ESO Science Archive Facility - Phase 3 Data Release Description
ESO programme MUSE library of stellar spectra, Data Release DR1
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MUSE Library of Stellar Spectra. DR1.

Abstract

We assembled a library of 35 high-fidelity MUSE stellar spectra for a subset of the stars part of the X-SHOOTER Spectral Library, covering the Hertzsprung-Russell diagram for both extragalactic and stellar studies. We verified the continuum shape of these spectra with synthetic broad-band colors derived from the spectra. We also report some spectral indices from the Lick system, derived from the new observations. The spectra span the range from ~4800 to ~9300 Angstrom, with a resolving power varying within this limits from 1750 to 3750.

Overview of Observations

The observations were carried out with the MUSE (Multi-Unit Spectroscopic Explorer) integral field unit spectrograph at the VLT in Apr-May 2017 in non-photometric conditions. Each star was observed six times, following the same offset pattern used for MUSE spectrophotometric standards to minimize any systematic effects (for HD 204155 this pattern was repeated twice).

Release Content

The 35 targets are listed in Table 1. The columns are: *(1-2)* target identifications; *(3)* spectral type; *(4)* RA and Dec. (J2000); *(5)* UT date and time of the start of the observation; *(6)* airmass range [sec(z)] spanned during the observations; *(7)* exposure time of a single exposure (each target was observed 6 times, except for HD 204155 which was observed 12 times); *(8)* spectrophotometric standard ID; *(9)* airmass of the standard (no range is shown because those observations lasted only a few seconds).

Table 1. Target list and log of observations.

ID1	**ID2**	**Sp. Type**	**RA Dec. (J2000)**	**UT DATE and TIME**	**sec(z)**	**Exp.Time (seconds)**	**Spectroph. Std. ID**	**sec(z) Std.**
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
HD 057060	...	O7e...	07:18:40.38 -24:33:31.3	2017-05-03 01:07	1.63-1.70	0.14	LTT3218	1.01
HD 064332	...	S	07:53:05.27 -11:37:29.4	2017-05-03 01:23	1.61-1.68	4.80	LTT3218	1.01
HD 067507	RU Pup	CNv...	08:07:29.83 -22:54:45.3	2017-05-03 02:00	1.68-1.76	7.68	LTT3218	1.01
HD 085405	Y Hya	C	09:51:03.72 -23:01:02.3	2017-05-03 02:17	1.21-1.23	1.94	LTT3218	1.01
HD 096446	...	B2IIIp	11:06:05.82 -59:56:59.6	2017-05-03 01:41	1.24-1.24	1.94	LTT3218	1.01
HD 099648	...	G8Iab	11:27:56.24 +02:51:22.6	2017-07-18 23:54	1.89-2.00	0.14	GD153	1.58
HD 099998	BS 4432	K3.5III	11:30:18.89 -03:00:12.6	2017-05-030 0:39	1.10-1.09	0.15	LTT3218	1.01
HD 100733	BS 4463	M3III	11:35:13.28 -47:22:21.3	2017-05-02 06:55	2.39-2.52	0.95	GD108	1.06
HD306799	CD-60 3636	M0Iab	11:36:34.84 -61:36:35.2	2017-05-02 23:17	1.38-1.37	3.86	GD108	1.06
HD 101712	...	M3Iab	11:41:49.41 -63:24:52.4	2017-04-18 06:59	1.84-1.89	4.79	EG274	1.06
HD 102212	BS 4517	M1III	11:45:51.56 +06:31:45.7	2017-05-03 00:53	1.20-1.19	0.15	LTT3218	1.01
HD 114960	...	K5III	13:13:57.57 +01:27:23.2	2017-04-01 07:35	1.35-1.39	1.93	GD108	1.23
IRAS 15060+0947	...	M9III	15:08:25.77 +09:36:18.2	2017-07-18 23:35	1.22-1.21	43.65	GD153	1.58
HD 147550	...	B9V	16:22:38.90 -02:04:47.5	2017-05-21 04:53	1.08-1.08	1.95	LTT7987	1.03
HD 160365	...	F6III	17:38:57.85 +13:19:45.3	2017-05-21 08:33	1.53-1.57	1.92	LTT7987	1.03
HD 160346	...	K3V	17:39:16.92 +03:33:18.9	2017-05-21 06:06	1.14-1.14	1.94	LTT7987	1.03
HD 163810	...	G3V	17:58:38.45 -13:05:49.6	2017-05-21 08:51	1.18-1.21	14.56	LTT7987	1.03
HD 164257	...	A0	18:00:07.32 +06:33:14.1	2017-05-21 09:07	1.45-1.49	1.92	LTT7987	1.03
[B86] 133	NSV 24166	M4	18:03:45.47 -30:03:00.7	2017-05-02 07:11	1.03-1.02	83.77	GD108	1.06
HD 167278	...	F2	18:14:33.65 +00:10:32.9	2017-05-21 09:22	1.35-1.39	7.72	LTT7987	1.03
HD 170820	...	K0III	18:32:13.11 -19:07:26.3	2017-05-28 09:43	1.31-1.32	3.87	LTT7987	1.08

HD 172230	...	A5	18:38:54.95 +06:16:14.8	2017-05-31 05:09	1.28-1.26	3.87	GD153	1.48
HD 173158	...	K0	18:43:45.31 +05:44:14.6	2017-05-31 05:25	1.25-1.23	6.78	GD153	1.48
HD 174966	...	A3	18:53:07.83 +01:45:19.7	2017-05-31 05:41	1.19-1.17	4.85	GD153	1.48
HD 175640	...	B9III	18:56:22.66 -01:47:59.5	2017-05-21 09:36	1.23-1.26	1.94	LTT7987	1.03
HD 179821	...	G5Ia	19:13:58.61 +00:07:31.9	2017-05-31 05:56	1.18-1.17	7.76	GD153	1.48
HD232078	...	K3IIp	19:38:12.07 +16:48:25.6	2017-05-31 07:12	1.35-1.34	9.67	GD153	1.48
HD 193256	...	A8Vn...	20:20:26.57 -29:11:28.8	2017-05-31 06:10	1.16-1.14	1.95	GD153	1.48
HD 193281A	...	A2III	20:20:27.88 -29:11:50.0	2017-05-31 06:10	1.16-1.14	1.95	GD153	1.48
HD 193281B	...	K2III	20:20:28.07 -29:11:47.2	2017-05-31 06:10	1.16-1.14	1.95	GD153	1.48
HD 193896	...	G5IIIa	20:23:00.79 -09:39:17.0	2017-05-31 06:25	1.19-1.17	1.94	GD153	1.48
HD 196892	...	F6V	20:40:49.38 -18:47:33.3	2017-05-31 06:42	1.15-1.13	7.78	GD153	1.48
HD200081	...	G0	21:01:22.42 -02:30:50.4	2017-05-31 06:55	1.28-1.25	6.77	GD153	1.48
HD204155	...	G5	21:26:42.91 +05:26:29.9	2017-05-31 07:26	1.37-1.29	7.72	GD153	1.48
HD209290	...	M0.5V	22:02:10.27 +01:24:00.8	2017-05-31 07:56	1.33-1.30	9.66	GD153	1.48

Release Notes

This is the first release of the MUSE spectral library. The spectra were transferred into barycentric reference system. The wavelength is in dry air. The spectra span the region from ~4800 to ~9300 Angstrom, with a resolving power varying within this limits from 1750 to 3750.

Data Reduction and Calibration

The data were processed with the ESO MUSE pipeline (version 2.6) and include all "standard" processing steps for a data cube: bias/dark subtraction, flat fielding, geometric distortion correction, wavelength calibration.

The 1-dimensional spectra were extracted within circular apertures with radii of 6 arcsec, and the sky was estimated within annuli with an inner radius of 7 arcsec and a width of 4 arcsec. A few stars were treated differently. For [B86] 133 we reduced the extraction aperture radius to 4 arcsec (keeping the sky annulus the same as for the majority of the targets) to avoid contamination from nearby sources - because the object is located in a crowded Milky Way bulge field. HD 193256 is close to the edge of the MUSE field of view, and the extraction apertures had to be smaller, with a radius 4.6 arcsec, the sky annulus had an inner radius of 4.6 arcsec and a width of 2 arcsec. HD 193281 is a binary with ~3.8 arcsec separation and the components cross-contaminate each other. To separate the two spectra we first extracted a combined spectrum of the two stars together with the same aperture and annulus as for the bulk of the stars. We then rotated each plane of the data cube by 180 degrees around the center of the primary and subtracted the rotated plane from the original non-rotated plane to remove the contribution of the primary at the location of the secondary. Subsequently, we extracted the spectrum of the secondary with an aperture with a radius of 1.2 arcsec and a sky annulus with an inner radius of 1.8 arcsec and a width of 4 arcsec. Finally, we decontaminated the spectrum of the primary by subtracting the spectrum of the secondary from the combined spectrum of the binary.

The 6 (or 12 in case of HD 204155) individuals spectra were combined and their errors were calculated as RMS of the combined spectra.

Data Quality

We verified the continuum shape of these spectra comparing the synthetic broadband colors derived from the spectra with actually measured broad band colours available form the literature and find an agreement to withing a few percent. The agreement between the individual exposures is also excellent, generally bellow a tenth of a percent – the typical S/N is in the range of 100-200.

Known issues

The absolute flux calibration is unreliable – the data were taken under non-photometric conditions.

Data Format

Files Types

The spectra are presented as standard 1-dimensional fits files containing: wavelength (in Angstrom), flux (in erg s^{-1} cm^{-2} $Ang.^{-1}$), and flux errors (in erg s^{-1} cm^{-2} $Ang.^{-1}$).
Each file is named following:
[*star_id*]_av.fits
where [*star_id*] is the identification label of the star listed in Table 1 (with spaces and special characters removed).

We include, as ancillary material, plots of the different exposures collected for each star and the corresponding X-SHOOTER Spectral Library spectrum (with the naming convention: [*star_id*].jpg, see Figures 2 and A.1 in Ivanov et al. 2019 for further details).

Acknowledgements

Any publication making use of this data, whether obtained from the ESO archive or via third parties, must include the following acknowledgment:

- "Based on data products created from observations collected at the European Organisation for Astronomical Research in the Southern Hemisphere under ESO programme(s) 099.D-0623(A)"

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- "This research has made use of the services of the ESO Science Archive Facility."

Detailed description of this data can be found in:

- Ivanov, V. D. et al. 2019, A&A, 629, 100: "MUSE library of stellar spectra."