

Documentation of **redmonster** Output Files

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1 Introduction

This document describes the format and content of the files generated by the **redmonster** software.

The principal output of the software is the *redmonster* file. It contains all of the spectroscopic redshift and classification information, as well as the models used for the fits. This file is described in §2.

By default, the software does not store the χ^2 surfaces generated by the fitting routines. However, the software does provide the option to write these surfaces to a separate *chi2arr* file. This file is described in §3.

2 *redmonster* File

2.1 Naming convention

Primary output files from **redmonster** will generally follow the naming scheme

redmonster-pppp-mmmmm.fits

where *pppp* is the 4-digit SDSS plate number, and *mmmmm* is the 5-digit MJD. These correspond with the *spPlate* input file and cannot be changed by the user.

When a file with the above naming convention exists in the specified directory, the default behavior of the software is to overwrite it. However, the user may elect to leave the older file intact, in which case the new file will be written as

redmonster-pppp-mmmmm-YYYY-nn-dd_HH:MM:SS.fits

where *YYYY*, *nn*, *dd*, *HH*, *MM*, and *SS* are the year, month, day, hour, minute, and second, respectively, of the time (GMT) at which the file was written.

2.2 File type

All **redmonster** outputs are uncompressed FITS files with all relevant information in the primary HDU header, a BIN table, and an imageHDU. The file size is approximately 20 MB.

2.3 File structure

The general structure of the file is as follows:

HDU0	NULL	Empty
HDU1	Binary FITS Table	Object redshifts and classifications
HDU2	nfibers \times npix float image	Best-fit template model for each object

2.4 Header

The primary HDU header is nearly identical to that of the *spPlate* files¹, with a few minor additions specific to **redmonster**. Those additions are as follows:

¹Documented at <http://data.sdss3.org/datamodel/index-files.html>

VERS_RM	Version of redmonster that produced the file
DATE_RM	Date and time (GMT) of redmonster completion
NFIBERS	Number of fibers used

2.5 Binary table

The binary FITS table contains all redshift and classification information. The data included is as follows, specified by the binary table's header:

Z1	Best redshift (least χ_r^2)
Z2	Second best redshift
Z_ERR1	1- σ error associated with Z1
Z_ERR2	1- σ error associated with Z2
CLASS	Object type classification
SUBCLASS	Best-fit template parameters
FIBERID	<i>spPlate</i> fiber numbers used (0-based)
MINVECTOR	Coordinates of best-fit template in <i>ndArch</i> file
ZWARNING	Warning flags (identical to BOSS flags)
DOF	Degrees of freedom used in calculating χ_r^2
NPOLY	Number of additive polynomials used
FNAME	Full name of <i>ndArch</i> file of best-fit template
NPIXSTEP	Pixel step size in redshift space used

There are a few things to note about the values in the BIN table. First, in some cases (failure of fit, small $\Delta\chi^2$, etc.), redshift values have been set to -1. In these cases, the associated errors have also been set to -1. Second, for *ndArch* files with multiple parameter dimensions, the dictionaries corresponding to those dimensions have been converted into a string when written to SUBCLASS. The tuples comprising the values of MINVECTOR have been treated the same way. Using the built-in python function `eval()` will convert them back to dictionaries and tuples, respectively.

2.6 ImageHDU

The imageHDU contains an `nfibers` \times `npix` float image comprised of the best-fit models (template + polynomials at global minimum of χ^2 surface)

for each fiber. The models are in units of $10^{-17} \text{erg cm}^{-2} \text{s}^{-1} \text{\AA}^{-1}$

3 *chi2arr* File

3.1 Naming convention

The *chi2arr* file follows the naming scheme

$$\textit{chi2arr-tttttttttt-pppp-mmmmm.fits}$$

where *tttttttttt* is the template's type (derived from the *ndArch* file), *pppp* is the 4-digit SDSS plate number, and *mmmmm* is the 5-digit MJD. As in §2.1, plate number and MJD are taken from the input *spPlate* file. Currently, there is no secondary naming scheme, and older *chi2arr* files will be overwritten.

3.2 File Type

All *chi2arr* files are in the uncompressed FITS format. All data is located in the primary HDU.

The file size varies depending on number of template parameters and redshift range, but can quickly become quite large. For example, fitting 300 templates to 595 fibers at 3469 redshifts results in a 4.7 GB file.

3.3 File structure

The primary HDU contains a **numpy** array of χ^2 values of dimensions $\text{nfibers} \times \text{npar}_1 \times \dots \times \text{npar}_N \times \text{n}_z$, where npar_i is the length of the i^{th} parameter dimension and n_z is the number of redshifts explored.

There is no information in the header.