Rest-frame optical-UV properties of luminous high redshift (z∼5) LBGs: Young Galaxies in the Early Universe

Aprajita Verma[1,2], Matthew D. Lehnert[1], Natascha M. Förster Schreiber[1], Malcolm N. Bremer[3], Laura Douglas[3]

[1] *Max Planck Institut für extraterrestrische Physik, Postfach 1612, D-85741 Garching, Germany*
[2] *Astrophysics, Department of Physics, Denys Wilkinson Building, Keble Road, Oxford OX1 3RH, UK*
[3] *H H Wills Physics Laboratory, University of Bristol, Tyndall Avenue, Bristol BS8 1TL, UK*

Abstract

High redshift galaxies play a key role in our developing understanding of galaxy formation and evolution. Since such galaxies are being studied so soon after the Big Bang, within a Gyr, they provide a unique probe of the physics of one of the first generations of large-scale star-formation. We describe a comprehensive observational program to study high redshift galaxies selected from deep optical imaging surveys complemented by infrared data and follow-up spectroscopy. Using the Lyman break technique, we have identified a sample of high-redshift galaxies in several deep fields (public and our own) within which candidates (>50) have been spectroscopically confirmed to lie at z>5. Through a combination of deep, high resolution imaging data at visible wavelengths from the VLT and HST with high sensitivity infrared imaging data from Spitzer-IRAC, we have determined the rest-frame optical and UV SEDs of a significant number of z>5 galaxies, derived their physical properties and estimated the comoving mass and star formation rate densities of this sample. While we have found a diverse population, the characteristic properties of this sample differ from LBGs at z∼3 of comparable luminosity. At redshift z∼5, LBGs are typically ∼few$\times 10^9 M_\odot$, a factor of ten less massive than at z∼3; and the majority (two-thirds) are young (<100Myr), whereas only a small fraction of z∼3 LBGs have such young ages. These young and moderately massive z∼5 galaxies are "in formation" meaning that most of the their star-formation has likely occurred during the last few crossing times. They emit significant amounts of ionising radiation but are typically so young as to not to have contributed much to reionization before z∼6-7.