National Aeronautics and Space Administration

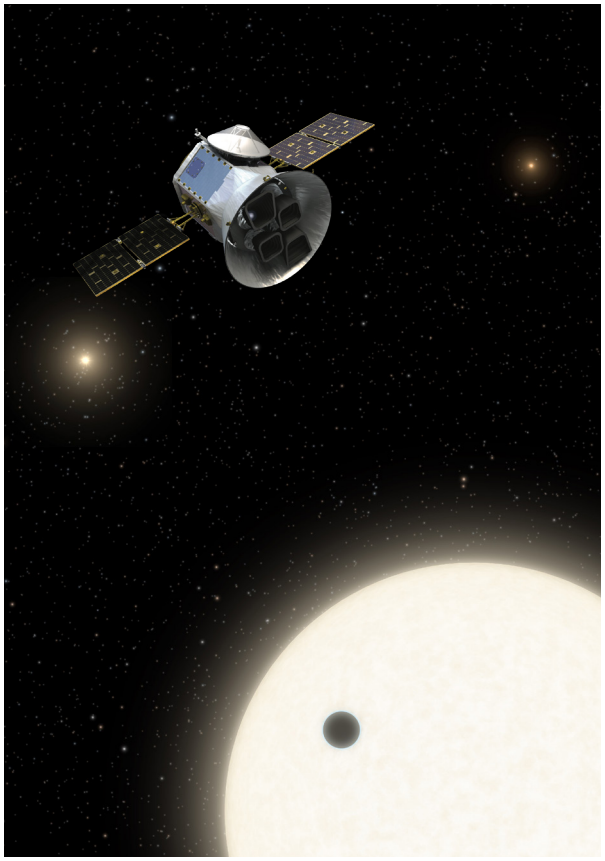
NASAfacts

TESS and Lightkurve

The Transiting Exoplanet Survey Satellite (TESS) is a NASA-sponsored Astrophysics Explorer-class mission that is performing a near all-sky survey to search for planets transiting nearby stars. Launched on April 18, 2018, TESS successfully completed its prime mission on July 4, 2020. Since then, TESS has entered its extended mission during which it has continued to scan the sky for exoplanets and transient events.

In the extended mission, TESS is more community focused, with a much larger guest investigator (GI) program. This program enables teams to propose for the collection of new 2-minute and 20-second cadence targets, provides funding for US investigators to analyze 2-minute and 20-second cadence and full-frame image (FFI) data, and provides funding for US investigators to collect ground-based data that supports TESS science. All proposals are managed by the GI office.

There is no exclusive-use data rights to observations collected by TESS. All data are made available through the MAST public archive once data processing and validation is complete. Anyone can apply for TESS time, and anyone can use TESS data!



Types of Data Products

During science operations, TESS takes a continuous stream of images each with a 2-second exposure. From these 2-second integrations, there are several data products produced:

- Full-frame images (FFIs), which cover the entire Sector observed. They have a cadence of 30-min during years 1 and 2, and 10-min during years 3 and 4.

- Target Pixel Files (TPFs), which are postage stamps of selected targets observed with either a 2-min (all years) or 20-second cadence (years 3 and 4).

- Light curve files, which contain flux time series data and are produced for each 2-min and 20-second cadenced target (from the TPFs). These light curves are corrected for instrumental and noise effects.

You can find out more about the TESS mission and its data products via the following links.

- https://heasarc.gsfc.nasa.gov/docs/tess/
- https://tess.mit.edu
- https://archive.stsci.edu/missions-and-data/tess

Lightkurve

Lightkurve offers a user-friendly way to analyze time series data on the brightness of planets, stars, and galaxies. The package is focused on supporting science with NASA's Kepler and TESS space telescopes, but can equally be used to analyze light curves obtained by backyard telescopes.

To get started with Lightkurve, you will need to first download and install a copy of it. To do this, you need to have a working version of Python (https://www.python.org) on your computer, then follow the instructions listed here:

https://docs.lightkurve.org/about/install .html

If you have no experience using Python but would still like to learn how to reduce TESS data using Lightkurve, you can play with all of the tutorials listed here:

https://docs.lightkurve.org/tutorials/index .html

This is possible via the Google Colab feature. Each tutorial can be opened via the colab button found at the top right. If you have a Google/Gmail account, the notebook will then open for you and you can interact and run each cell once you have first pasted in the following command at the start of the tutorial.

!pip install lightkurve

Several Jupyter notebooks and analysis techniques are presented and discussed here:

https://docs.lightkurve.org/tutorials/index.html

These tutorials provide an overview of various topics, including correcting TESS light curves for sources of noise such as scattered light and adjusting for crowding in images.

The best way to learn is by working on an example. If you have an object you are particularly interested in studying and aren't sure if it has been observed by TESS, check out our viewing tool:

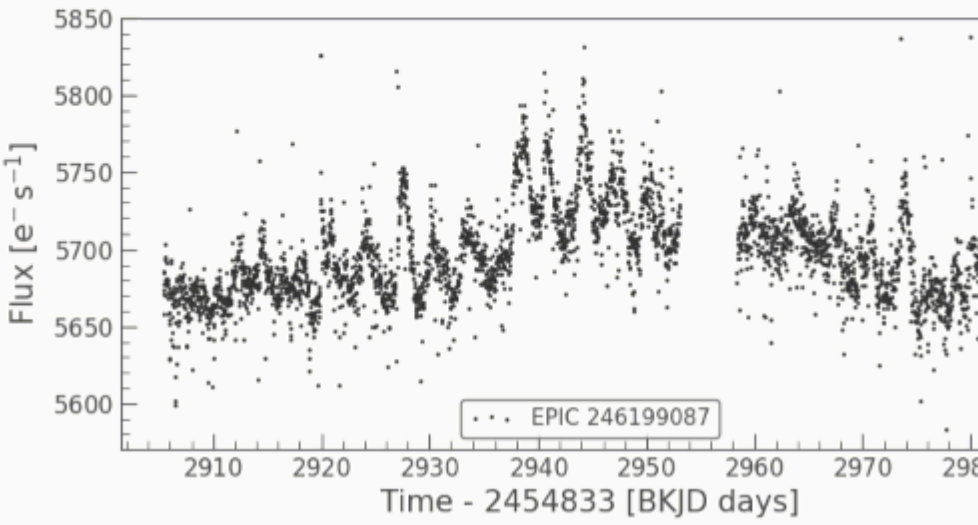
https://heasarc.gsfc.nasa.gov/cgi-bin/tess/webtess/wtv.py

This will tell you if your object was likely observed by TESS, and if so, in which sector and with which camera.

If you have any questions please contact us at:

https://heasarc.gsfc.nasa.gov/docs/tess/helpdesk.html

```
[7]: import lightkurve as lk
     pixelfile = lk.search_targetpixelfile("Trappist-1")[1].download()
     pixelfile.to_lightcurve(method="pld").remove_outliers().scatter();
```



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