

## ExoVista Change Log

### v2.4

**August 11, 2023**

Replaced `load_scene()` with a full `Scene()` class that reads in a FITS file and has utility functions to report specific values.

Revised `load_stars()` to handle variations in the target list more gracefully. (However, some restrictions still apply. For example, each header must begin with the corresponding label in “starbase,” and it needs to have only one RA and Dec pair to read them correctly.)

Added command-line arguments to `readfits.py` and its derivatives to control the internal plotting parameters.

Changed the overwrite protection to include files with the same star ID, not just the whole filename. (This isn’t strictly necessary, but it makes indexing easier.)

Added an “overwrite” setting that changes the code’s behavior from skipping existing star IDs to overwriting them. (Default = False.) (This could not be done at runtime from inside the parallel pool.)

Added a radius limit for warm/cold Jupiters ( $P > 10$  days, scaled with stellar luminosity) to better reflect the observed distribution.

Added BmV to the “starbase” stellar parameters list instead of forcing it to be assigned separately.

Made `load_stars()` able to accept a variable number of lines in the file header.

Tried to make the target list parsing more flexible to cover various aliases.

Updated the stellar parameter handling in `read_solarsystem()`.

Added command line arguments for filename and directory to `parsefits.py`.

Added new figures and general cleanup to the User Guide.

Removed `M_V` from the required stellar parameters list. (Note: `M_V` is no longer used for any code calculations, but it will be used to calculate `Vmag` in `read_solarsystem.py` if it is specified, and `Vmag` is not.)

Updated the example FITS file.

Changed “TYC2” in the output filename to “TYC.” (Still applies to both Tycho and Tycho-2.)

Added BmV to the “starbase” list of stellar parameters.

### v2.34

**Unreleased**

Fixed a legacy indexing issue in the post-processing files.

Changed the default orbital integration time in `ExoVista.py` to 10 years.

More cleanup of the `solar_system.dat` input file.

Added a `solar_system_tutorial.dat` input file for instructional purposes.

### v2.33

**May 23, 2023**

Minor QoL changes to the `solar_system.dat` input file.

Added an error message for trying to overwrite an existing output file.

Added the “readfits-flipbook.py” script, which animates scenes to the screen at runtime (ffmpeg *not* required).  
Fixed a bug in the animations that caused planets to freeze at the edge of the occulting disk.  
Minor cleanup of parsefits.py.  
Improved the appearance of the readfits.py plots.  
Added Mercury to the solar\_system.dat input file.  
Turned off usebins in the standard build of ExoVista.py.

## **v2.32**

**May 15, 2023**

Fixed a bug in the color-coding in readfits.py.  
Added the “readfits-anim.py” script, which creates animated plots of ExoVista scenes (requires ffmpeg).  
Revised “setup.py” to better reflect the functionality of Cython.  
Updated the installation documentation to better reflect the functionality of Cython.

## **v2.31**

**May 9, 2023**

Reduced the mini-target list from 10 stars to 8.  
Fixed the order of arguments in mass\_to\_radius().  
Cleaned up the command line output to be more informative.  
Fixed the numbering of the FITS extensions in the output setup in generate\_scene().

## **v2.3**

**May 5, 2023**

Fixed a fencepost error in plotting the disk brightness in readfits.py.  
Changed generate\_scene.py to actually use the “starbase” dict of stellar parameters.  
Added sky coordinates and proper motion to the “starbase” dict.  
Added the “parsefits.py” script, which parses an output FITS file to create a single-system input file that matches it exactly.  
Added rdust\_blowout, tsublimate, and the imaging parameters to the single-system input file format as a new (optional) “Settings” section.  
Added rdust\_blowout, tsublimate, and iwa to the header of the disk data cube extension in the output FITS file.  
Added a “hires” Settings parameter that resets the disk spectral resolution to equal the star/planet spectral resolution. (Default: False. Warning: causes high memory usage.)  
Added “HIRES” to the output file name to signal when the high resolution is being used.  
Added a  $T_{\text{eff}} > 3500$  K restriction to load\_stars.py based on the range of the Kurucz models.  
Added an optional random spread in the phase functions (a parameterized multiplier on the Lambertian).  
Added an option to use a stellar spectrum file in place of the Kurucz models (still subject to the bounds of the Kurucz models).  
Added an optional random spread in the mass-radius relation based on the “fractional dispersion” hyperparameters of Chen & Kipping (2017).

Fixed a bug that caused zero stars to be assigned to a core for some sizes of target lists (which causes a crash).  
Added an example stellar spectrum (Kurucz model for the Sun).  
Updated the example output file (our Solar system at 10 pc, 10 year integration).  
Added command-line input of file names to ExoVistaSystem.py.  
Modified ExoVistaSystem.py to detect and set the number of disk components based on the input file.  
Significant overhaul of readfits.py, including improved input handling, backwards compatibility, and outputting the list of transit and eclipse events.  
Laid the groundwork for dust emission/absorption spectra generation with the load\_lqabs() routine in generate\_scene.py (not yet used).  
Fixed a bug that broke RNG seed repeatability in generate\_scene().  
Fixed a planet-counting bug in load\_scene().  
Added the new add\_background module, which generates random extragalactic background sources for a scene.

## **v2.2**

**March 23, 2023**

Fixed a bug in the output of stellar coordinates.  
Added phase angle to the planet data listed in the FITS files.  
Added a version number line to the FITS files to allow backward-compatibility of post-processing scripts.  
Added transit and eclipse detection.  
Added a fifth plot for planet trajectories to readfits.py.  
Added printing of transit and eclipse times to readfits.py.  
Shifted the N-body integrator from Python to C++ to speed up integration with transit detection.  
Updated post-processing scripts to handle multiple code versions.  
Added functionality to readfits.py to reenter the FITS file name or number if an error occurs.  
Added functionality to ExoVistaSystem.py to prompt for an input filename, accept one as a command line argument, and check for the correct "Star, Planets, Disks" format.  
Set up ExoVistaSystem.py to read the number of disk components from the input file.  
Fixed a bug in the coordinate transformations.  
Fixed the parameters of the added Earth twins.  
Adjusted the Earth twins to zero eccentricity so that the starting phase angle would be exactly 90 degrees.  
Ensured generate\_scene() would report parameters continuing through the desired maximum time. (Note this means there will always be multiple timesteps in the output.)  
Fixed a potential bug in coordinate list handling.  
Changed solar\_system.dat from ID -1 to ID 999 for formatting reasons.  
Fixed a bug in handling the Earth twin in load\_scene.py and readfits.py.  
Fixed a bug that prevented the seeded RNG from returning consistent results.  
Updated the user guide and made various revisions for clarity.

## **v2.1**

**February 2, 2023**

Added an RNG “seed” parameter to defaults.py.

Added an “eecprob” parameter to defaults.py that sets the overall likelihood that a planet in the EEC bounding box is in fact an EEC. (Default: 1.0.) Also works if different EECs have different bounding boxes.

Added PDF versions of the User Guide and Change Log.

Split defaults.py into a constants.py parameter list containing values that should not be changed, and a settings.py dataclass containing all of the values that should be user-settable.

Added various parameters to the Settings dataclass: planet parameter limits emin/emax, imin/imax, sysimin/sysimax, sysPAmin/sysPAmay; also disk particle size minsize/maxsize; also all of the hard-coded disk profile parameters.

Cleaned up the variable lists in constants and settings.

Added a 10-object target list for testing purposes.

Replaced the file-based MyRng with a seeded Numpy RNG.

Removed the unused sag13\_eta\_grid() function from generate\_planets.py.

Removed the wrapper function for generate\_scene() from ExoVista.py.

Added a total iteration cap of 200 on the planet creation loop. (Adding a massive planet can render multiple small planets unstable, decreasing the total planet count. A planet added on the next iteration will reset the “non-increasing” step count without a net increase in planet count.)

Tested the stability of the longitude (as opposed to argument) of periastron at low inclinations.

Modified readfits.py to not output the phase curve plot if there is only one timestep in the FITS file.

Moved all of the user controls in readfits.py to the beginning of the script.

Created a basic user interface for readfits.py to select a FITS file from the command line.

Updated the documentation.

## **v2.0.1**

**January 27, 2023**

Tested load\_scene.py on v1.3 outputs.

Changed the file read by the MyRNG routine from 10 million random numbers to 1 million in order to comply with Github’s file size limits.

Added change log.

Added README instructions.

## **v2.0**

**January 26, 2023**

First public Python release.