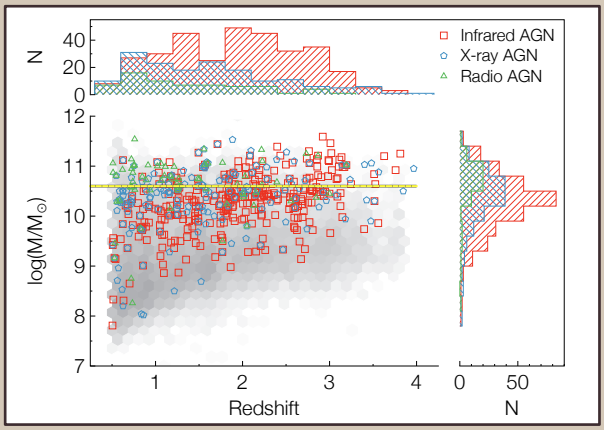

Figure 2: Host galaxy mass as a function of redshift for our **infrared**, **X-ray** and **radio**-selected AGN. We limit the sample to **stellar masses of log M/M$_\odot$ > 10.6**, where we estimate to be complete to z = 4.

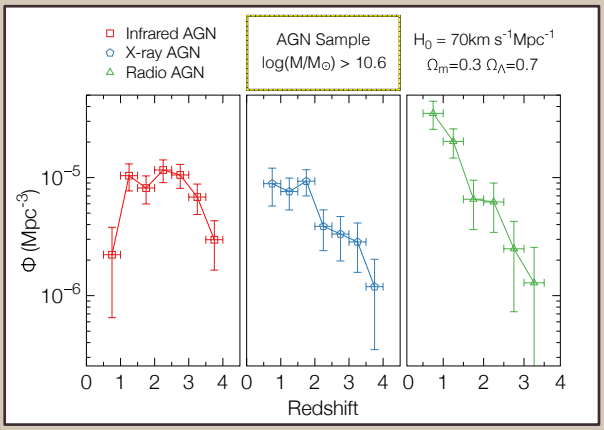

Figure 3: The comoving space density ($1/V_a$ method, Schmidt 1968) of our AGN sample as a function of redshift. Horizontal errors represent the redshift bin size, while the vertical errors are derived from Poisson statistics.

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.

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).

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).

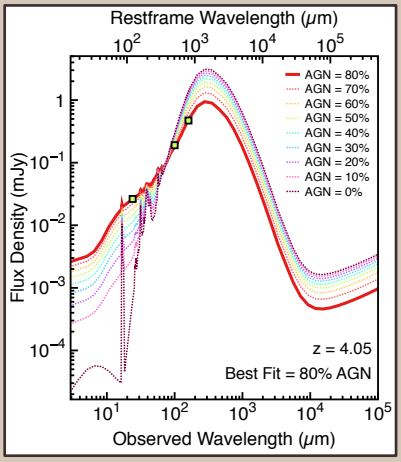

Figure 4: Best fit FIR SED template for a ZFOURGE AGN (Dale et al. 2014). The dotted lines portray the different fractional contribution of AGN infrared emission, normalised to 75μm.

4 Future Work

We plan to extend our sample out to a redshift of z ~ 6 to study the evolution of AGN in the early universe. Our initial focus will be on overcoming the challenge of distinguishing between the star-formation and accretion components in the energy budget of active galaxies at high redshifts. To achieve this, we will combine ZFOURGE data with new *Herschel* far-infrared photometry to assist with the decomposition of AGN and starburst emissions. Figure 4 shows preliminary fits to far-infrared data for a high redshift 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