LAMOST Data Release Two

Section 1. Overview

The Large Sky Area Multi-Object Fiber Spectroscopic Telescope (LAMOST) is a Chinese national scientific research facility operated by the National Astronomical Observatories, Chinese Academy of Sciences. It is special reflecting Schmidt telescope with 4000 fibers in a field of view of 20 deg2 in the sky. Until July 2014, LAMOST has completed its pilot survey which was launched in October 2011 and ended in June 2012, and the first two years of its regular survey which was initiated on September 2012. After this three-years-survey, we totally obtain 4,136,482 spectra, which consist of stars, galaxies, quasars and other unknown type[1−7]. Now, LAMOST has published these spectra online and perform its second data release (DR2) online (http://dr2.lamost.org/), and the data products released in DR2 include the following:

Spectra. - In general, there are 4,136,482 flux- and wavelength-calibrated, sky-subtracted spectra released publicly in the DR2. It includes 3,784,461 stars, 37,206 galaxies, 8,630 quasars, and 306,185 unknown objects, and these spectra cover the range 3690-9100 angstrom with a resolution of 1800[2−3] at 5500 angstrom.
Spectroscopic Parameters Catalogs. - In this data release, five spectroscopic parameters catalogs are also published. They consist of the LAMOST general catalog, the A type stars catalog, the A, F, G and K type stars catalog, the M dwarfs catalog and the observed plate information catalog. Besides the fifth catalog, other four catalogs all include 35 columns of basic spectroscopic information, for example, right ascension, declination, signal to noise ratio, magnitude, classification and redshift. In addition, the A type stars catalog publish line indices of eight spectral lines and four balmer line widths at 20% below the local continuum, the A, F, G and K type stars catalog provides effective temperature, surface gravity, and metallicity as well, and the M dwarfs catalog release the Halpha line equivalent width, ten line indices, one metallicity sensitive parameter and a flag which indicates whether or not exist magnetic activity. The the observed plate information catalog mainly publish nine basic plate information for all published plates.

The following section 2 will introduce released FITS file, including the naming and structure of FITS file. In the sub-section 2.1, we will describe the naming rule of LAMOST FITS file, and in the sub-section 2.2 and 2.3, we will explain the LAMOST FITS file structure, including the primary header and data array. The section 3 will introduce the four released parameter tables, and they are the LAMOST general catalog, the A type stars catalog, the A, F, G and K type stars catalog, the M dwarfs catalog and the observed plate information catalog separately, which are described in the sub-section 3.1, 3.2, 3.3, 3.4 and 3.5.

Section 2. FITS File Description

2.1 FITS File Designation

In this data release, over 4 million FITS file are published on-line, and they are named in the form of 'spec-MMMMM-YYYY_spXX-FFF.fits', where 'MMMMM' represents the local modified Julian day (LMJD) which is a non-negative integer, 'YYYY' is the plan identity string (PLANID), 'XX' indicates the spectrograph identity number which is between 1 and 16, and 'FFF' shows the fiber identity number which is in the range of 1 to 250[8]. In addition, we can also get the LAMOST designation for an object from the DESIG keyword, and it is named in the form 'LAMOST JHHMMSS.ss+DDMMSS.ss', where 'HHMMSS.ss' is right ascension in unit of HMS, and '+DDMMSS.ss' is declination in unit of DMS.

2.2 FITS File Structure

A FITS file shall be composed by a primary header data unit (HDU), a optional conforming extensions and other optional special records. A LAMOST FITS file in this release only contains the primary HDU, and it is followed by a primary data array. Sub-section 2.2.1 will introduce keywords in the primary header, and sub-section 2.2.2 will describe the primary data array.

2.2.1 Primary FITS Header

We reorganize keywords of the primary FITS header in this data release, and divided them into eight groups, which include mandatory keywords, file information keywords, telescope parameter keywords, observation parameter keywords, spectrograph parameters keywords, weather condition keywords, data reduction parameters keywords and spectra analysis results keywords. We will explain each keyword as follows.

2.2.1.1 Mandatory Keywords

Mandatory keywords are required in every Header Data Unit (HDU), and their value must be written in fixed format.

```
SIMPLE  =                    T /Primary Header created by MWRFITS v1.8
BITPIX  =                  -32 /
NAXIS   =                    2 /
NAXIS1  =                 3909 /
NAXIS2  =                    5 /
EXTEND  =                    T /Extensions may be present
```

SIMPLE Keyword — It is required to be the first keyword in the primary header of all FITS file. The value field shall contain a logical constant with the value T if the file conforms to this standard. This keyword is mandatory for the primary header and is not permitted in extension headers. A value of F signifies that the file does not conform to this standard.

BITPIX Keyword — The value field shall contain an integer, and it shall specify the number of bits that represent a data value. A value of -32 represents IEEE single precision floating point.

NAXIS Keyword — The value field shall contain a non-negative integer no greater than 999, representing the number of axes in the associated data array. A value of zero signifies that no data follow the header in the HDU.

NAXIS1 and NAXIS2 Keywords — The value field of these two indexed keywords shall contain a non-negative integer, representing the number of elements along axis n of a data array. The NAXIS1 keyword represents the number of wavelength array, i.e., the column number of the primary data array, and the NAXIS2 keyword indicates the row number of the primary data array.

EXTEND Keyword — The value field shall contain a logical value indicating whether the FITS file is allowed to contain conforming extensions following the primary HDU. This keyword may only appear in the primary header and must not appear in an extension header. If the value field is T then there may be conforming extensions in the FITS file following the primary HDU. This keyword is only advisory, so its presence with a value T does not require that the FITS file contains extensions, nor does the absence of this keyword necessarily imply that the file does not contain extensions[9] .

2.2.1.2 File Information Keywords

```
FILENAME= 'spec-56094-kepler05F56094_sp01-020.fits' /
AUTHOR  = 'LAMOST Pipeline'    / Who compiled the information
EXTEN0  = 'Flux Inverse Wavelength Andmask Ormask' /
N_EXTEN =                    1 / The extension number
EXTNAME = 'Flux    '           / The extension name
ORIGIN  = 'NAOC-LAMOST'        / Organization responsible for creating this file
DATE    = '2013-11-13T08:11:53' / Time when this HDU is created (UTC)
```

FILENAME Keyword — The value field shall contain a character string giving the name of this FITS file. Take the ‘ spec-56094-kepler05F56094_sp01-020.fits ‘ as an example, ‘56094’ is the local modified Julian day, ‘kepler05F56094’ is the plan ID, ‘sp01’ is the spectrograph ID, and ‘020’ is the Fiber ID.

AUTHOR Keyword — This keyword contains a string constant ‘LAMOST Pipline’, which represents the author who produce this file.

EXTEN0 Keyword — This keyword contains a string constant ‘Flux Inverse Subcontinuum Andmask Ormask’ explaining each row of the primary data array in a primary HDU.

N_EXTEN Keyword — The value field shall contain an integer giving the extension number of a FITS file.

EXTNAME Keyword — This keyword contains a character string to be used to distinguish among different extensions of the same type in A FITS file. Within this context, the primary array should be considered as equivalent to an IMAGE extension.

ORIGIN Keyword — This ORIGIN keyword contains a string constant ‘NAOC-LAMOST’, which indicates the Organization responsible for this FITS file. ‘NAOC’ represents the abbreviation of National Astronomical Observatories, Chinese Academy of Sciences.

DATE Keyword — The value field shall contain a character string giving the UTC time when this FITS file is created.

2.2.1.3 Telescope Parameter Keywords

```
TELESCOP= 'LAMOST  '           / GuoShouJing Telescope
LONGITUD=              117.580 / [deg] Longitude of site
LATITUDE=              40.3900 / [deg] Latitude of site
FOCUS   =                19964 / [mm] Telescope focus
CAMPRO  = 'NEWCAM  '           / Camera program name
CAMVER  = 'v2.0    '           / Camera program version
```

TELESCOP Keyword — This keyword contains a string constant ‘LAMOST’ giving the name of our telescope.

LONGITUD Keyword — The keyword contains a floating-point constant, which provide the longitude of Xinglong station where LAMOST is mounted on.

LATITUDE Keyword — The keyword contains a floating-point constant, which provide the latitude of Xinglong station.

FOCUS Keyword — The FOCUS keyword gives the telescope focus, and its unit is millimeter.

CAMPRO Keyword — The value field contain a string constant ‘NEWCAM’, which shows the name of camera.

CAMVER Keyword — The value field contain a character string, which gives the present camera program version.

2.2.1.4 Observation Parameter Keywords

```
DATE-OBS= '2012-06-15T19:06:53.23' / The observation median UTC
DATE-BEG= '2012-06-16T02:42:58.0' / The observation start local time
DATE-END= '2012-06-16T03:30:18.0' / The observation end local time
LMJD    =                56094 / Local Modified Julian Day
MJD     =                56095 / Modified Julian Day
LMJMLIST= '80775522-80775550'  / Local Modified Julian Minute list
PLANID  = 'kepler05F56094'     / Plan ID in use
RA      =        291.161958000 / [deg] Right ascension of object from input catalog
```

```
DEC     =        36.9413330000 / [deg] Declination of object from input catalog
RA_OBS =        291.161958000 / Fiber pointing RA during observation
DEC_OBS =        36.9413330000 / Fiber pointing DEC during observation
OFFSET =            F   / Whether there is a fiber offset during observation
DESIG   = 'LAMOST J192438.86+365628.7' / Designation of LAMOST target
FIBERID =                   20 / Fiber ID of Object
CELL_ID = 'F0413   '           / Fiber Unit ID on the focal plane
X_VALUE =       -35.6488302210 / [mm] X coordinate of object on the focal plane
Y_VALUE =        788.595269846 / [mm] Y coordinate of object on the focal plane
OBJNAME = '224754452945158'    / Name of object
OBJTYPE = 'P       '           / Object type from input catalog
OBJSOURC= 'JianningF'          / Name of input catalog
T_INFO  = 'NULL    '           / Target information
T_FROM  = 'P       '           / Target catalog
FIBERTYP= 'Obj     '           / Fiber type of object
MAGTYPE = 'Kp      '           / Magnitude type of object
MAG1    =                15.67 / [mag] Mag1 of object
MAG2    =                99.00 / [mag] Mag2 of object
MAG3    =                99.00 / [mag] Mag3 of object
MAG4    =                99.00 / [mag] Mag4 of object
MAG5    =                99.00 / [mag] Mag5 of object
MAG6    =                99.00 / [mag] Mag6 of object
MAG7    =                99.00 / [mag] Mag7 of object
OBS_TYPE=                    0 / The type of target (OBJ, FLAT, ARC or BIAS)
OBSCOMM =                    0 / Science, Test
RADECSYS= 'FK5     '           / Equatorial coordinate system
EQUINOX =              2000.00 / Equinox in years
EXPID01= '01b-20111024193352-4-80436692' / ID string for blue exposure 1
EXPID02= '01b-20111024201936-5-80436737' / ID string for blue exposure 2
EXPID03= '01b-20111024205711-6-80436775' / ID string for blue exposure 3
EXPID04= '01r-20111024193400-4-80436692' / ID string for red exposure 1
EXPID05= '01r-20111024201945-5-80436737' / ID string for red exposure 2
EXPID06= '01r-20111024205720-6-80436775' / ID string for red exposure 3
LAMPLIST= 'lamphgcdne.dat'     / Arc lamp emission line list
SKYLIST = 'skylines.dat'       / Sky emission line list
NEXP    =                    2 / Number of valid exposures
NEXP_B  =                    2 / Number of valid blue exposures
NEXP_R  =                    2 / Number of valid red exposures
EXPT_B  =              2400.00 / [s] Blue exposure duration time
EXPT_R  =              2400.00 / [s] Red exposure duration time
EXPTIME =              2400.00 / [s] Minimum of exposure time for all cameras
BESTEXP =             80775522 / MJM of the best exposure
SCAMEAN =                 8.87 / [ADU] Mean level of scatter light
```

`DATE-OBS` Keyword — The value field shall contains a character string, which gives the median moment UTC of multiple exposures.

`DATE-BEG` Keyword — The value field shall contains a character string giving the observation start Beijing Time.

`DATE-END` Keyword — The value field shall contains a character string, which provide the observation end Beijing Time.

`LMJD` Keyword — The value field shall a non-negative integer giving the local modified Julian day.

`MJD` Keyword — The value field shall a non-negative integer giving the modified Julian day.

`LMJMLIST` Keyword — The value field shall contains a character string, which shows a list of local modified Julian minute of n times exposures.

`PLANID` Keyword — The value field shall contains a character string providing the plan name of the target.

`RA` Keyword — The value field shall contains a non-negative real floating-point number, which gives the right ascension of target from the input catalog.

`DEC` Keyword — The value field shall contains a non-negative real floating-point number, which gives the declination of target from the input catalog.

`RA_OBS` Keyword — The value field shall contains a non-negative real floating-point number, which gives the pointing right ascension of target during observation. This keyword is new in DR2.

`DEC_OBS` Keyword — The value field shall contains a non-negative real floating-point number, which gives the pointing declination of target during observation. This keyword is new in DR2.

`OFFSET` Keyword — The value field shall contains a boolean value, T(ure) or F(alse), which indicates if there is a fiber-offset for the target. The fiber-offset usually applied for the very bright stars (r<11) to avoid CCD saturation. This keyword is new in DR2.

`DESIG` Keyword — The value field shall contains a character string, which indicates the name of LAMOST target. Like the name of SDSS target, numbers after the character 'J' and before '+' represents RA in unit of HMS , and numbers after the character '+' are DEC in unit of DMS.

`FIBERID` Keyword — The value field shall contains a non-negative integer between 1 and 250, which shows the fiber ID and shall be used together with the spectrograph ID.

`CELL_ID` Keyword — The value field shall contains a character string, which gives the fiber unit ID on the focal plane. LAMOST focal plane is divided into four quadrant named 'EFGH' respectively, the first character of this keyword represents the quadrant number, the first two numbers after the first character is the row number in this quadrant, and the next two numbers is the column numbers.

`X_VALUE` and `Y_VALUE` — Keywords Their value field shall contain two real floating-point numbers, which give X and Y coordinates of target on the focal plane.

`OBJNAME` Keyword — The value field shall contains character string, giving the name ID of object that determined by the RA, DEC and HTM method[10] .

OBJTYPE Keyword — The value field shall contains a character string giving the class of objects in input catalogs.

OBJSOURC Keyword — The value field shall contains a character string which shows the name of organization or person who submit input catalog.

T_INFO Keyword — The value field shall contains a character string which shows the target ID from SDSS, UCAC4, PANSTAR and other catalogue.

T_FROM Keyword — The value field shall contains a character string which shows input catalog submitted by an organization or a person determined by the tsource.

FIBERTYP Keyword — The value field shall contains a character string, giving the type of fiber assigned to this target. This keyword has six values, i.e., Obj, Sky, F-std, Unused, PosErr and Dead. Obj means the fiber is assigned to a object, including star, galaxy and so on. Sky indicates the fiber is allocated to take skylight. F-std shows the fiber is used to take the light of a flux calibration standard star. Unused, PosErr and Dead mean the fiber is not used, goes to a wrong position, or does not work respectively.

MAGTYPE Keyword — The value field shall contains a character string, which shows the magnitude type of a target.

MAG1 , MAG2 , MAG3 , MAG4 , MAG5 , MAG6 and MAG7 Keywords The value field shall contains a real floating-point number between 0 and 100, giving the associated magnitudes of MAGTYPE keyword. For example, The MAGTYPE keyword is 'ugrizjh', the MAG1, MAG2, MAG3, MAG4, MAG5, MAG6 and MAG7 keywords provide the magnitudes of u, g, r, i, z, j and h filter respectively.

OBS_TYPE Keyword — The value field shall contains a character string giving the type of observation targets, which include object, flat, bias and arc lamp.

OBSCOMM Keyword — The value field shall contains a character string constant representing the observation purposes , which includes observations used for science researches and kinds of tests.

RADECSYS Keyword — The value field shall contains a character string giving the equatorial coordinate system based on the J2000 position.

EQUINOX Keyword — The value field shall contains a real floating-point number giving the standard epoch used at present.

LAMPLIST Keyword — The value field shall contains a character string giving the file name of arc lamp emission line list, which is used in the process of wavelength calibration.

EXPID01 , EXPID02 , EXPID03 , EXPID04 , EXPID05 , EXPID06 ,...., EXPID0n Keywords — The value field shall contains a character string giving ID string for n/2 time red and blue exposures .

SKYLIST Keyword — The value field shall contains a character string giving the file name of sky emission line list, which is used in the process of sky subtraction.

NEXP , NEXP_B and NEXP_R Keywords — The value field of these three keywords shall contain three non-negative integers, which provide numbers of exposures, and numbers of valid blue and red exposures respectively.

EXPT_B and EXPT_R Keywords — The value fields of these two keywords shall contain two real floating-point numbers, which give exposure duration times of blue and red CCD.

EXPTIME Keyword — The value field shall contains a real floating-point, which gives the minimum of blue and red total exposures times.

BESTEXP Keyword — The value field shall contains a integer, which gives the MJM of a exposure with maximum signal and noise ratio in n time exposures.

SCAMEAN Keyword — The value field shall contains a real floating-point giving the mean level of scatter light, which is the average flux of regions where there is no fiber and is at the left and right edge of a two dimension spectra image.

2.2.1.5 Spectrograph Parameters Keywords

```
SPID    =                    1 / Spectrograph ID
SPRA    =              291.011 / [deg] Average RA of this spectrograph
SPDEC   =              37.1712 / [deg] Average DEC of this spectrograph
SLIT_MOD= 'x2/3    '           / Slit mode, x1 ,x2/3 or x1/2
```

SPID Keyword — The value field shall contains a non-negative integer numbers between 1 and 16, which provides the spectrograph ID.

SPRA and SPDEC Keywords — The value field of these two keywords shall contain two real floating-point numbers, which are the averages of RA and DEC of all objects in each spectrograph.

SLIT_MOD Keyword — The value field shall contains a character string giving the mode of slit, which includes x1, x2/3 and x1/2. At present, only mode x2/3 is available, which responds spectra resolution equals to 1800.

2.2.1.6 Weather Condition Keywords

```
TEMPCCDB=              -107.80 / [deg] The temperature of blue CCD
TEMPCCDR=              -111.45 / [deg] The temperature of red CCD
SEEING  =                 3.60 / [arcsecond] Seeing during exposure
MOONPHA =                27.34 / [day] Moon phase for a 29.53 days period
TEMP_AIR=                 2.9 / [deg] Temperature outside dome
TEMP_FP =                10.1 / [deg] Temperature of focal plane
DEWPOINT=                -12.8 / [deg] Temperature of dew point
DUST    = '        '           / Reservation
HUMIDITY=                0.00 /
WINDD   =                0.00 / [deg] Wind direction
WINDS   =                0.00 / [m/s] Wind speed
SKYLEVEL= '        '           / Reservation
```

TEMPCCDB Keyword — The value field shall contains a real floating-point number, which provides the temperature of blue CCD. The unit 'degree' represents centigrade degree.

TEMPCCDR Keyword — The value field shall contains a real floating-point number, which provides the temperature of red CCD. The unit 'degree' represents centigrade degree.

SEEING Keyword — The value field shall contains a real floating-point number giving seeing during exposure, which is calculated by manually measuring the full width at half maximum of guide star image.

MOONPHA Keyword — The value field shall contains a real floating-point number giving the moon phase.

TEMP_AIR Keyword — The value field shall contains a real floating-point number giving the temperature outside dome, which is measured by automatic weather

instrument. The unit ‘degree’ represents centigrade degree.

TEMP_FP Keyword — The value field shall contains a real floating-point number giving the temperature of focal plane, which is measured by automatic weather instrument. The unit ‘degree’ represents centigrade degree. This keyword is new in DR2.

DEWPOINT Keyword — The value field shall contains a real floating-point number giving the dew-point temperature, which is also measured by the automatic weather instrument. The unit ‘degree’ represents centigrade degree.

DUST Keyword — The value of this keyword is temporarily empty at present, because the dust measuring instrument is now in debugging, and we will write this parameters into fits header when problems are resolved.

HUMIDITY Keyword — The value field shall contains a real floating-point number between 0 and 1, which gives humidity in the air.

WINDD Keyword — The value field shall contains a real floating-point number which records the instantaneous wind direction when start exposure, and the direction of north is the 0 degree wind direction.

WINDS Keyword — The value field shall contains a real floating-point number which records the instantaneous wind speed when start exposure, and wind direction and speed are also measured also by the automatic weather instrument.

SKYLEVEL Keyword — This keyword is NULL now, because the instrument is debugging.

2.2.1.7 Data Reduction Parameters Keywords

```
 EXTRACT = 'aperture'           / Extraction method
SFLATTEN=                    T / Super flat has been applied
PCASKYSB=                    T / PCA sky-subtraction has been applied
NSKIES  =                   20 / Sky fiber number
SKYCHI2 =        2.47476156753 / Mean chi^2 of sky-subtraction
SCHI2MIN=        2.05070620446 / Minimum chi^2 of sky-subtraction
SCHI2MAX=        2.86502963170 / Maximum chi^2 of sky-subtraction
NSTD    =                    4 / Number of (good) standard stars
FSTAR   = '84-133-178-185'     / Fiber ID of flux standard stars
FCBY    = 'catalog '           / Standard stars origin (auto, manual or catalog)
HELIO   =                    T / Heliocentric correction
HELIO_RV=       -9.40252898307 / [km/s] Heliocentric correction
VACUUM  =                    T / Wavelengths are in vacuum
NWORDER =                    2 / Number of linear-log10 coefficients
WFITTYPE= 'LOG-LINEAR'         / Linear-log10 dispersion
COEFF0  =              3.56820 / Central wavelength (log10) of first pixel
COEFF1  =          0.000100000 / Log10 dispersion per pixel
WAT0_001= 'system=linear'      /
WAT1_001= 'wtype=linear label=Wavelength units=Angstroms' /
CRVAL1  =              3.56820 / Central wavelength (log10) of first pixel
CD1_1   =          0.000100000 / Log10 dispersion per pixel
CRPIX1  =                    1 / Starting pixel (1-indexed)
CTYPE1  = 'LINEAR  '           /
DC-FLAG =                    1 / Log-linear flag
```

EXTRACT Keyword — The value field shall contains a character string, which indicates the method of spectrum extraction. In LAMOST spectra reduction pipeline, only the aperture method is applied to spectra extraction.

SFLATTEN Keyword — The value of this keyword shall be Boolean, which represents whether or not use the super flat. In LAMOST spectra reduction pipeline, super flat is used to make the fiber-to-fiber relative efficiency around 1, and it can be estimated through spline fitting the flat flux of all fibers in a spectrograph.

PCASKYSB Keyword — The value of this keyword shall be Boolean, which represents whether or not use the PCA method to subtract sky light. In LAMOST spectra reduction pipeline, the PCA method is used to subtract sky light at the wavelength range larger than 7200 angstrom.

NSKIES Keyword — The value field shall contains a integer, which shows the number of sky fiber in a spectrograph.

SKYCHI2 Keyword — The value field shall contains a real floating-point, which gives the mean chi square of sky-subtraction. In the process of LAMOST spectra reduction, super sky is obtained by spline fitting m sky spectra. And thus, the chi square between the super sky and each sky spectra in an exposure, and the average chi square of m sky spectra can also be able to obtain. Assuming n times exposures, there will be 2n average chi square because of n blue spectra and n red spectra, and this keyword will be evaluated by calculating the mean value of these 2n average chi squares.

SCHI2MIN Keyword — The value field shall contains a real floating-point, which gives the minimum chi square of sky-subtraction. As mentioned above, there will be 2n average chi squares assuming n time exposures, and this keyword will be the minimum of these chi squares.

SCHI2MAX Keyword — The value field shall contains a real floating-point, which gives the maximum chi square of sky-subtraction. As mentioned above, there will be 2n average chi squares assuming n time exposures, this keyword will be the maximum of these chi squares.

NSTD Keyword — The value field shall contains a non-negative integer, which shows the number of flux standard stars with good spectra quality.

FSTAR Keyword — The value field shall contains a character string giving the fiber identity numbers of flux standard stars, which are separated by the symbol ‘-’.

FCBY Keyword — The value field shall contains a character string giving the selection methods of flux standard stars, which include auto, manual and catalog. Auto represents the standard stars are selected by the LAMOST reduction pipeline, manual means they are picked out by experienced staffs, and catalog indicates the standard stars are provided by the input catalog.

HELIO Keyword — The value of this keyword shall be Boolean, which represents whether or not to perform the heliocentric correction.

HELIO_RV Keyword — The value field shall contains a real floating-point, which gives the radial velocity used to carry out the heliocentric correction.

VACUUM Keyword — The value of this keyword shall be Boolean, which represents whether or not the LAMOST spectra is converted to vacuum wavelength.

NWORDER Keyword — The value of this keyword shall contains a integer, which gives number of linear-log10 coefficients.

WFITTYPE Keyword — The value field shall contains a character string giving linear-log10 dispersion.

`COEFF0` Keyword — The value field shall contains a real floating-point number, which provides central wavelength (log10) of first pixel.

`COEFF1` Keyword — The value field shall contains a real floating-point number giving log10 dispersion per pixel.

`WAT0_001` Keyword — The value field contains a character string.

`WAT1_001` Keyword — The value field contains a character string.

`CRVAL1` Keyword — The value field shall contains a real floating-point number, which gives the coordinate value of the reference pixel provided by the CRPIX1 keyword[11].

`CD1_1` Keyword — The value field shall contains a real floating-point giving the dispersion of per pixel.

`CRPIX1` Keyword — The value of this keyword shall contains a integer, which sets the reference pixel location on pixel axis [11].

`CTYPE1` Keyword — The value field shall contains a character string, which will have the value 'LINEAR' to define the wavelength axes to be linear[12].

`DC-FLAG` Keyword — The value of this keyword shall be Boolean, a value of 0 defines a linear sampling of the dispersion and a value of 1 defines a logarithmic sampling of the dispersion[12].

2.2.1.8 Spectra Analysis Results Keyword

```
VERSPIPE= 'v2.7.5  '           / Version of Pipeline
CLASS   = 'STAR    '           / Class of object
SUBCLASS= 'G5      '           / Subclass of object
Z       =          -0.00032162 / Redshift of object
Z_ERR   =           0.00000210 / Redshift error of object
Z_FROM  =   'PIPELINE  ' / By which method computes the redshift
SN_U    =                 1.26 / SNR of u filter
SN_G    =                 6.29 / SNR of g filter
SN_R    =                17.65 / SNR of r filter
SN_I    =                22.46 / SNR of i filter
SN_Z    =                16.34 / SNR of z filter
```

`VERSPIPE` Keyword — The value field shall contains a character string constant, which provides the version of LAMOST pipelines used to spectra processing and analysis. In this data release, the value of VERSPIPE is 'v2.6.4'. It should be noted that, 'v2.6' is the version of spectra reduction pipeline, 'v4' is the version of spectra analysis pipeline, and 'v2.6.4' combines these two versions together.

`CLASS` Keyword — The value field shall contains a character string providing the classification result determined by the LAMOST spectra analysis pipeline, which includes 'STAR', 'GALAXY', 'QSO' or 'Unknown'.

`SUBCLASS` Keyword — The value field shall contains a character string, which gives a sub-classification results for stars. This keyword provides a more detailed spectra type for F, G, K and M dwarfs, and spectra and photometric type for A type stars. For galaxies, quasars or unknown type objects, this keyword is set to 'Non' now.

`Z` Keyword — The value field shall contains a real floating-point number providing redshift for a target, which is determined mainly by the LAMOST spectra analysis pipeline. For the case that redshift is unable to calculate by the pipeline, it will be manually determined through measuring the shifts of some spectral line centers. If the quality of a spectrum is poor, or it is classified as 'Unknown', its redshift is artificially set to -9999.0.

`Z_ERR` Keyword — The value field shall contains a real floating-point number, which gives redshift error of a target. At present, the values of Z_ERR keywords are not yet published, and we will release redshift errors at the next data release in September of this year.

`Z_FROM` Keyword — The value field shall contains three possible methods to compute the Z value: 'PIPELINE', 'EYE-CHECK', and 'LASP'. This keyword is new in DR2.

`SN_U`, `SN_G`, `SN_R`, `SN_I` and `SN_Z` Keywords — The value fields of these five keywords shall contain five real floating-point numbers, which give the signal and noise ratio (SNR) of u, g, r, i and z bands. Using the center wavelength and band width, we can obtain the wavelength range of each SDSS band, and then the SNR in each band is the median value at each pixel in this band.

2.2.2 Primary data array

The primary data array has 5 rows and NAXIS1 (a keyword explained previously) columns, and the table 1 explain the data and data type in each row. We make a table similar to the primary data array opened by the FV software, which shows the first row at the bottom of the table.

Table1: Primary data array of LAMOST fits file

Row Number	Data	Type
5	Ormask	float
4	Andmask	float
3	WaveLength	float
2	Inverse Variance	float
1	Flux	float

The primary data array of LAMOST FITS file is shown in table 1. The first row is flux, and the second row stores the 'inverse variance' of the uncertainties (one over sigma-squared) which can be used to estimate signal and noise ratio of each pixel (flux*(inverse variance) ^ 0.5). Different from the DR1 data array, wavelength is stored in the third row, which can be directly used by users. The 'andmask' information in fourth row is a decimal integer determined by six-bit binary number shown in table 2, which represent six situations respectively as listed in table 3. The associated bit of 'andmask' will be set to 1, if the case always appears in each exposure. Like 'andmask', 'ormask' information in fifth row is also a decimal integer determined by six-bit binary number. The difference is that each bit of 'ormask' will be set to 1 if the related case happens in any exposure.

Table 2: Six bits of 'Andmask' and 'Ormask'

6 5 4 3 2 1

Table 3: The significance of six bits of 'Andmask' and 'Ormask'

Bit	Keyword	Comments
1	BADCCD	bad pixel on CCD
2	BADPROFILE	bad profile in extraction
3	NOSKY	no sky information at this wavelength
4	BRIGHTSKY	sky level too high
5	BADCENTER	fiber trace out of the CCD
6	NODATA	no good data

For a spectrum, if you want to check which case in table 3 has happened in its spectrum reduction process, you can firstly convert the decimal 'Andmask' and 'Ormask' to six-bit binary number. Then, a case must has happened in each exposure if associated bit is 1 in binary 'Andmask', and a case must has happened at least one time if associated bit is 1 in binary 'Ormask'.

Section 3. LAMOST Catalogs

In this section, we will introduce five LAMOST catalogs published in this data release as well, which can be available from the website of http://dr2.lamost.org/catalogue. They are the LAMOST general catalog, the A type stars catalog, the A, F, G and K type stars catalog, the M dwarfs catalog and the observed plate information catalog respectively. Here, we should note that, the A type stars catalog, the A, F, G and K type stars catalog and the M dwarfs catalog are all subsets of the LAMOST general catalog. In addition, except galaxies, quasars and unknown objects, most majorities of objects not included in above three catalog are F, G and K type stars which do not meet the select criterion, and the remaining small fraction of these objects are O and B type stars, white dwarf stars, emission line stars, carbon stars, spectroscopic double stars and so on.

The following table 4, table 5, table 6, table 7 and table 8 separately show all fields of above five catalogs, and also provide clear comments for each field. Most fields in these tables are explained in detail in sub-section 2.2.1, and we only introduce the fields which are not introduced in previous section in sub-section 3.1, 3.2, 3.3, 3.4 and 3.5.

3.1 LAMOST general catalog

In this sub-section, we will present the LAMOST general catalog. It includes objects obtained from LAMOST pilot survey and two years regular survey, including 3,784,461 stars, 37,206 galaxies, 8,630 quasars, and 306,185 unknown objects. In this catalog, there are 2,364,630 objects with SNR of g band larger than 10, 3,205,453 objects with SNR of i band larger than 10, and 2,323,317 objects with SNR of g band larger than 10 and SNR of i band larger than 10.

All parameters of this catalog are listed in the table 4, and most majorities of them are explained in section 2.2.1 in detail. In order to prevent saturation, we artificially add offsets to the equatorial coordinates from input catalog for a fraction of luminous stars during observation, thus we add four new fields in all five tables, and they are 'ra_obs', 'dec_obs', 'offset' and 'offset_v' respectively. The fields 'ra_obs' and 'dec_obs' are fiber pointing right ascension and declination during observation (The fields RA and Dec are the equatorial coordinate from input catalog), the field 'offset' represents whether there is a fiber offset during observation, and the field 'offset_v' gives the offset value of equatorial coordinator in the input catalog if the 'offset' field is true. Besides, the fields 'z' and 'zerr' are redshift and redshift error respectively, and they are set to -9999 if the redshift are unable to be estimated.

On the website http://dr2.lamost.org/catalogue, we provide two format LAMOST general catalogs, there are the FITS catalog and the CSV catalog respectively, and the two catalog files have the same contents.

Table 4: LAMOST general catalog

Field (unit)	Type	Comment
obsID	long integer	Unique Spectra ID
designation	varchar	Target Designation
obsDate	char	Target Observation Date
mjd	char	Local Modified Julian Day
planID	char	Plan Name
spID	integer	Spectrograph ID
fiberID	integer	Fiber ID
ra (degree)	float	Right Ascension from input catalog
dec (degree)	float	Declination from input catalog
ra_obs (degree)	float	Fiber Pointing Right Ascension
dec_obs (degree)	float	Fiber Pointing Declination
offset	bool	Whether there is a fiber offset during observation
offset_v (arcsec)	float	If offset is true, it gives the offset distance from the target's coordinator in input catalog
snru	float	Signal Noise Ratio of u filter
snrg	float	Signal Noise Ratio of g filter
snrr	float	Signal Noise Ratio of r filter
snri	float	Signal Noise Ratio of i filter
snrz	float	Signal Noise Ratio of z filter
objType	varchar	Object Type
class	varchar	Spectra Type
subClass	varchar	Stellar Sub-Class
magType	varchar	Target Magnitude Type

mag1 (mag)	float	Associated Magnitude 1
mag2 (mag)	float	Associated Magnitude 2
mag3 (mag)	float	Associated Magnitude 3
mag4 (mag)	float	Associated Magnitude 4
mag5 (mag)	float	Associated Magnitude 5
mag6 (mag)	float	Associated Magnitude 6
mag7 (mag)	float	Associated Magnitude 7
tsource	varchar	Organization or person who submit input catalog
fiberType	varchar	Fiber Type of target [Obj, Sky, F-std, Unused, PosErr, Dead]
tfrom	varchar	Input catalog submitted by an organization or a person determined by the tsource
tcomment	varchar	Target ID from SDSS, UCAC4, PANSTAR and other catalogue
z	float	Redshift
zerr	float	Redshift Uncertainty

3.2 A type stars catalog

In this sub-section, we will introduce the A type stars catalog. We publish all 197,005 A type stars in this catalog, which are obtained during the pilot and general survey. Table 5 shows all fields of this catalog, the 'class' field presents the two-dimension spectral classification results, and nearly all A type stars have luminosity class, which are provided by the LAMOST analysis pipeline. Different from DR1, we add more line indices in this catalog. The fields 'KP6' , 'KP12', and 'KP18' are Ca II K line indices with band widths of 6, 12, and 18 angstrom, the fields 'Halpha12', 'Halpha24', 'Halpha48', and 'Halpha70' are Halpha line indices with band widths of 12, 24, 48, and 70 angstrom, the fields 'Hbeta12', 'Hbeta24', 'Hbeta48', and 'Hbeta60' are Hbeta line indices with band widths of 12, 24, 48, and 60 angstrom, the fields 'Hgamma12', 'Hgamma24', 'Hgamma48', and 'Hgamma54' are Hgamma line indices with band widths of 12, 24, 48, and 54 angstrom, the fields 'Hdelta12', 'Hdelta24', 'Hdelta48', and 'Hdelta64' are Hdelta line indices with band widths of 12, 24, 48, and 64 angstrom, the field 'Paschen13' is Paschen line index from local continuum at 8467.5 with band widths of 13.0, the field 'Paschen142' is Paschen line index from local continuum at 8598.0 with band widths of 42.0, and the field 'Paschen242' is Paschen line index from local continuum at 8751.0 with band widths of 42.0. Similar as the DR1, the fields 'HalphaD0.2', 'HbetaD0.2', 'HgamaD0.2', and 'HdeltaD0.2' are the widths at 20% below the local continuum of these four balmer lines. If these line indices and line widths are not available, they are set to -9999. We provide two formats A type stars catalog, which include a FITS table and a CSV table, and can be download from the website http://dr2.lamost.org/catalogue.

Table 5: A type stars catalog

Field (unit)	Type	Comment
obsID	long integer	Unique Spectra ID
designation	varchar	Target Designation
obsDate	char	Target Observation Date
mjd	char	Local Modified Julian Day
planID	char	Plan Name
spID	integer	Spectrograph ID
fiberID	integer	Fiber ID
ra (degree)	float	Right Ascension from input catalog
dec (degree)	float	Declination from input catalog
ra_obs (degree)	float	Fiber Pointing Right Ascension
dec_obs (degree)	float	Fiber Pointing Declination
offset	bool	Whether there is a fiber offset during observation
offset_v (arcsec)	float	If offset is true, it gives the offset distance from the target's coordinator in input catalog
snrg	float	Signal Noise Ratio of g filter
snrr	float	Signal Noise Ratio of r filter
snri	float	Signal Noise Ratio of i filter
snrz	float	Signal Noise Ratio of z filter
objType	varchar	Object Type
class	varchar	Stellar Class
subClass	varchar	Stellar Sub-Class
magType	varchar	Target Magnitude Type
mag1 (mag)	float	Associated Magnitude 1
mag2 (mag)	float	Associated Magnitude 2
mag3 (mag)	float	Associated Magnitude 3
mag4 (mag)	float	Associated Magnitude 4
mag5 (mag)	float	Associated Magnitude 5
mag6 (mag)	float	Associated Magnitude 6
mag7 (mag)	float	Associated Magnitude 7

tsource	varchar	Organization or person who submit input catalog
fiberType	varchar	Fiber Type of target [Obj, Sky, F-std, Unused, PosErr, Dead]
tfrom	varchar	Input catalog submitted by an organization or a person determined by the tsource
tcomment	varchar	Target ID from SDSS, UCAC4, PANSTAR and other catalogue
z	float	red shift
zerr	float	Uncertainty of red shift
KP6 (angstrom)	float	Ca II K line index with band widths of 6 angstrom
KP12 (angstrom)	float	Ca II K line index with band widths of 12 angstrom
KP18 (angstrom)	float	Ca II K line index with band widths of 18 angstrom
Halpha12 (angstrom)	float	Halpha Line Index with band widths of 12 angstrom
Halpha24 (angstrom)	float	Halpha Line Index with band widths of 24 angstrom
Halpha48 (angstrom)	float	Halpha Line Index with band widths of 48 angstrom
Halpha70 (angstrom)	float	Halpha Line Index with band widths of 70 angstrom
Hbeta12 (angstrom)	float	Hbeta Line Index with band widths of 12 angstrom
Hbeta24 (angstrom)	float	Hbeta Line Index with band widths of 24 angstrom
Hbeta48 (angstrom)	float	Hbeta Line Index with band widths of 48 angstrom
Hbeta60 (angstrom)	float	Hbeta Line Index with band widths of 60 angstrom
Hgamma12 (angstrom)	float	Hgamma Line Index with band widths of 12 angstrom
Hgamma24 (angstrom)	float	Hgamma Line Index with band widths of 24 angstrom
Hgamma48 (angstrom)	float	Hgamma Line Index with band widths of 48 angstrom
Hgamma54 (angstrom)	float	Hgamma Line Index with band widths of 54 angstrom
Hdelta12 (angstrom)	float	Hdelta Line Index with band widths of 12 angstrom
Hdelta24 (angstrom)	float	Hdelta Line Index with band widths of 24 angstrom
Hdelta48 (angstrom)	float	Hdelta Line Index with band widths of 48 angstrom
Hdelta64 (angstrom)	float	Hdelta Line Index with band widths of 64 angstrom
Paschen13 (angstrom)	float	Paschen line index from local continuum at 8467.5 with band widths of 13.0
Paschen142 (angstrom)	float	Paschen line index from local continuum at 8598.0 with band widths of 42.0
Paschen242 (angstrom)	float	Paschen line index from local continuum at 8751.0 with band widths of 42.0
HalphaD0.2 (angstrom)	float	A width at 20% below the local continuum of Halpha line
HbetaD0.2 (angstrom)	float	A width at 20% below the local continuum of Hbeta line
HgamaD0.2 (angstrom)	float	A width at 20% below the local continuum of Hgama line
HdeltaD0.2 (angstrom)	float	A width at 20% below the local continuum of Hdelta line

3.3 A, F, G and K type stars catalog

In this sub-section, we will introduce the A, F, G and K type stars catalog. We totally published 2,207,803 stars in this catalog, including 34,337 A type stars, 687,108 F type stars, 1,118,231 G type stars and 368,127 K type stars. These objects are selected with the criterion of SNR in g band larger than 6 in dark nights, and SNR in g band larger than 20 in bright nights. Table 6 lists all fields of this catalog, the fields ‘teff’, ‘logg’, ‘feh’, ‘tefferr’, ‘loggerr’, ‘feherr’ respectively provide the effective temperatures, surface gravities, metallicities and their errors, which are determined by the LAMOST Stellar Parameter pipeline. In addition, ‘rv’ and ‘rverr’ are heliocentric radial velocity and uncertainty separately, and ‘rv’ are obtained by the software of ULYSS. It should be noted that, A type stars in this catalog is a subset of the A type star catalog, and they all have high SNR spectra; whereas a number of stars in the A type stars catalog have low SNR spectra. We provide two formats A, F, G and K type stars catalog, which include a FITS table and a CSV table, and can be available from the website http://dr2.lamost.org/catalogue.

Table 6: A, F, G and K type stars catalog

Field (unit)	Type	Comment
obsID	long integer	Unique Spectra ID
designation	varchar	Target Designation
obsDate	char	Target Observation Date
mjd	char	Local Modified Julian Day
planID	char	Plan Name
spID	integer	Spectrograph ID
fiberID	integer	Fiber ID
ra (degree)	float	Right Ascension from input catalog
dec (degree)	float	Declination from input catalog
ra_obs (degree)	float	Fiber Pointing Right Ascension
dec_obs (degree)	float	Fiber Pointing Declination
offset	bool	Whether there is a fiber offset during observation

offset_v (arcsec)	float	If offset is true, it gives the offset distance from the target's coordinator in input catalog
snru	float	Signal Noise Ratio of u filter
snrg	float	Signal Noise Ratio of g filter
snrr	float	Signal Noise Ratio of r filter
snri	float	Signal Noise Ratio of i filter
snrz	float	Signal Noise Ratio of z filter
objType	varchar	Object Type
class	varchar	Stellar Class
subClass	varchar	Stellar Sub-Class
magType	varchar	Target Magnitude Type
mag1 (mag)	float	Associated Magnitude 1
mag2 (mag)	float	Associated Magnitude 2
mag3 (mag)	float	Associated Magnitude 3
mag4 (mag)	float	Associated Magnitude 4
mag5 (mag)	float	Associated Magnitude 5
mag6 (mag)	float	Associated Magnitude 6
mag7 (mag)	float	Associated Magnitude 7
tsource	varchar	Organization or person who submit input catalog
fiberType	varchar	Fiber Type of target [Obj, Sky, F-std, Unused, PosErr, Dead]
tfrom	varchar	Input catalog submitted by an organization or a person determined by the tsource
tcomment	varchar	Target ID from SDSS, UCAC4, PANSTAR and other catalogue
rv (km/s)	float	Heliocentric Radial Velocity
rverr (km/s)	float	Uncertainty of Heliocentric Radial Velocity
z	float	red shift
zerr	float	Uncertainty of red shift
teff (K)	float	Effective Temperature which are obtained by the software of ULYSS
tefferr (K)	float	Effective Temperature Uncertainty
logg (dex)	float	Surface Gravity which are obtained by the software of ULYSS
loggerr (dex)	float	Surface Gravity Uncertainty
feh (dex)	float	Metallicity which are obtained by the software of ULYSS
feherr (dex)	float	Metallicity Uncertainty

3.4 M dwarfs catalog

In this sub-section, we will introduce the M dwarfs catalog. We publish all 210,829 M dwarfs in this catalog, and their parameters are listed in table 7. On the basis of the M dwarfs catalog of DR1, we add 21 new fields in this table to provide equivalent widths and spectral line indices. The fields 'ewHa' and 'ewHaerr' are Halpha line equivalent widths and errors, the fields 'TiO1', 'TiO1Err', 'TiO2', 'TiO2Err', 'TiO3', 'TiO3Err', 'TiO4', 'TiO4Err', 'TiO5', and 'TiO5Err' are five TiO molecule spectral indices and errors, the fields 'CaH1', 'CaH1Err', 'CaH2', 'CaH2Err', 'CaH3', and 'CaH3Err' are three CaH molecule spectral indices and errors, the fields 'CaOH' and 'CaOHErr' are CaOH molecule spectral indices and errors, and the field 'Na' is Na line index. Besides, we provide a metallicity sensitive parameter 'zeta' and its error 'zetaerr', and the magnetic activity flags 'type'. The value of 'type' includes 1, 0, and -9999, where 1 represents a M dwarf star has magnetic activity, 0 means a M dwarf star has no magnetic activity, and -9999 indicates it is unable to determine whether a M dwarf star has magnetic activity because of low SNR. In addition, 'z' is rv/C, where rv is heliocentric radial velocity and C is light speed, 'zerr' is uncertainty of z. 'z' are obtained by the template match method. We provide two formats M dwarfs catalog, which include a FITS table and a CSV table, can be available from the website http://dr2.lamost.org /catalogue.

Table 7: M dwarfs catalog

Field (unit)	Type	Comment
obsID	long integer	Unique Spectra ID
designation	varchar	Target Designation
obsDate	float	Target Observation Date
mjd	char	Local Modified Julian Day
planID	char	Plan Name
spID	integer	Spectrograph ID
fiberID	integer	Fiber ID
ra (degree)	float	Right Ascension from input catalog
dec (degree)	float	Declination from input catalog
ra_obs(degree)	float	Fiber Pointing Right Ascension
dec_obs(degree)	float	Fiber Pointing Declination
offset	bool	Whether there is a fiber offset during observation

offset_v (arcsec)	float	If offset is true, it gives the offset distance from the target's coordinator in input catalog
snru	float	Signal Noise Ratio of u filter
snrg	float	Signal Noise Ratio of g filter
snrr	float	Signal Noise Ratio of r filter
snri	float	Signal Noise Ratio of I filter
snrz	float	Signal Noise Ratio of z filter
objType	varchar	Object Type
class	varchar	Stellar Class
subClass	varchar	Stellar Sub-Class
magType	varchar	Target Magnitude Type
mag1 (mag)	float	Associated Magnitude 1
mag2 (mag)	float	Associated Magnitude 2
mag3 (mag)	float	Associated Magnitude 3
mag4 (mag)	float	Associated Magnitude 4
mag5 (mag)	float	Associated Magnitude 5
mag6 (mag)	float	Associated Magnitude 6
mag7 (mag)	float	Associated Magnitude 7
tsource	varchar	Organization or person who submit input catalog
fiberType	varchar	Fiber Type of target [Obj, Sky, F-std, Unused, PosErr, Dead]
tfrom	varchar	Input catalog submitted by an organization or a person determined by the tsource
tcomment	varchar	Target ID from SDSS, UCAC4, PANSTAR and other catalogue
z	float	red shift
zerr	float	Uncertainty of red shift
ewHa (angstrom)	float	Equivalent Width of Halpha line
ewHaErr (angstrom)	float	Equivalent Width of Halpha line
TiO1	float	Spectral Indice of TiO1
TiO1Err	float	Spectral Indice Error of TiO1
TiO2	float	Spectral Indice of TiO2
TiO2Err	float	Spectral Indice Error of TiO2
TiO3	float	Spectral Indice of TiO3
TiO3Err	float	Spectral Indice Error of TiO3
TiO4	float	Spectral Indice of TiO4
TiO4Err	Float	Spectral Indice Error of TiO4
TiO5	float	Spectral Indice of TiO5
TiO5Err	float	Spectral Indice Error of TiO5
CaH1	float	Spectral Indice of CaH1
CaH1Err	float	Spectral Indice Error of Ca1H
CaH2	float	Spectral Indice of CaH2
CaH2Err	float	Spectral Indice Error of Ca2H
CaH3	float	Spectral Indice of CaH3
CaH3Err	float	Spectral Indice Error of Ca3H
CaOH	float	Spectral Indice of CaHO
CaOHErr	float	Spectral Indice Error of CaOH
Na (angstrom)	float	Line Indice of Na Line
zeta	float	Metallicity Sensitive Parameter
zetaerr	float	Error of Metallicity Sensitive Parameter
type	integer	Magnetic Activity

3.5 Observed Plate Information Catalog

In this sub-section, we will introduce the observed plate information catalog. Besides 'pID', 'obsDate' and 'planID' fields also in other four catalogs, we provide other five basic information of 1,934 published plates in this catalog as described in table 8. 'cra' and 'cdec' are right ascension and declination of center star of each plate, 'cmag' is the magnitude of center star, 'seeing' is the dome seeing of the first exposure, 'expTime' is the total exposure time of n time exposures, and 'MJM' is the local modified Julian minute at the start time of each plate. We provide two formats observed plate information catalog, which include a FITS table and a CSV table, and can be available from the website http://dr2.lamost.org /catalogue.

Table 8: observed plate information catalog

Field (unit)	Type	Comment
pID	Integer	Plate ID
obsDate	float	Target Observation Date
planID	char	Plan Name
cra (degree)	float	Right Ascension of center star
cdec (degree)	float	Declination of center star
cmag (mag)	float	Magnitude of center star
seeing	float	Seeing of the first exposure
expTime (second)	float	The total exposure time of n time exposures
MJM	Integer	Local Modified Julian Minute at the start time of each plate

Bibliography

http://www.sdss.org/
Stoughton, Chris, Lupton, Robert H., Bernardi, Mariangela et al. 2002, Sloan Digital Sky Survey: Early Data Release, AJ, 123, 485.
Abazajian, Kevork, Adelman-McCarthy, Jennifer K., et al. 2003, The First Data Release of the Sloan Digital Sky Survey, AJ, 126,2081.
Abazajian, Kevork, Adelman-McCarthy, Jennifer K., et al. 2004, The Second Data Release of the Sloan Digital Sky Survey, AJ, 128, 502.
Zhang, Yueyang, Deng, Licai, Liu, Chao, et al. 2013, DA White Dwarfs Observed in the LAMOST Pilot Survey, AJ, 146, 34.
Cui, Xiangqun, Zhao, Yongheng, Chu, Yaoquan, et al. 2012, The Large Sky Area Multi-Object Spectroscopic Telescope (LAMOST), RAA, 12, 1197.
Zhao, Gang, Zhao, Yongheng, Chu, Yaoquan, et al. 2012, LAMOST spectral survey – An overview, RAA, 12, 723.
Luo, A-li, Zhang, Haotong, Zhao Yongheng, et al. 2012, Data release of the LAMOST pilot survey, RAA, 12, 1243.
Pence, W.D., Chiappetti, L., Page, C.G., et al. 2010, Definition of the Flexible Image Transport System (FITS), version 3.0, A&A, 524, 4
http://www.skyserver.org/htm/
http://adass.org/adass/proceedings/adass94/greisene.html
http://iraf.net/irafdocs/specwcs.php

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