The Exo.MAST Portal: An Exoplanet Focused View into MAST Data

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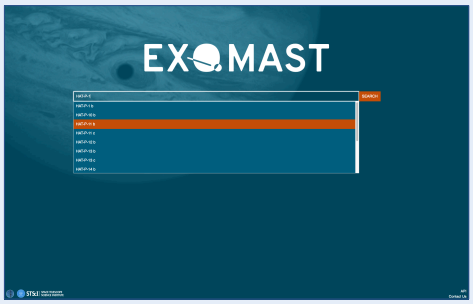
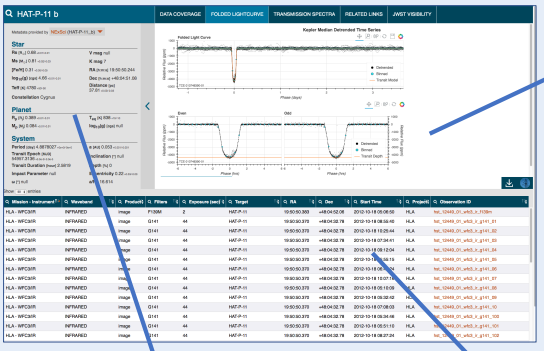
Questions?
Ask me! Or tweet me @Strakul

What is Exo.MAST?

Exo.MAST (https://exo.mast.stsci.edu/) consolidates data from a variety of sources to provide users with a unified view of exoplanet parameters. These are presented in an interface that showcases other MAST data available for that system as well as a variety of quick-look tools to further explore the planet.



As users type their desired planet, suggested names are provided to auto-complete their search.



Quick look and links to additional information. In this example, a folded lightcurve from Kepler data is shown.

Physical parameters from the ExoMAST database

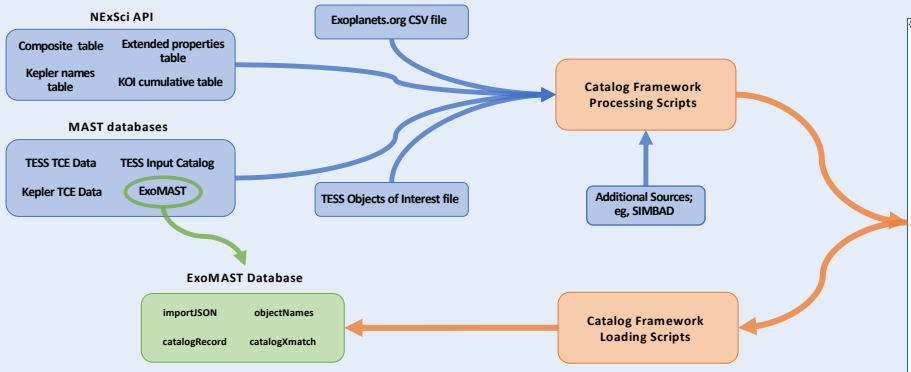
Table of MAST results from the Common Archive Observation Model (CAOM) database at MAST

How Are Planet Data Loaded to Exo.MAST?

Exo.MAST currently hosts four 'catalog' sources of exoplanet data: NExSci, exoplanets.org, Kepler Objects of Interest (KOI), and the TESS Threshold Crossing Events (TCE).
We will soon include the TESS Objects of Interest (TOI).

Data from these various sources is gathered via a set of Python processing scripts. These scripts also call ancillary data from other locations such as SIMBAD or internal databases. They can also derive parameters from existing values.

The processing scripts populate custom-built "Planet" objects that are output as JSON files of consolidated information. This represents a full record of all existing and derived information for that particular planet and catalog.



Example JSON output for HAT-P-11 b with NExSci data

A set of Python scripts reads these JSON documents and loads the data to a Microsoft SQL Server database. To do this, the scripts take a mapping document that associates JSON fields with database table names and columns.
We currently rely on pyODBC to handle database connections and use direct SQL statements, but we're considering tools like SQLAlchemy to facilitate loading to other RDBMS.

How is the Exo.MAST Database Organized?

One of the biggest challenges in exoplanet research is how to correctly handle multiple sets of planet information and how to search for them across catalogs by different planet aliases.

In Exo.MAST, each planet is given a unique integer identifier in the catalogXmatch table. Planet names and aliases are obtained from the catalogs themselves and from queries against Simbad. These are stored as individual rows in the objectNames table, which is used by the processing script to identify existing entries and by the API and UI to gather the correct planet for any given alias.

catalogXmatch table

Contains the main identifier information for a each unique planet. Links to the Kepler and TESS TCE data is also listed here.

exoplanetID	nexsci_name	keplerID	keplerExt	tessID	tessExt	...
100	HAT-P-11 b	10748390	TCE_1	28230919	TCE_1	...

Results of catalogXmatch and objectNames are accessible via API call; for example,
https://exo.mast.stsci.edu/api/v0.1/exoplanets/identifiers/?name=hatp11b

objectNames table

Contains all names used to refer to a particular exoplanet

exoplanetID	planet_name
100	HAT-P-11 b
100	Kepler-3 b
100	KOI 3.01
100	NLTT 48335 b
100	HIP 97657 b
100	TYC 3561-2092-1 b
100	TIC 28230919 (S0014-S0014) TCE_1

catalogRecord table

Contains parameter information for a given planet for a given catalog. Note that each planet can be listed multiple times (once for each catalog).

exoplanetID	planet_name	catalog_name	transit_duration	transit_duration_ref	...
100	HAT-P-11 b	nexsci	0.0984942	Morton et al. 2016	...
100	K00003.01	koi	0.098439583	Kepler Objects of Interest	...
100	HAT-P-11 b	exoplanets.org	0.0957	Bakos 2010	...
100	TIC 28230919 (S0014-S0014) TCE_1	TESS-DV	0.097793368		...

The catalogRecord table contains the bulk of the exoplanet parameter information. Each row corresponds to an individual catalog entry for a particular planet.

A subset of columns is used for the information displayed in the UI. The full set of information can also be accessed via API calls; for example,
https://exo.mast.stsci.edu/api/v0.1/exoplanets/HAT-P-11%20b/properties

More information on the API can be found at https://exo.mast.stsci.edu/docs/