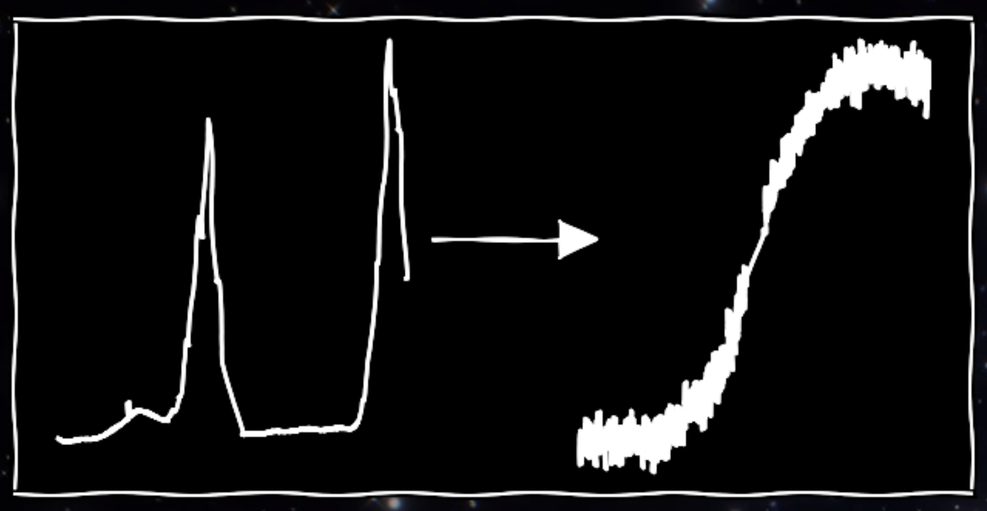

TESSreduce

Transient focused *TESS* data reduction

TESS Sci Con II

Ryan Ridden-Harper (JHU), A. Rest (STScI), R. Hounsell (UMBC, NASA GSFC), T. Müller-Bravo (U. Southampton), Q. Wang (JHU), A. Villar (Penn. State)
Contact: rridden@stsci.edu

TESS **has collected a wealth of data for objects across the sky. This high cadence data has the potential to provide unique and valuable insights into a wide range of phenomena such as progenitors of transients, lensed supernovae, GRBs, and Solar System objects. Studies of such phenomena with *TESS* can often be challenging due to a complex background, subtle shifts in alignment, and no well defined photometric zero point. With `TESSreduce` we have created a pip-installable, open source Python pipeline to reduce and calibrate *TESS* data. `TESSreduce` builds on and makes extensive use of `Lightkurve` and `TESScut`.**

With `TESSreduce` analyzing *TESS* data is simple, opening up the door for anyone to study transient phenomena! You can find `TESSreduce` on GitHub: https://github.com/CheerfulUser/TESSreduce

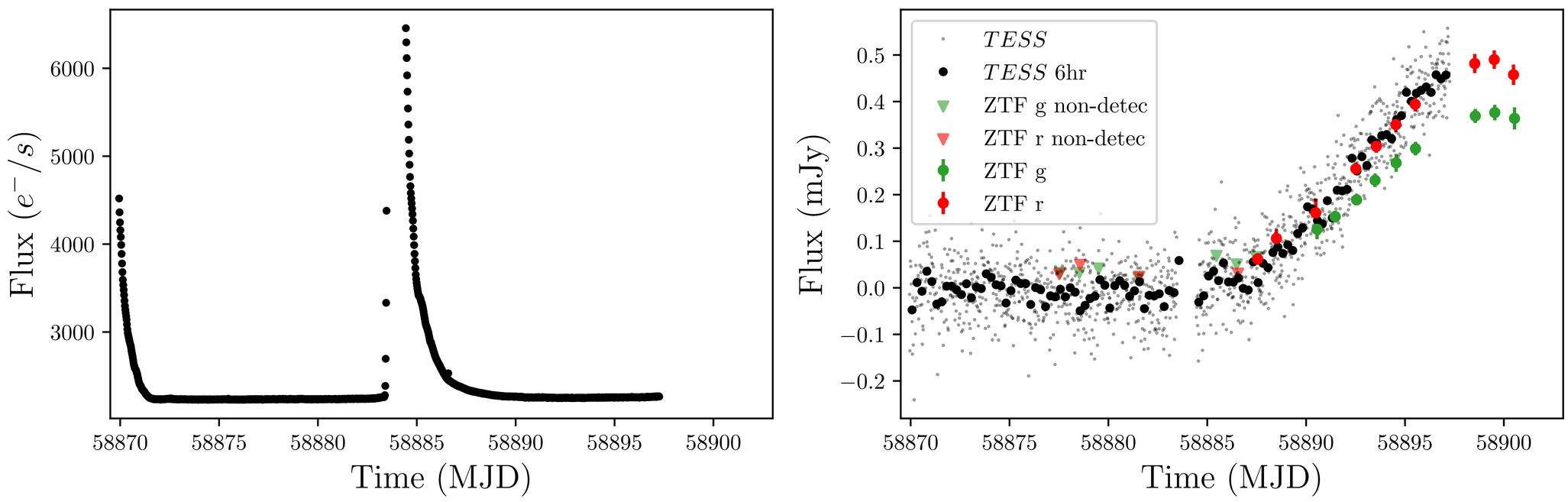

Figure 1: The raw light curve of SN2020cdj (left) is dominated by the scattered light background, with no clear indication of the supernova. Following the reduction with `TESSreduce` (right), the background is cleanly subtracted, alongside artifacts from spacecraft drift. Furthermore the light curve has been calibrated to PS1 photometry allowing it to be directly compared to other measurements such as the public ZTF data made available with Alerce.

Background subtraction

One of the biggest challenges with *TESS* data is in reliably subtracting the dynamic scattered light background. With `TESSreduce` we use ***Gaia***, **PS1**, and **SkyMapper** source catalogues to identify and mask out all sources, we then calculate the smooth background with all pixels that aren't masked. We augment this smooth background with the discrete strap background by calculating the effective quantum efficiency enhancement provided by the electrical straps. The resulting background is a great representation of the dynamic *TESS* background, as seen in **Fig. 2**.

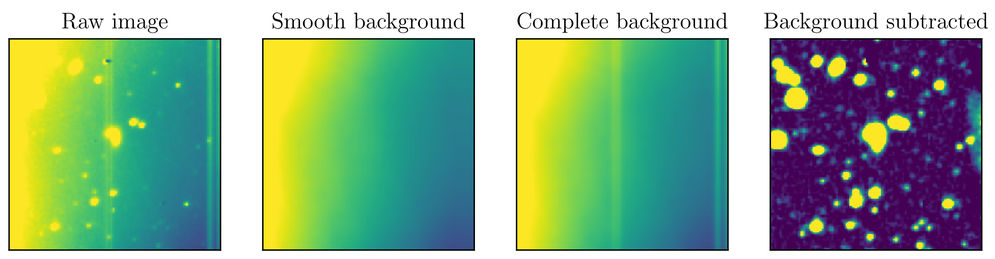

Figure 2: The raw *TESS* image is dominated by a complex background (left), we model this background with a smooth and continuous background (middle left), which is enhanced in discrete columns by backing electrical straps (middle right). Subtracting the modelled background produces a great subtraction (right).

Example reduction

Reducing *TESS* data with `TESSreduce` is simple and can be done in only a few lines of Python code! `TESSreduce` can be applied to any object, in this example we apply it to SN 2020adw.

```
import tessreduce as tr
obj = tr.sn_lookup('SN2020adw')
tess = tr.tessreduce(obj_list=obj,reduce=True)
Finally we subtract the baseline flux and plot!
tess.lc[1] -= np.nanmedian(tess.lc[1,:400])
tess.plotter(ground=True)
```

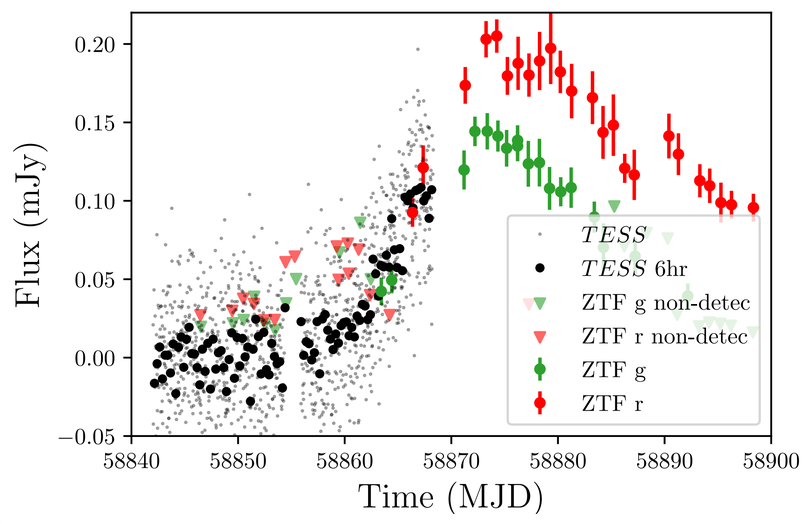

Figure 3: Calibrated TESS light curve of SN2020adw as produced by `TESSreduce`, alongside the public ZTF light curves.