DR2 Spectra Readme

Version 1.0, Nov 14, 2022 (Mike Koss Mike.koss@eurekasci.com for questions)

This is a summary of the spectral data. More detailed information can be found in the ApJS article describing the spectra. https://iopscience.iop.org/article/10.3847/1538-4365/ac6c05, Specifically section 3 and master observing table 8. All of the information from table 8 is in the fits header of each spectra.

The released DR2 spectra do not have all arrays of the initial spectra, and are limited to wavelength, flux, flux error (when recorded). In creating the final output spectra, we have limited the fits headers to those from the paper.

Please contact Mike.koss@eurekasci.com with questions and issues.

Overview

The DR2 release is limited to 1449 spectra for 70-month BAT AGN from the DR2 release ApJS special issue.

There are another ~700, 105 month BAT AGN spectra (part of the DR3), and ~400 DR2 (part of DR2 Beta). These will be released in subsequent publications.

NIR spectra will be part of a separate release.

Constructing a complete sample for your science study

The final 1449 DR2 spectra include spectra for 816/858 AGN. When combined with the DR1 spectra exist for 857/858 AGN. Some of these 816 AGN only had spectra with narrow wavelength ranges for velocity dispersion and those in the Galactic plane (<5 degrees) may be highly extincted. The study of 746 unbeamed AGN (Oh 2022) used 102 DR1 spectra (36 6DF spectra and 66 other DR1 spectra) and was able to have complete emission line coverage (Hbeta to NII) for 99.6%. We also provide a list of the DR1 spectra used in the Oh paper. In nearly all cases the S/N of DR2 spectra was better than DR1, so outside of this specific case of needing full wavelength coverage, users should use the DR2.

The raw ESO data (for Xshooter, FORS2, and a few MUSE and EFOSC2 spectra) can all be found on the specific ESO telescope bibliography page https://telbib.eso.org/detail.php?bibcode=2022ApJS..261....2K.

Flux Calibration and Flux Errors

While reduction programs provide errors, absolute flux calibration of spectra is challenging and systematic errors of 20-30% to account for varying PSFs should conservatively be considered. Outside of archival spectra (ARCH) nightly standards were used for all spectra.

Changes post submission

1. Post submission, an archival spectra from the ROSAT campaigns was found to have an incorrect wavelength solution, for BAT ID 619, so the number of spectra is 1448. Two other good spectra already exist for BAT ID 619.

File naming conventions

BAT1210_s1449_XSHO_b.fits

BAT ID: BAT ID from 70-month catalog (Table 1 for more info about the AGN). This includes each of the 858 AGN. Three dual AGN are included that would have been detected by BAT (1077B,112B, and 841B).

Spec ID: Row ID from master table in DR2 release (1449 rows). Each row is a unique spectra of an AGN, but may contain a blue and red side.

Instrument: 4 digit instrument code:
DBSP: Palomar/doublespec,
XSHO: Xshooter,
FORS: VLT/FORS2,
GMAN: SOAR/Goodman,
LRIS:, Keck/LRIS,
BNCH: Dupont/Boller and Chivens,
MAGE: Magellan/MagE,
MUSE: VLT/MUSE,
ARCH: Archival, variety of archival telescopes, typically from ROSAT surveys, please see master (table 7) for specific instruments setups.

Intra-instrument : b: blue side, for instruments with dichroic typically at <5500 Ang for Palomar/Doublespec and Xshooter, this also includes any spectrum that starts blueward 5500 Ang, r: red side.

Blue and red spectra

We did not typically combine blue and red spectra into a single spectra due to the varying instrumental resolutions and gaps near the dichroic. This leads to 2351 files including both blue and red. 1444 are blue files and 907 are red. 5 red spectra from DBSP are of high Galactic extinction (E(B-V)>2) sources and do not have a blue spectra since they were not detected.

Loading Spectra

The spectra have not been deredshifted to z=0 or corrected for Galactic Extinction. The units of all spectra are 10^-17 erg s^-1 cm^-2 A^-1.

Fits Headers

Here is an example image of the fits headers from the first spectrum. Below is a more detailed explanation of the different header values.

```
SIMPLE  =                    T / conforms to FITS standard
BITPIX  =                    8 / array data type
NAXIS   =                    0 / number of array dimensions
EXTEND  =                    T
BUNIT   = '10^(-17) erg/(cm^2 s Angstrom)' / Flux multiplier
SPECTRA =                    1 / Spectra number in DR2
BAT_ID  = '1       '           /
HIERARCH Telescope = 'APO     ' /
DIAMETER= '2.5m    '           /
HIERARCH Instrument = 'SDSS    ' /
FILE    = 'spec-7148-56591-0518.fits' /
HIERARCH File red = 'No data '           /
FLAGS   = '3611-10365'         / No data is no flags.
DATE    = '2013-10-26'         /
RANGE   = '3611-10365'         / Range in Angstrom
GRATING = 'SDSS    '           /
HIERARCH grating_red = 'No data ' /
R       = '1398    '           /
R_RED   = '2350    '           /
RES_BLUE= '3.6     '           / FWHM in Ang at 5000 Ang.
RES_RED = '3.6     '           / FWHM in Ang at 8500 Ang.
HIERARCH Slit Width = '2.0     ' / Arcsec
HIERARCH Slit Width Red = 'No data ' /
HIERARCH Slit length = '2.0     ' / Arcsec
HIERARCH Slit length red = 'No data ' /
HIERARCH Width kpc = '1.5     ' /
ANGLE   = '0       '           /
SEEING  = '1.36    '           / Seeing in arcsec.
AIRMASS = '1.34    '           /
EXPOSURE= '3611    '           / Total exposure in sec.
CRPIX   = 'No data '           /
CRPIXRED= 'No data '           /
BC      = '0.0     '           / Barycentric correction in km/s.
EBV     = '0.03    '           /
HIERARCH DR1_spectra? = 'BASS_DR1_0001.fits' /
HIERARCH DR1_source = 'SDSS    ' /
```

BAT ID: Catalog ID in the BAT survey.

Telescope, diameter, instrument: Name of observatory, its diameter, and instrument used.

File: Raw file associated with spectra. For telescopes with both a blue and a red side, two spectra are listed.

Flags: Any associated flags with calibration or spectral extraction. Star: indicates foreground stellar contamination, that a very nearby star (<2″) contributed to the emission despite a very small extraction region. Red: indicates that only the red side is extracted because the

Galactic extinction was so high (e.g., AV > 3) that no source is detected in the blue. Calibration: indicates that the object was observed under poor conditions or the standard star was observed on a different night, so spectral calibration may be more uncertain than usual. Tellurics: indicates that the spectrum suffers from worse-than-usual telluric correction or that the molecfit correction was unsuccessful. Shortblue: the setup has a shorter-than-normal blue wavelength coverage due to a reduction issue.

Date: UT date of observation.

Spectral Range: Range of the spectra in angstroms.
Grating: Name of associated grating or grism.

R and Res FWHM: Instrumental resolution and FWHM in Å.

Slit: Slit width in arcseconds.

Slit length: Extraction length along the slit in arcseconds. If multiple exposures were combined with optimal extraction (e.g., Palomar/DBSP), the average value is listed.

Angle: Position angle in degrees, measured east of north. In most cases the sources were observed at parallactic unless a nearby galaxy was observed in the same slit.

Seeing: Recorded seeing of observations. When possible we use the average seeing. We have not corrected the seeing observations to the observed air mass.

Exposure: Total exposure from all combined observations for the individual spectra.

CDELT: Pixel dispersion in Å pixel−1. Only included for spectra with linear dispersions (e.g., not the SDSS).

Airmass: Average air mass during observation.

BC: Barycenter correction in kilometers per second needed for Earth's motion based on observation time and observatory location. The computed correction should be added to any observed velocity to determine the final barycentric radial velocity. As this correction is small (e.g., <30 km s−1), it has not been applied to any catalog measurements in the DR2.

EBV: Atmospheric extinction.

DR1_spectra? : Name of DR1 spectra if available.

DR1_source: DR1 source of spectra. Note for either Palomar or the SDSS these are the same spectra.