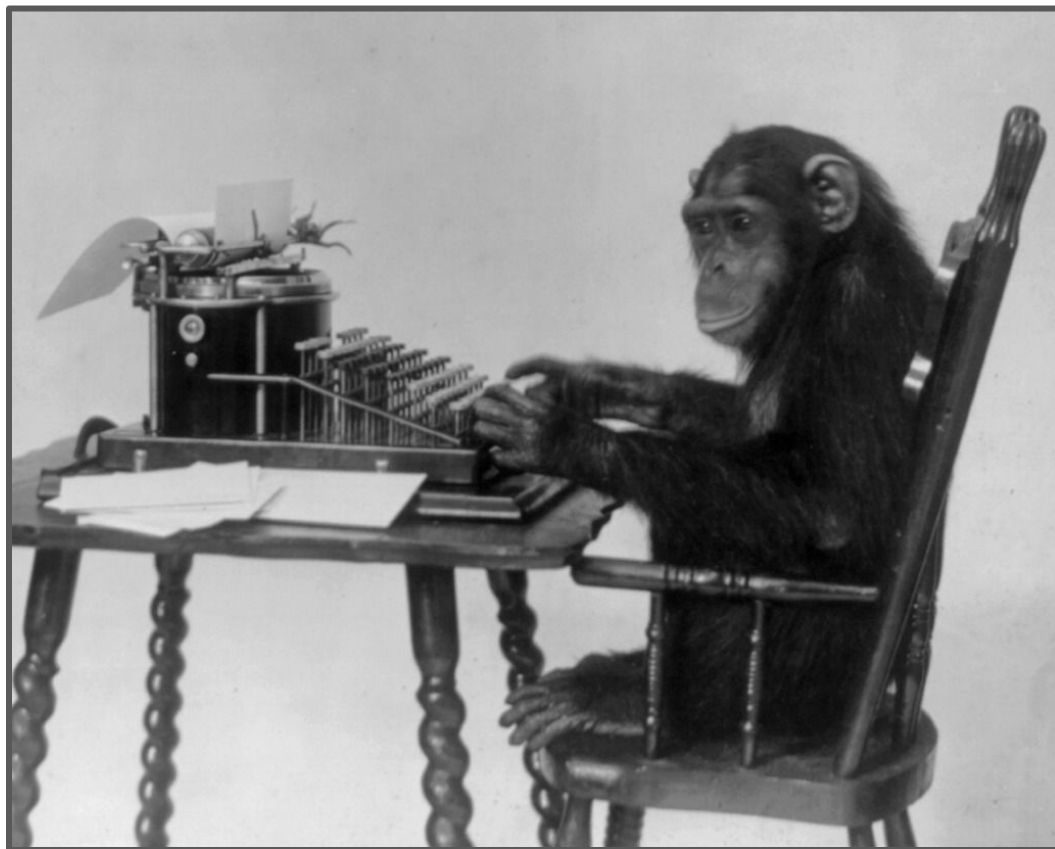# Solar system lightcurve analysis tool

M.S.P. Kelley (UMD)

ZTF Collaboration Meeting, Berlin — 2023 May 10 - 12
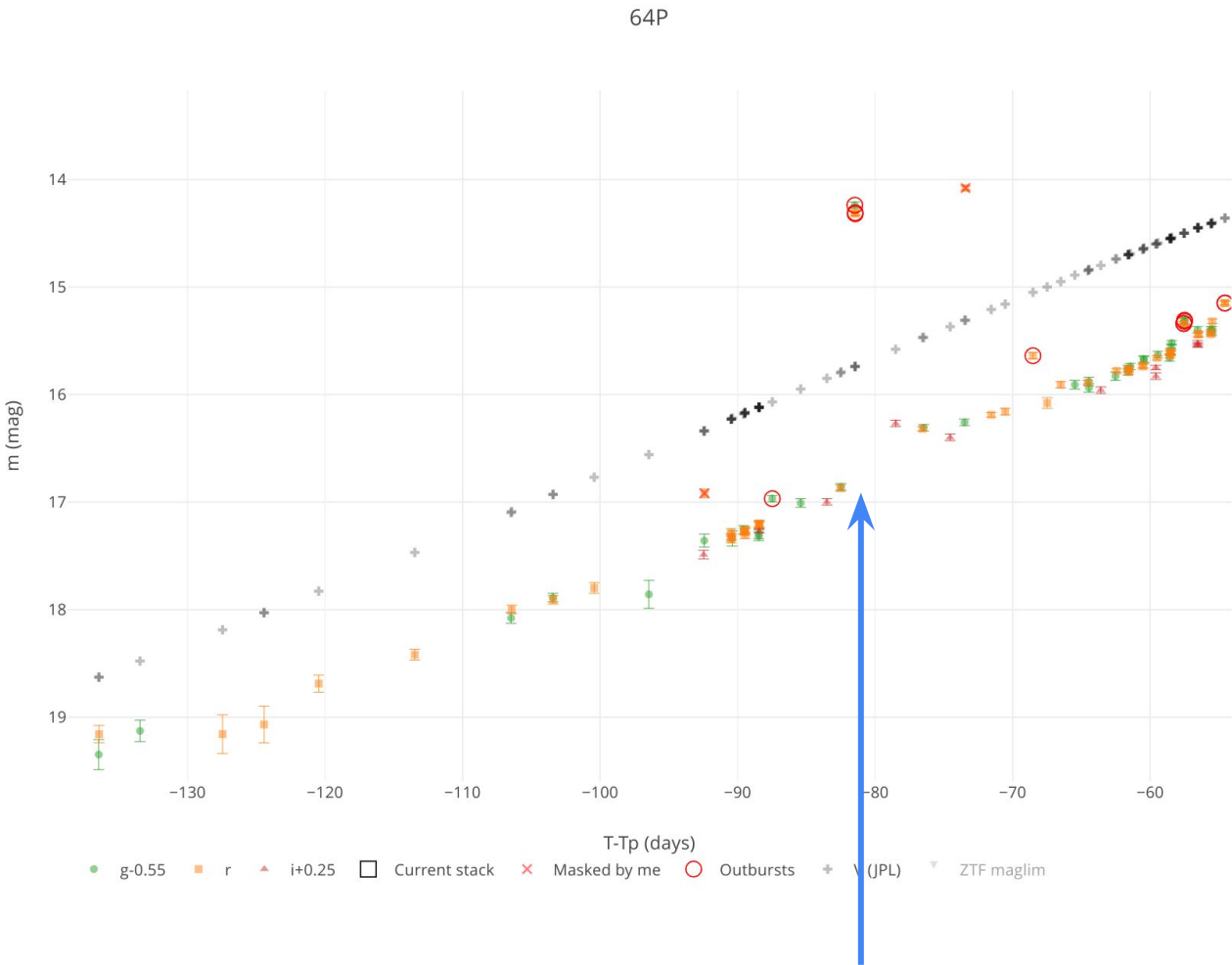
What did we do?

2018 Aug 13

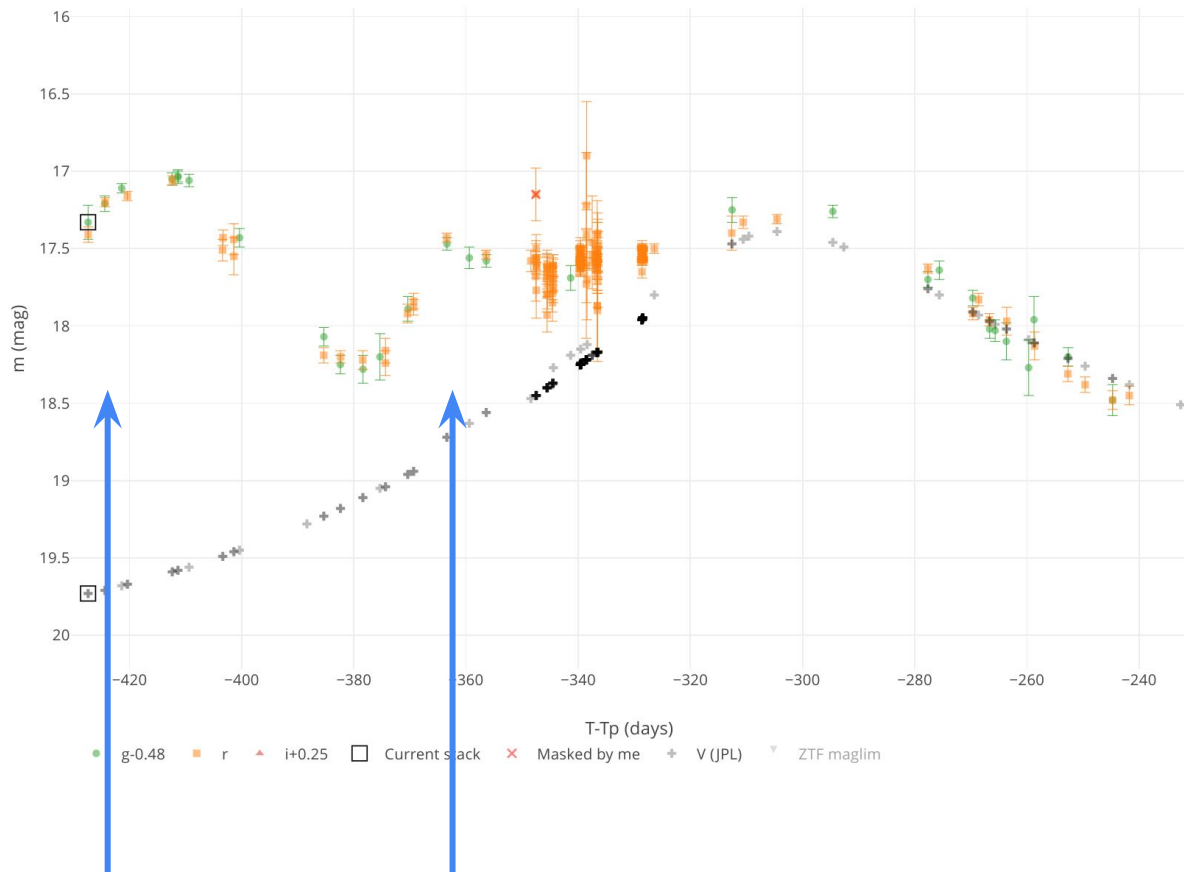Discovered our first cometary outburst with ZTF at 64P/Swift-Gehrels

Kelley et al. 2018, CBET 4544

2018 December / 2019 January

Characterized *two* dust mass loss events from *asteroid* (6478) Gault.
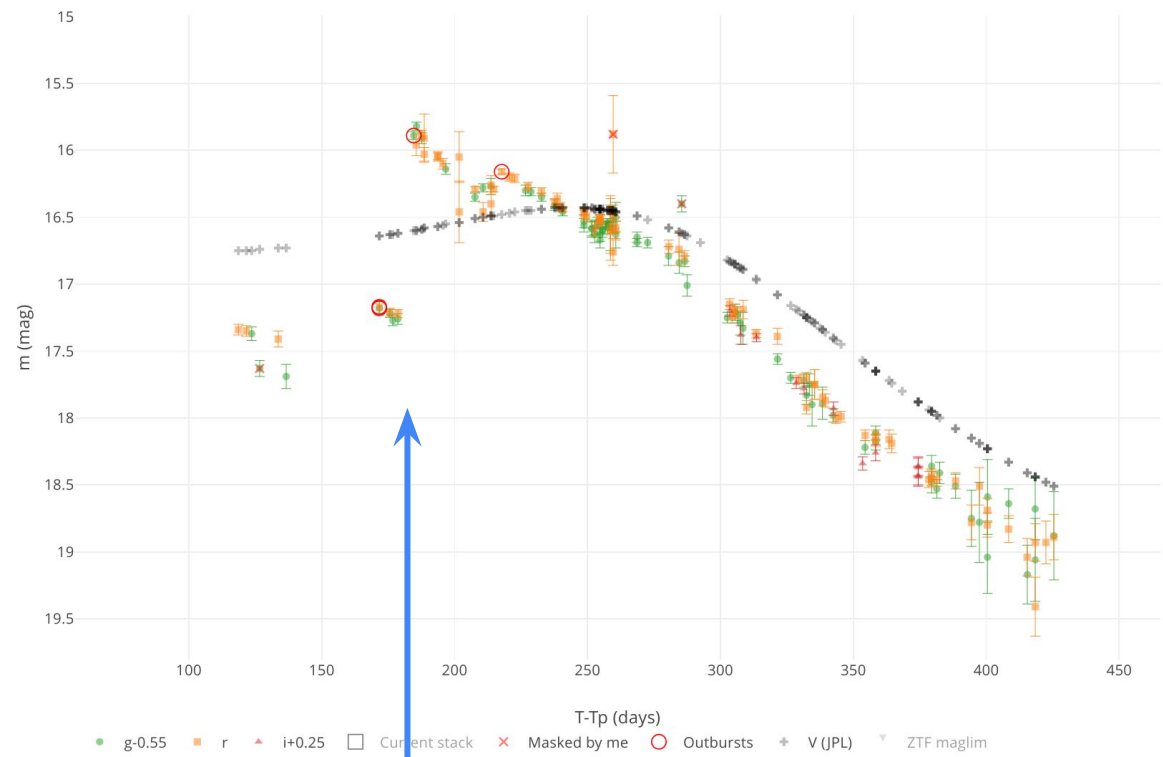
Ye et al. 2019, ApJL **874**, L16

2019 May

Found 240P/NEAT varying between quiescent and heightened activity states after a recent orbital perturbation by Jupiter.
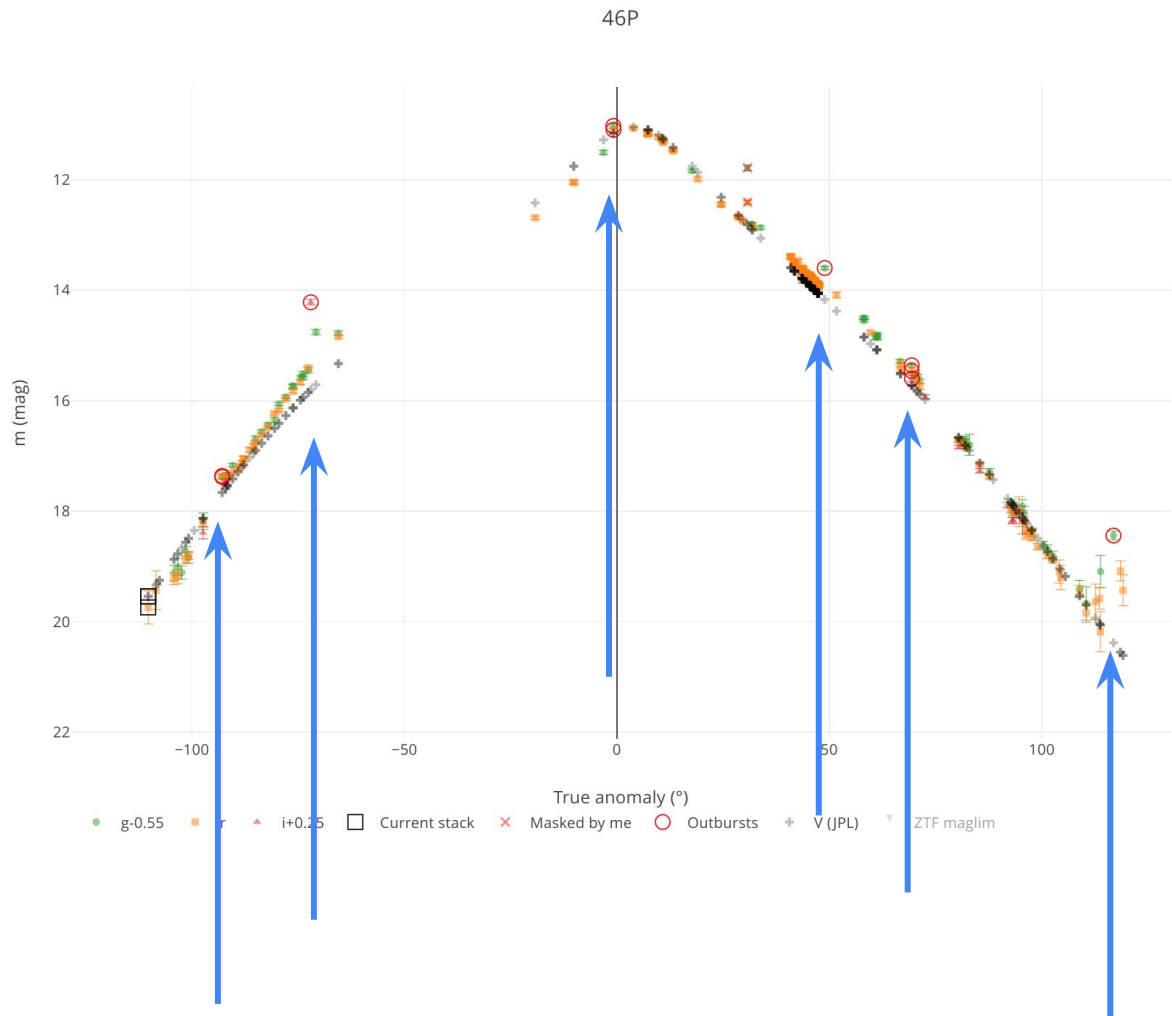
Kelley et al. 2019, ApJL **886**, L16

2020 October

Identified *six* outbursts of comet 46P/Wirtanen, all of them $\lesssim 10^6$ kg of dust (not very much).
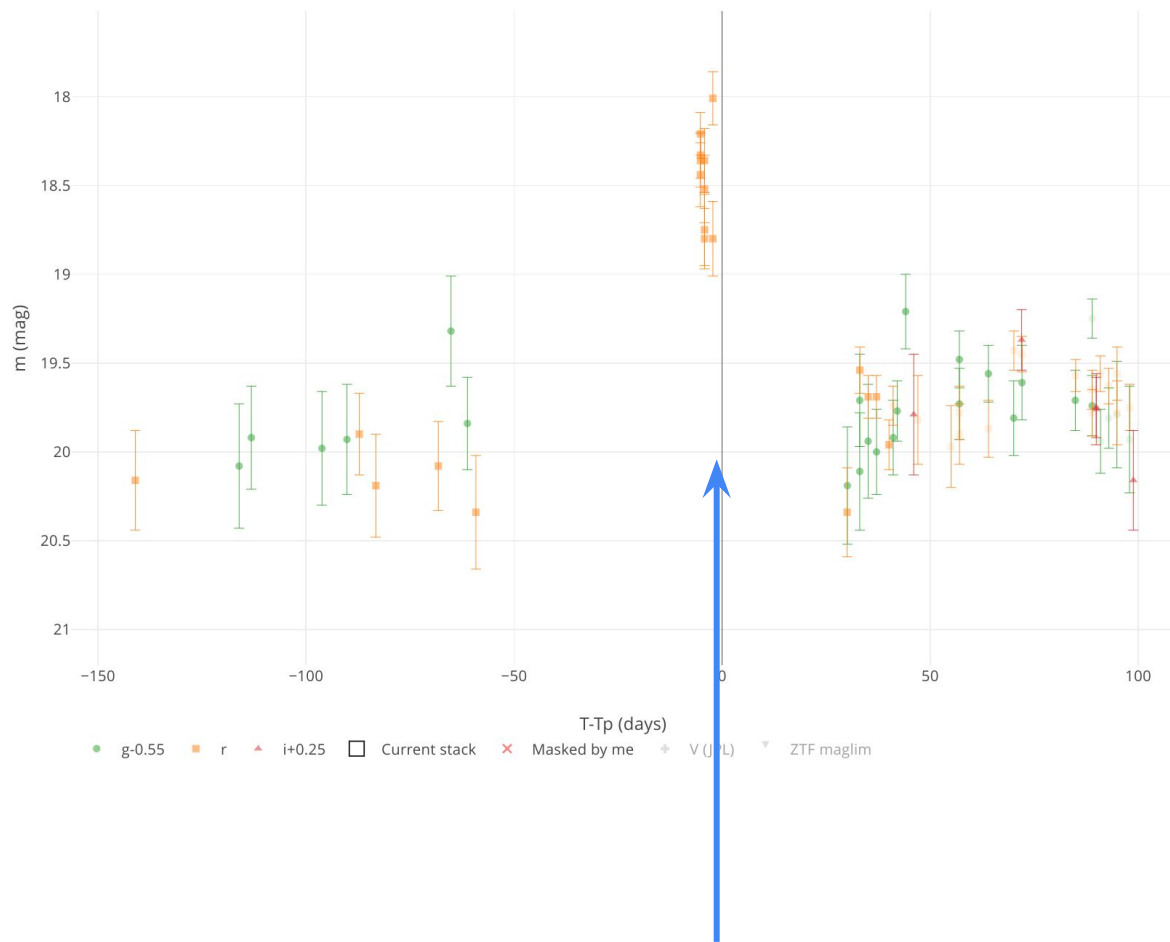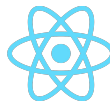
Kelley et al. 2021, PSJ **2**, 131

2021 September

Near-Earth asteroid 2021 HS found to be much brighter than expected (it's a comet).

[Ye et al. 2023, PSJ **4**, 47](#)

Lightcurve analysis tool features

Web-based front-end to ZChecker photometry database.

- Javascript
- React class with its own control panel
- Material UI

Data is served to the user via API calls.

Plots are generated with plotly.js

- Enables interactive use: zoom, select data points, compute colors, hide data points.

- Linked to an image and metadata viewer: selecting data points updates the display.

- Plots look good enough to copy-paste and share.

Several options for x- and y-axis plots, including:

- Absolute or apparent magnitude.

- Configurable aperture size.

- Specialized quantities and scale factors for comets.

- Centroid offset, seeing, heliocentric distance, or whatever other metadata might be useful.
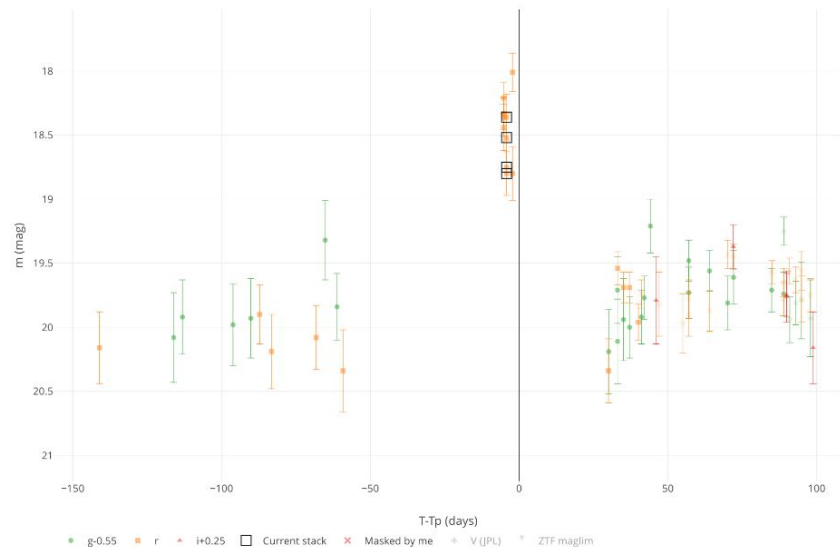
Lightcurve analysis tool caveats

Not a plug and play tool, but can be abstracted from the code.

→ Has already been re-used for a quick look tool for another project.

→ Will be used for a future Minor Planet Center database viewer.

2021 HS

m (mag) vs T-Tp (days)

18
18.5
19
19.5
20
20.5
21

-150   -100   -50   0   50   100

T-Tp (days)

● g-0.55   ■ r   ▲ i+0.25   ☐ Current stack   ✕ Masked by me   ✦ V (JPL)   — ZTF maglim

0 selected points   4 points in current stack

MASK   UNMASK   CLEAR SELECTION   **MASK**   **UNMASK**

Nominally consider 5-pix radius photometry for masking data. If this target is best considered with a smaller aperture, note it above.

✓ Current stack photometry is nominal.

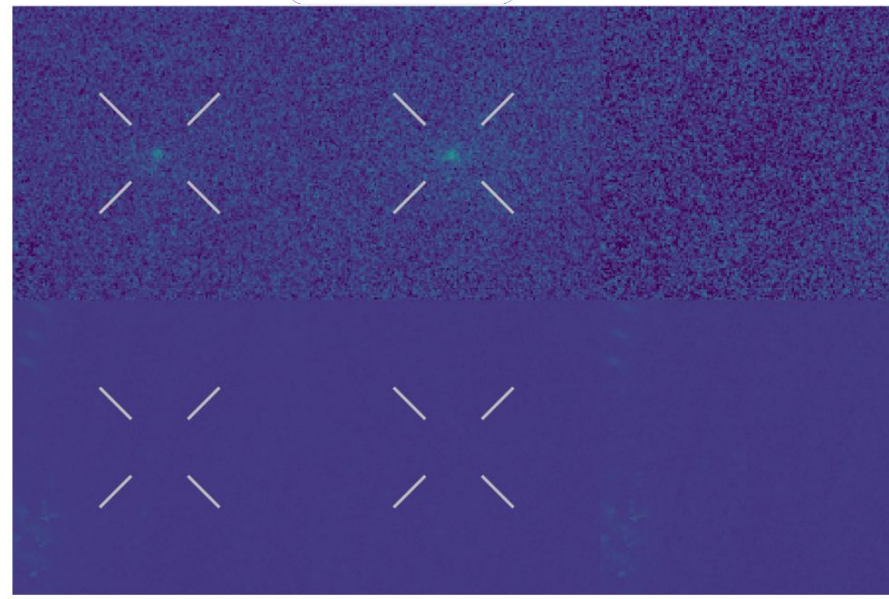| g-r (mag)	r-i (mag)	Aperture radius	y-axis	x-axis	Cometary activity slop...
0.55	0.25	5 pix	m (mag)	T-Tp (days)	-2
Solar: 0.39 mag	Solar: 0.12 mag	1 pix = 1.01"	H = absolute magnitude; Hy = cometary absolute magnitude		Activity ~ rh^k

| 2021 HS | 2021-08-02 |
| SBDB | MPC | MPCHECKER | PS1 |

2021hs-20210802-pre0.800-zr-ztf-stack   DOWNLOAD...

Use left/right arrows to navigate stacks. TOGGLE LEGEND.

file basename / T-Tp
2021hs-20210802-pre0.800-zr-ztf-stack / -4.226

I◄ FIRST   ◄ PREVIOUS   NEXT ►   LAST ►I

79 of 134 selected stacks

Date 2021-08-02   Filter zr   RA 170.204023°