

User Guide

AstroImageJ Macro for Creating an AAVSO Exoplanet Report

Revision 2.4

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1. Introduction

In support of AAVSO's Exoplanet Database, an AstroImageJ (AIJ) macro has been developed that allows AIJ users to automatically create a properly formatted file (referred to as an "Exoplanet Report") that can later be uploaded to the database. The sections below describe how to use this AIJ macro. Note that it is not necessary to use this AIJ macro to create an Exoplanet Report; a plain text file that conforms to the required report format is all that is required. The macro described here is simply designed to help AIJ users automatically create such a report. Comments on this document or the AIJ macro can be sent to: dennis@astrodennis.com.

1.1 AAVSO WebObs Interface

Once created, the Exoplanet Report upload will be done via the AAVSO WebObs Exoplanet Submission page at <https://aavso.org/apps/exosite/submit>. Use of the Exoplanet WebObs page also assumes that the user has entered appropriate site and equipment information (links to AAVSO sites to do this can be found at the bottom of the WebObs page). The Documentation tab on the upper part of the Exoplanet WebObs page can be selected for help on how to enter data on the page, as well as a description of the AAVSO Exoplanet Report format that the output of the AIJ macro described herein will conform to.

1.2 Macro Input: An AIJ Measurement File

In addition to user entries via a set of dialogues, the macro will ask the user to select the "measurement file" from an AIJ exoplanet observation. This file represents the results of differential photometry measurements for each image and must conform to the following:

1. Elements in each row are delimited either with a tab, space, or a comma.
Note: AIJ-created measurement files that have an extension of .xls, .txt, or .tbl all use a tab, whereas a .csv file uses a comma.
2. The first row in the measurement file, the header, contains a list of labels associated with the corresponding data items in the next series of rows.
3. Each row after the first row, should contain the following items:

- a. Date of the differential photometry measurement in any one of the following timebases: JD_{UTC} , HJD_{UTC} , and BJD_{TDB} . The preferred timebase for such measurements is BJD_{TDB} , although the others are also allowed.
 - b. A differential photometry measurement representing the difference in brightness of the target star relative to that of one or more comparison stars, as well as associated error values. The measurements must be in terms of the relative normalized flux of the target star. Item 4. below describes how relative normalized flux can be added to an open AIJ measurement table.
 - c. Values of any detrend parameters that were used in the exoplanet transit modeling (e.g., AIRMASS, Width_T1, etc.). Note that if Meridian Flip is used, indications of where the meridian flip occurred are not included in the measurement table, but are added by the macro when it constructs the AAVSO Exoplanet Report (see item 9 in Section 3.0 below).
4. The following describes how values for Relative Normalized Flux are added to an open AIJ measurement table.

Relative Normalized Flux values are added to an open AIJ measurement table via the following steps:

- a. On AIJ's Multi-plot Y-data screen, make sure that the row for rel_flux_T1 (usually the first row) has the following values set:
Bin Size=1, Fit Mode=off, Page Rel=unchecked, Scale=1, and Shift =0.
- b. Next, click on the down arrow under New Col for the above row for rel_flux_T1. The following should appear:

Add new columns to table

Add new column from X-data
New column name (from X-data): BJD_TDB_B

Add new column from Y-data
New column name (from Y-data): rel_flux_T1_n

Add new column from Y-error
New column name (from Y-error): rel_flux_err_T1_n

Remove Scale from Y-data and Y-error before saving

Remove Shift from Y-data before saving

New data column(s) will be added to the open table.
Save table to save new column(s) to disk.

OK Cancel

By clicking OK, three new columns are added to the open measurement table. These columns have the following labels associated with them:

BJD_TDB_B
rel_flux_T1_n
rel_flux_err_T1_n.

This updated measurement table should be saved and should be the one selected when asked for by the macro. This measurement table can be saved to disk by going to the Multi-plot Main screen and selecting File->Save data to file. The last two added columns, rel_flux_T1_n and rel_flux_err_T1_n, are what the macro will use to populate the AAVSO report.

The following describes the steps necessary to install, access and use the AIJ macro.

2.0 Accessing the Macro

The macro can be accessed from AIJ's Multi-plot Main screen by selecting File->Create AAVSO Exoplanet Database formatted report...

3.0 Using the Macro

Once selected, the macro will lead the user through a series of dialogues before creating an output file that can then later be uploaded to the AAVSO Exoplanet Database using the aforementioned WebObs page. If the user successfully navigates through all of these dialogues, then this output file will be created and placed in the same directory as the user's input measurement file (see Section 4.0 below).

The AIJ log window will be used to record any ERROR messages.

Since the AAVSO exoplanet report will be associated with a Primary Observer and optionally one or more Secondary Observers, the macro begins with the entry of the Primary Observer's AAVSO observer code. Since this macro is intended to run off-line, there is no validity checking of this observer code – this will be done when the macro's output file is uploaded on AAVSO's web site – except for checking that its length is five (5) characters or less. If the user does not yet have an AAVSO observer code, then one can be obtained by going to the following site: <https://www.aavso.org/apps/register/>.

The user will then be asked to select or enter the following information, most of which are required entries (these are identified in the macro dialogue with a “*”):

1. The timebase that the measurement file date/time base is in.
2. If the data column containing the date/time of the observation has a header column with a label other than JD.UTC, HJD.UTC, or BJD.TDB, then the user will enter what that label is. Since Measurement files created by AIJ normally use these naming conventions,

this entry can be left blank for AIJ-created measurement files.

3. The name of the host star. This should be a name that is known to NASA's MAST (Mikulski Archive for Space Telescopes) site (<https://archive.stsci.edu/>). A validity check that the star name is known to MAST will be done at the time of the report upload using WebObs, however, the macro will validate that the star name is non-empty and is less than or equal to 100 characters.
4. The exoplanet name. A validity check will be made that the entry for the exoplanet name is less than or equal to 100 characters. If left blank, the exoplanet name will take on the same name as the host star.
5. Binning used at the time of image capture (i.e., 1x1, 2x2, 3x3, or 4x4).
6. Exposure time, in seconds, used to record each measurement point. A validity check will be made that the entry for exposure time is less than or equal to 600 seconds.
7. Filter type used, selected from one of the valid AAVSO filter types.
8. After selecting OK on the first page of the macro, the next page of dialogues appears.

Detrend parameter list: enter a comma-separated list of zero to four detrend parameters that were used in the user's exoplanet transit modeling. A validity check will be made that the size of this list is less than or equal to 100 characters. Use the descriptors (e.g., AIRMASS, Width_T1, etc.) for each detrend parameter that are found in the column headings of AIJ's measurement table. The corresponding values for each such detrend parameter are then copied by the macro from the appropriate column in the measurement table to the AAVSO report. Note: If meridian flip was used as a detrend parameter, use Meridian_Flip as the name of the detrend parameter. In this case, there will be no corresponding AIJ column heading found in AIJ's measurement table. Instead, the user must enter the exact same meridian flip time marker that was set on the AIJ Multi-plot Main panel for this observation. The macro will then insert a value of -1.000000 for all observational entries up to this meridian flip time and 1.000000 for all observational entries after the meridian flip time.

9. The following free-form information can be entered.
 - a. Secondary observers – i.e., a comma-separated list of AAVSO observer codes for other “observers” who are to be associated with this observation. A validity check will be made that the size of this list is less than or equal to 60 characters.
 - b. Priors used in the exoplanet analysis – e.g., period, radius of host star, limb darkening coefficients. A validity check will be made that the size of this list is

less than or equal to 250 characters.

- c. Results of the exoplanet analysis, for example: $(R_p/R_*)^2=0.012$, $a/R_*=7.4$, $i=85.1$, $T_c=2459258.357642$. A validity check will be made that the size of this list is less than or equal to 250 characters.
 - d. Notes that describe weather conditions, systematics associated with this observation, other anomalies, image pixel deviation, etc.
10. Finally, the macro will ask the user to select whether the data items in the measurement file are delimited with a tab, space, or comma (see item 1. of Section 1.2). In addition, it will present a checkbox that should be checked if the measurement file header row has a label in the first position. For AIJ-created measurement files, since they have no label in the first column of the header row, this checkbox should remain unchecked. This option allows use of measurement files created from other programs where there may be a label in the first column.
11. After clicking OK, the user should then select the measurement file to be used as input to the macro.

4. Macro Output

If it completes successfully, the macro will produce an output file suitable for later input to the AAVSO Exoplanet Database WebObs facility. Such an output file will be named as follows:

“AAVSO_Report_ *observer-code* _ *date-time* _ *date-type* _ *measurement-type*.txt” where:

- “*observer-code*” = the primary observer’s AAVSO observer code,
- “*date-time*” = the year, month, day, hour, minute, and second at the time the file was created,
- “*date-type*” = the type of date format used in the measurement data (i.e., BJD_TDB, JD_UTC, or HJD_UTC),
- “*measurement-type*” = Rnflux.

This file naming convention provides an automated way of creating unique output file names.