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EXTREME EMISSION LINE GALAXIES IN CANDELS: BROAD-BAND SELECTED, STAR-BURSTING DWARF GALAXIES AT $Z > 1$

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ABSTRACT

We identify an abundant population of extreme emission line galaxies at redshift $z = 1.6 - 1.8$ in the Cosmic Assembly Near-IR Deep Extragalactic Legacy Survey (CANDELS) imaging from *Hubble Space Telescope/ Wide Field Camera 3* (HST/WFC3). 69 candidates are selected by the large contribution of exceptionally bright emission lines to their near-infrared, broad-band fluxes. Supported by spectroscopic confirmation of strong [OIII] emission lines – with equivalent widths ~ 1000Å – in the four candidates that have HST/WFC3 grism observations, we conclude that these objects are dwarf galaxies with $\sim 10^8\ M_\odot$ in stellar mass, undergoing an enormous star-burst phase with $M_*/\dot{M}_*$ of only ~ 10 Myr. The star formation activity and the co-moving number density (3.7×10^{-4} Mpc^{-3}) imply that strong, short-lived bursts play a significant, perhaps even dominant role in the formation and evolution of dwarf galaxies at $z > 1$. The observed star formation activity can produce in less than 5 Gyr the same amount of stellar mass density as is presently contained in dwarf galaxies. Therefore, our observations provide a strong indication that the stellar populations of present-day dwarf galaxies formed mainly in strong, short-lived bursts, mostly at $z > 1$.
Subject headings:

1. INTRODUCTION

The formation history of dwarf galaxies with masses $\sim 10^8\ M_\odot$ can usually only be studied through 'archaeological' age reconstruction, based on resolved stellar populations (e.g., Grebel 1997; Mateo 1998). Their high-redshift progenitors have so far remained elusive despite the ever increasing depth of spectroscopic observing campaigns and imaging from the ground and the *Hubble Space Telescope* (HST). In this Letter we identify an abundant population of $z > 1$ dwarf galaxies undergoing extreme star bursts, through HST/ *Wide Field Camera 3* (WFC3) imaging from the Cosmic Assembly Near-IR Deep Extragalactic Legacy Survey (CANDELS, Grogin et al. 2011; Koekemoer et al. 2011), that may well be the progenitors of present-day dwarf galaxies with stellar masses $\sim 10^8 - 10^9\ M_\odot$.

At the present day, star bursts contribute a minority to the total star formation activity in dwarf galaxies (Lee et al. 2009). However, there is abundant evidence that the the star formation histories are complex and that bursts play an important role (as reviewed by Mateo 1998). Many authors find evidence for short-lived (∼10 Myr) SF events in nearby star-forming dwarf galaxies from a range of observational and modeling techniques (e.g., Schaerer et al. 1999; Mas-Hesse & Kunth 1999; Thornley et al. 2000; Tremonti et al. 2001; Harris et al. 2004), while others argue that star formation epochs are more prolongued (e.g., Calzetti et al. 1997; Lee 2008; McQuinn et al. 2009). Simulations also indicate that star formation histories of low-mass galaxies are episodic or even burst-like (e.g., Pelupessy et al. 2004; Nagamine 2010).

As most stars in dwarf galaxies formed more than 5 Gyr ago (e.g., Dolphin et al. 2005; Weisz et al. 2011), it is crucial to understand the mode of star formation in dwarf galaxies at those early epochs, but 'archaeological' studies do not have the resolution in terms of stellar population age to constrain strengths, durations, and frequency of bursts. The increased frequency of interaction with other galaxies and higher gas fractions at $z > 1$ may have resulted in strong, short-lived star bursts. In this Letter we address the open question of how many and how frequently strong, short-lived star bursts occur in dwarf galaxies at $z > 1$, and how relevant this mode of star formation is for the build-up of the dwarf galaxy population in a cosmological context.

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