

Solar System Working Group Update

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ZTF Collaboration Meeting, Berlin — 2023 May 10 - 12





NEAR EARTH OBJECT DISCOVERIES

- NEOZTF group uses the ZStreak, ZMODE and Tails to monitor moving objects in the solar system
- ZStreak used to monitor fast moving object : Objects moving at speeds > 10⁰ per day.
- Past 5 months:
 - 21 New NEO Discoveries credited towards ZTF
 - 24 NEOs recovered
 - 2 NEO precoveries
 - Precovery of COMET C/2023 A3 (Tsuchinshan-ATLAS)

2023 HU2 Discovered : 20th April 2023





Established a collaboration with Željko Ivezić (UW) and Lynne Jones (Rubin Observatory) to study the rotational light curves and colors of the Jovian Trojan populations. Work is in progress...

TF Prompt outburst survey

Outbursts of solar system objects are due to a variety of mechanisms, e.g., rotational break-up, impacts, cliff collapse, rapid release of volatiles.

Photometry and morphology of all comets (and a few asteroids) are examined daily.

New reports since the Evanston meeting:



Three new outbursts	-0.6 and -0.4 mag at 44P/Reinmuth 2 [Kelley, ATel#15722]
	–1.9 mag at 7P/Pons-Winnecke [Kelley, Ye, et al. ATel#15772]
Cometary activity co-discoveries	C/2023 A3 (Tsuchinshan-ATLAS) [Ye, CBET#5228]
	P/2022 BV9 (Lemmon) [Kelley & Ye <u>CBET#5251]</u>
Unusual morphology	Debris cloud of C/2020 J1 (SONEAR) [Ye & Kelley ATel#15767]



C/2020 J1 with 4.3-m LDT, October 2022

Comet C/2020 J1 (SONEAR)

Comet that never crossed the water-ice line, but disrupts (Ye & Kelley 2022).

q = 3.4 au



Ye, Kelley (UMD), ATel 15767

C/2020 J1





C/2020 J1 (SONEAR) ZTF r-band images From 3.4 to 6.7 au.

The diffuse morphology in later epochs indicated something unusual had occurred.

So we obtained follow-up data...

C/2020 J1 (SONEAR) LDT r' image 2022 Oct 27 r_h =5.9 au Ye & Kelley



Debris cloud

Pseudo-nucleus r = 21 mag

Faint tail



C/2020 J1



ZTF photometry shows absolute magnitude brightened by a small amount after perihelion... is this a clue to the origin of the debris cloud or a projection effect?



Comet P/2021 HS (Pan-STARRS)

- Designated as an asteroid at discovery; ZTF Twilight Survey observations at high phase angle showed a dust coma.
- One of the lowest levels of activity ever observed among comets.
- Uncloaking ultra-low activity comets!
- Published in The Planetary Science Journal (Ye, Kelley, Bauer, Farnham, et al. 2023)

Comet C/2020 P4 (SOHO) is also being investigated. Stay tuned...

Phase curve of P/2021 HS



TF Cometary archival photometry survey

Goal is to find all outbursts ≤ -0.5 mag in the ZTF archive. This project has the benefit of uncovering several other aspects:

- population colors and color variation
- dependence of activity on heliocentric distance
- the scattering properties of dust

A data set is being prepared for submission to the NASA Planetary Data System.

- \rightarrow 182 lightcurves reviewed, many more to go.
- \rightarrow 189 outbursts (73 from comet 29P).

Team status



Your assignments and reviews

Search								
Matches unforma	s, case inser	nsitive						
144 rows								
Designation	N(nights)	N(obs)	N(g)	N(r)	N(i)	Assignment	Reviewed	Review ψ updated
129P	340	705	61	127	14	Complete	Reviewed	2023 May 10
145P	132	526	92	129	3		Reviewed	2023 May 10
264P	145	334	7	13	11	Complete	Reviewed	2023 May 10
21P	206	426	137	130	0	Complete	Reviewed	2023 May 04
C/2020 H11	370	984	9	53	7		Reviewed	2023 May 01
49P	227	860	73	126	17	Complete	Reviewed	2023 May 01
84P	249	669	90	156	27		Reviewed	2023 May 01
105P	156	309	35	48	8	Complete	Reviewed	2023 May 01
163P	101	374	10	30	31	Complete	Reviewed	2023 May 01
164P	261	463	52	72	13	Complete	Reviewed	2023 May 01
195P	642	1934	35	74	12	Complete	Reviewed	2023 May 01
217P	158	366	39	58	14	Complete	Reviewed	2023 May 01
241P	189	514	48	213	17	Complete	Reviewed	2023 May 01
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That "Green Comet" C/2022 E3 (@TF)

Comets tend to be green in optical images due to C_2 molecules produced in the coma.

To see C_2 , we generally need:

- 1. Larger production rates.
- 2. Closer to the Sun and Earth.
- 3. Good separation between gas and dust.

It also helps if the comet is visible outside of twilight.







GREEN COMET

AVS Academy Green Comet by Anagha Lokesh, Virginia

-5 Study IQ

Green Comet, Background, Composition ...

Newsweek

Watch Final Hurrah of Green Comet ...



The green comet ZTF returns to the ...

F Forbes See The Green Comet Tonight: Don't Mis...



FindLiveJob WSFA Green comet discovered by Pal... Green comet to appear in night sky for ...



8 KGW green comet swings past Earth ...



How to see the green comet TONIGH ...



IFLScience



Green Comet Set To Make Closest Pas...



Green Comet Videos And Pictures: Fail



Artist's illustration of a green comet. A comet known as C/2022 E3 (ZTF) will soon make a close approach to Earth. ISTOCK





Tips to see the green comet in the UK ...



Green Comet - IAS EXAM





Vahoo Sports

A rare green comet will be

green comet whiz past Earth tonight



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S The Irish Sun



SpotboyE







ZTF full-CCD r-band 2023 Feb 16 r_h =1.2 au, Δ =0.6 au N up, E left



ZTF photometry shows a typical comet

g-*r* = 0.51 mag (Sun = 0.39 mag) *r*-*i* = 0.22 mag (Sun = 0.12 mag)



ZTF full-CCD r-band 2023 Feb 16 r_h =1.2 au, Δ =0.6 au N up, E left



Afp is a cometary quantity proportional to mass loss rate. $Q_{dust} \sim r_{h}^{-7}$ from 6 to 4 au (dynamical effects?) $Q_{dust} \sim r_{h}^{-1}$ from 4 to 1.5 au

The break in the brightening trend is presently not predictable, an example of the challenge of predicting cometary brightness after discovery (here, near 4.4 au).