ESO Phase 3 Data Release Description

Data Collection	High_z_supernova_spectra
Release Number	1
Data Provider	B. Leibundgut and S. Blondin
Date	30.06.2011 – update 04.03.2014

ESSENCE/FORS1 High-z Type Ia Supernovae Data Release 2

Abstract

The ESSENCE Survey was initiated to determine the nature of the "dark energy" that causes the accelerated expansion of the universe by determining its equation-of-state parameter, w. We aim to answer a simple, but very important, question: is the dark energy of the universe consistent with a cosmological constant (w=-1)? If not, this means the dark energy must be a more general energy field such as "quintessence."

Over the six-year period of the survey (2002-2007) we have discovered and followed-up ~200 Type Ia supernovae (SNe Ia) over a large redshift range (out to z~0.8). To properly identify these SNe Ia and determine their redshift, we have carried out optical long-slit spectroscopy using the FORS1 instrument of the VLT at ESO's Cerro Paranal Observatory, Chile. These spectra were obtained under program IDs 170.A-0519 and 176.A-0319 (PI Leibundgut).
In this release, we present a revised version of the public dataset FORS1 - ESSENCE high-z Type Ia Supernovae (April 2005), obtained under program ID 170.A-0519 and published by Matheson et al. 2005 (2005AJ....129.2352M). We also present spectra of one additional high-redshift SN Ia obtained under program ID 176.A-0319 and published by Blondin et al. 2008 (2008ApJ...682..724B). The entire spectroscopic data set will be published in two forthcoming papers (Foley et al.; Blondin et al. -- in preparation).

More information on the ESSENCE survey can be found at the ESSENCE web page and in the following refereed publications:

- "Spectroscopy of High-Redshift Supernovae from the ESSENCE Project: The First 2 Years", Matheson et al. 2005 (2005AJ....129.2352M)
- "Hubble Space Telescope Observations of Nine High-Redshift ESSENCE Supernovae", Krisciunas et al. 2005 (2005AJ....130.2453K)
- "The ESSENCE Supernova Survey: Survey Optimization, Observations, and Supernova Photometry", Miknaitis et al. 2007 (2007ApJ...666..674M)
- "Observational Constraints on the Nature of Dark Energy: First Cosmological Results from the ESSENCE Supernova Survey", Wood-Vasey et al. 2007 (2007ApJ...666..694W)
- "Scrutinizing Exotic Cosmological Models Using ESSENCE Supernova Data Combined with Other Cosmological Probes", Davis et al. 2007 (2007ApJ...666..716D)
- "Exploring the Outer Solar System with the ESSENCE Supernova Survey", Becker et al. 2008 (2008ApJ...682L..53B)

The Archive Science Group migrated the ESSENCE DR2 to the Phase 3 infrastructure allowing seamless publication with the Science Data Products. Although it was possible to recover the

information needed for most of the files, ASG would like to inform the archive users that for 7 science data products (1D-spectra) out of 54 files, the header keywords MJD-END, PROVi and the related NCOMBINE, TMID and TELAPSE values may not be correct.

The files possibly affected are listed at the end of this document. The original file name information is recorded in the ORIGFILE header keyword of the FITS files.

Layout of Observations

Description of the ESSENCE search fields and supernova candidates can be found at the ESSENCE web page.

Release content

The spectra were obtained with a 1" slit and the 300V grism (+GG435 filter), yielding a wavelength coverage of ~4350-8950 Å sampled at roughly 2.6 Å/pixel. For one SN Ia we obtained two spectra with the 300I grism (+OG590 filter), yielding a wavelength coverage of ~6350-10350 Å sampled at roughly 2.5 Å/pixel.

We include both the final, wavelength and flux-calibrated 1d spectra as well as the processed 2d spectra (overscan- and bias-corrected, trimmed, flat-fielded, and wavelength calibrated). When more than one spectra of a given object were obtained on a same UT date, we combined them into a single 1d spectrum, weighted by the exposure time.

Wavelength units for both the 1d and 2d spectra are Angstroms. However, the 1d spectra have a barycentric correction applied, while the 2d spectrum do not. The flux unit for the 1d spectra is 1e-15 erg/s/cm2/ Å (cf. BUNIT keyword in the FITS header).

Comparison to the previous release

The present data release (version 2.0) is composed of two parts, *(a)* the revised version of 52 spectra of 49 targets which were released for the first time in April 2005 as FORS1 - ESSENCE high-z Type Ia Supernovae (version 1.0), and, *(b)* 2 spectra of one additional high-redshift SN Ia obtained under program ID 176.A-0319 and published by Blondin et al. 2008 (2008ApJ...682..724B).

Release Notes

The 2d spectra were processed using standard IRAF routines. For supernova spectra that were heavily contaminated by the spectrum of the host galaxy, we extracted the 1d spectra using a two-channel iterative technique employing the Richardson-Lucy restoration method outlined in Blondin et al. 2005 (2005A&A...431..757B), and implemented in the IRAF code "specinholucy". For all other cases we used the standard "apall" routine in IRAF.

The (relative) flux calibration was performed using our own set of routines written in IDL; these are described by Matheson et al. 2008 (2008AJ....135.1598M). These routines also adjust the wavelength solution using sky emission lines and perform a barycentric correction. We used spectra of standard stars taken during the same night as the science spectrum for the flux calibration.

Finally, we manually remove residual signal from sky lines as well as cosmic rays to generate the final 1d spectrum.

The data reduction methods are described more thoroughly by Matheson et al. 2005 (2005AJ....129.2352M). This paper also includes redshifts and spectroscopic classifications for the objects included in this release.

Data format

For each object spectrum taken on a specific UT date we include both the 1d spectrum as well as the 2d spectrum (or spectra). When more than one spectra of a given object were obtained on a same UT date, we combined them into a single 1d spectrum, weighted by the exposure time. The FITS header contains all the relevant parameters for a given spectrum.

The following file naming convention has been adopted for all the 1d spectra:
`ESSENCE_FORS1_<ESSENCE ID>_<UT DATE>(_300I)_v2.0.fits` where `<ESSENCE ID>` is the internal ESSENCE object identification (e.g., D033), `<UT DATE>` is in YYYYMMDD format and `_300I` indicates the spectrum obtained with the 300I grism.

For the 2d spectra, files are named according to:
`ESSENCE_FORS1_<ESSENCE ID>_<UT DATE>(_300I)(_A,B,C)_v2.0.2D.fits`
where `_A,B,C` indicates multiple spectra of a given object taken on the same UT date.

Data retrieval

Go to the ESO Data Products query form: http://archive.eso.org/wdb/wdb/adp/phase3_main/form to find and retrieve the data from the ESO Science Archive. Just press the Search button to find all data belonging to this release, or specify search constraints to find a subset thereof.

Acknowledgements

When using data products provided in this release, we request acknowledgement of the ESSENCE Survey and a reference to the relevant publication indicated by the REFERENC keyword in the FITS header. Please also use the following statement in your articles when using these data:

Based on data products from observations made with ESO Telescopes at the La Silla or Paranal Observatories under ESO programme ID 170.A-0519 and 176.A-0319.

List of the 1-D spectra whit possible header keywords inconsistencies:

ESSENCE_FORS1_B013_20021206_v2.0.fits
ESSENCE_FORS1_D033_20031123_v2.0.fits
ESSENCE_FORS1_D058_20031031_v2.0.fits
ESSENCE_FORS1_D062_20031029_v2.0.fits
ESSENCE_FORS1_E022_20031121_v2.0.fits
ESSENCE_FORS1_E119_20031123_v2.0.fits
ESSENCE_FORS1_E132_20031122_v2.0.fits