

Exoplanets

Lecture 4
31 October 2025

Outline

- Data archives of space missions
- Tools to detect exoplanets
- Exoplanet family

Ondrejov OES spectrograph

- Tour of Perek telescope facilities

MAST archive

- <https://mast.stsci.edu/portal/Mashup/Clients/Mast/Portal.html>
- <https://exo.mast.stsci.edu>
- <http://archive.stsci.edu/searches.html#missions>
- <http://simbad.u-strasbg.fr/simbad/>

ExoMast



MAST Home

Select a collection...

MAST Observations by Object Name or RA/Dec

[About Collections...](#)

and enter target:

Enter object name or RA and Dec to cone search

Search

[Show Examples...](#) [Random Search](#) [Advanced Search](#)



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My Download Basket: 0 fil...



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MAST FTP Service Change

On 25 Oct 2021, the MAST FTP server archive.stsci.edu will no longer support unencrypted FTP connections. Only encrypted FTPS will be supported. Read more about this change and some related FAQ on the [MAST FTP Service page](#).

Our apologies for the inconvenience.

MAST: Barbara A. Mikulski Archive for Space Telescopes

The MAST Portal lets you search multiple collections of astronomical datasets all in one place. Use this tool to find astronomical data, publications, and images.

Note: This site uses cookies in order to monitor feature usage, track user preferences, and provide authentication for some services. By using this site you consent to the use of cookies for such purposes.

 Search...

 Export Table...

Records Found: 45,777,137
(Load Limit: 50,000)
(Download Limit: 500,000)

ExoMast advanced search

Applied Filters

Clear All

Columns


Defaults Hide All

Filter Columns:

- ☒ Object Name or Position
- ☒ Observation Type
- ☒ Mission
- ☒ Provenance Name
- ☒ Instrument
- ☒ Project
- ☒ Filters
- ☐ Waveband
- ☒ Target Name
- ☐ Target Classification
- ☐ Sequence Number
- ☐ Observation ID
- ☒ RA

Filters



Object Name or Position



[Show Examples...](#)



No positional search performed.

Observation Type

Na...	Quant...
<input type="checkbox"/> science	(42,808,396 Total)
<input type="checkbox"/> calibration	(970,033 Total)
<input type="checkbox"/> engineering	(8 Total)


Mission

Na...	Quant...
<input type="checkbox"/> HLSP	(35,558,725 Total)
<input type="checkbox"/> SPITZER_SHA	(3,073,080 Total)
<input type="checkbox"/> HST	(1,084,244 Total)
<input type="checkbox"/> PS1	(998,018 Total)
<input type="checkbox"/> TESS	(876,824 Total)


Show 15 More

Provenance Name




Na...	Quant...
<input type="checkbox"/> QLP	(25,594,389 Total)
<input type="checkbox"/> TESS-SPOC	(5,364,496 Total)
<input type="checkbox"/> SSC Pipeline	(3,073,080 Total)
<input type="checkbox"/> TASOC	(1,732,388 Total)

Instrument



Na...	Quant...
<input type="checkbox"/> Photometer	(34,794,402 Total)
<input type="checkbox"/> Kepler	(2,611,689 Total)
<input type="checkbox"/> IRAC	(2,470,294 Total)
<input type="checkbox"/> GPC1	(998,018 Total)

Project



Na...	Quant...
<input type="checkbox"/> TESS	(34,794,402 Total)
<input type="checkbox"/> K2	(1,767,519 Total)
<input type="checkbox"/> PS1	(998,018 Total)
<input type="checkbox"/> HST	(943,924 Total)

Lightcurve manipulation tools

- Downloading of the LC
- Performing photometry on the TESS LC
- Checking the cut-offs
- Creating own photometric masks
- <https://docs.lightkurve.org> - lightkurve 2.0
- <https://github.com/afeinstein20/eleanor> - eleanor
- <https://arxiv.org/abs/1903.09152>

How to recover the first TESS planet candidate with *Lightcurve*?

Data from the TESS mission are [available from the data archive at MAST](#). This tutorial demonstrates how the [Lightcurve Python package](#) can be used to read in these data and create your own TESS light curves with different aperture masks.

Below is a quick tutorial on how to get started using *Lightcurve* and TESS data. We'll use the nearby, bright target Pi Mensae (ID 261136679), around which the mission team recently discovered a short period planet candidate on a 6.27 day orbit. See the [pre-print paper by Huang et al \(2018\)](#) for more details.

TESS data is stored in a binary file format which is documented in the [TESS Science Data Products Description Document](#). *Lightcurve* provides a `TessTargetPixelFile` class which allows you to interact with the data easily.

```
[1]: import lightcurve as lk
```

```
[2]: search_result = lk.search_targetpixelfile('Pi Mensae', mission='TESS', sector=1)
```

```
[3]: search_result
```

[3]: SearchResult containing 2 data products.

#	mission	year	author	exptime	target_name	distance
				s		arcsec
0	TESS Sector 01	2018	SPOC	120	261136679	0.0
1	TESS Sector 01	2018	TESS-SPOC	1800	261136679	0.0

```
[4]: tpf = search_result.download(quality_bitmask='default')
```

```
/Users/gb/dev/lightcurve/src/lightcurve/search.py:346: LightcurveWarning: Warning: 2 files available to download
```


ExoFop

- <https://exofofop.ipac.caltech.edu>

TIC ID 186812530	
In CTL?	Yes
TIC Contamination Ratio	0.006396
Number of Contamination Sources	80

Jump to ▾

Open Observing Notes (6)

Download ⬇

7 nearby targets within 1 arcmin:
[view](#) | [csv](#) | [pipe](#) | [text](#)

149 Files: [tar](#) | [zip](#)
File List: [csv](#) | [pipe](#)

[Text file of this page](#)



Basic Information											
Star Name & Aliases						Confirmed Planet Name(s)			RA/Dec (J2000, epoch 20		
TIC 186812530, 2MASS J08171689+1236049, APASS 41707956, Gaia DR2 650254479499119232, TYC 0802-00751-1, UCAC4 514-046693, WISE J081716.89+123604.7						N/A			08:17:16.89 12:36:04.76 124.320365° +12.601322°		

TESS Objects of Interest (1)											
TOI	TIC	Master priority ?	SG1A priority	SG1B priority	SG2 priority	SG3 priority ?	SG4 priority	SG5 priority	ACWG ESM ?	ACWG TSM ?	TESS Dispositi ?
TOI 503.01	TIC 186812530.01	4	5	5	4	4	4	5	58	223	CP

Community TESS Objects of Interest (0)					+ Create new	? CTOI Guidelines			
CTOI	Master priority	SG1A priority	SG1B priority	SG2 priority	SG3 priority	SG4 priority	SG5 priority	Initial Community Disposition	
	<div>?</div>							<div>?</div>	

Planet Parameters (2)														+ Add new
Name	TOI	Disposition ?	Epoch BJD	Period days	Depth mmag	Depth ppm	Duration hrs	Inclination deg	Impact Parameter <i>b</i>	Rad_p/Rad_s	a/Rad_s	Radius R_Earth	Mass M_Earth	

TESS Object of Interest (TESS Project) (1)													
TIC 186812530.01	TOI 503.01		2459249.58908 ± .0003773	3.6773569 ± .00000029	4.29715 ± .007766	3950 ± 7.15246	1.531 ± .33					11.5082 ± .623437	

<https://exo.mast.stsci.edu>

EXOMAST

Search by planet, object of interest or TESS TCE

[View Table of Exoplanets](#) 

Exoplanet Utilities

<https://astrutils.astronomy.osu.edu/exofast/>

For recent news, follow me on [twitter](#). You can also discuss with me and other users on [Reddit](#).

This applet, and the instructions below, are for EXOFASTv1. For any research grade analysis, [EXOFASTv2](#) is strongly recommended.

Online Applets

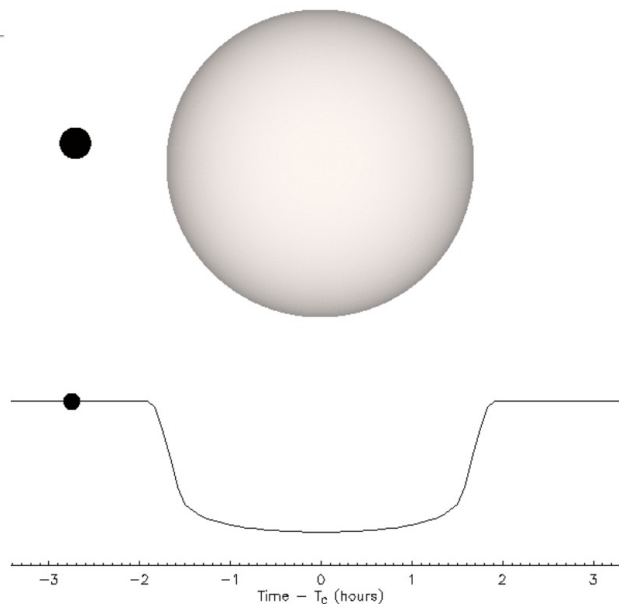
- [EXOFAST](#) -- Fits transit and/or RV data
- [Ephemerides](#) -- Calculates transit/eclipse ephemerides
- [Limb-darkening](#) -- Calculates the quadratic limb-darkening parameters
- [Barycentric Correction](#) -- Calculates the barycentric velocity correction

Documentation

- [README](#) -- Installation instructions
- [Documentation](#) -- Documentation for all EXOFAST routines
- [Release Notes](#) -- Summary of changes/updates
- [Limitations](#) - Warnings about limitations of EXOFAST

Other

- [barycorr.py](#) -- A pure Python code written by Shubham Kanodia that does time conversion and barycentric velocity corrections
- [barycorr.py](#) -- A Python interface written by René Tronsgaard (Aarhus University) that uses the online API for `utc2bjd`, `bjd2utc`, and `barycorr`
- [occultquad.py](#) -- Python implementation of `exofast_occultquad`
- [occultquad.f](#) -- Fortran implementation of `exofast_occultquad`
- [occultquad_extern](#) -- IDL wrapper for fortran version of `occultquad`



HAT-P-3b in true color, created with [TRANSITGIF](#).

Fitting with juliet

- Will be shown on a dedicated jupyter notebook
- <https://juliet.readthedocs.io/en/latest/>

Next lecture

- IMPORTANCE OF A FOLLOW-UP OBSERVING
- Which types of exoplanets do we know?
- Statistics of exoplanets
- Evolution of exoplanetary systems and Solar system