User Guide

AstroImageJ Macro for Creating an AAVSO Exoplanet Report

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Author: Dennis M. Conti

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 a "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/. 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 of a given target star and must conform to the following (a standard AIJ measurement file generally contains this information, with the possible exception of 3b):

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 contains a list of labels associated with the corresponding data items in the next series of rows.

3. The following are the minimum data items required in each row:
    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 or the differential magnitude of the target star. Since the standard AIJ measurement table records such measurements in relative flux, the following steps describe how relative normalized flux data can be added as additional columns to an opened measurement table:

        i. On AIJ's Multi-plot Y Data screen the following selections should be made for the appropriate Data Set (usually the first row for T1's rel_flux): Bin Size=1, Fit Mode=off, Page Rel = unchecked, Scale=1, and Shift=0.

        ii. The New Col selection for this Data Set can then be used to add rel_flux_T1_n and rel_flux_err_T1_n as new data columns to the open measurement table (note: it is not necessary to add the extra "time" column).

        iii. Confirm that rel_flux_T1_n and rel_flux_err_T_n are in the updated measurement table (the former column sometimes appears early in the table, and the latter at the end).

        iv. The measurement table should then be saved to disk by going to the Multi-plot Main screen and selecting File->Save data to file…

    c. Values of any detrend parameters that were used in the exoplanet transit modeling.

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 5.0 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 in the observation (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. The way in which the measurement data should be interpreted – i.e., either as Relative Normalized Flux or Differential Magnitude.

9. Next, if different from the default labels associated with the above type of measurement data selected, the user is asked to enter the header row labels associated with the

measurement data, as well as the error associated with the measurement data,. The defaults are:

a. For Relative Normalized Flux:
   rel_flux_T1_n
   rel_flux_err_T1_n.
b. For Differential Magnitudes:
   rel_flux_T1(mag)
   rel_flux_err_T1(mag).

10. After selecting OK, the next page of dialogues appears.

11. Detrend parameter list: a comma-separated list of zero to four items that are short descriptors for the detrend parameters which were used in the user's exoplanet transit modeling. The corresponding values for each such detrend parameter should be in the input measurement file and are case sensitive. For a measurements file created by AIJ, it is advisable to use the AIJ column headings for such descriptors (e.g., AIRMASS, Width_T1, etc.). A validity check will be made that the size of this list is less than or equal to 100 characters.

12. Next, if the labels in the measurement file header row for each detrend parameter are different from the descriptors used in the above detrend parameter list, then these labels can be specified by the user. If the descriptor in the above detrend parameter list is also used as the label, then these label entries can be left blank.

13. 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 – e.g., (Rp/Rc*)^2, a/R*, Tc. 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.

14. 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 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.

15. 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*" = either Rnflux or Dmag, depending on whether the user selected Normalized Relative Flux or Differential Magnitude as to how the measurement data should be interpreted.

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