

Purple Mountain Observatory
Chinese Academy of Sciences

WG1 status report from CNSA

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Routine Observation



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- We continuously tracking down the rocket upper stages launched by China. During the last year, **230,150** tracklets from **212** objects are obtained. (2022.01.01-2023.04.30)

R/B	number	orbit	tracklets
CZ-2C	31	LEO	13566
CZ-2D	17	LEO	10173
CZ-2F	1	LEO	287
CZ-3	5	HEO	15264
CZ-3A	9	HEO	18545
CZ-3B	30	HEO	61591
CZ-3C	7	HEO	12861
CZ-4	2	LEO	2229
CZ-4B	22	LEO	11421
CZ-4C	41	LEO	28989

R/B	number	orbit	tracklets
CZ-5	3	HEO	6044
CZ-6	4	LEO	2258
CZ-6A	2	LEO	1250
CZ-7A	1	HEO	2427
CZ-11	3	LEO	1341
CZ-11H	1	LEO	497
KZ-1A	3	LEO	429
KZ-11	1	LEO	582
YZ-1	15	MEO	16383
YZ-2	1	GEO	4674
AKM	13	GEO	19339

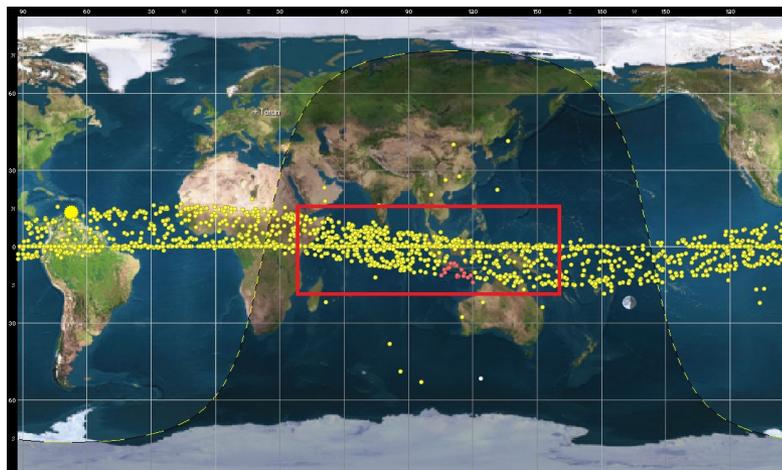
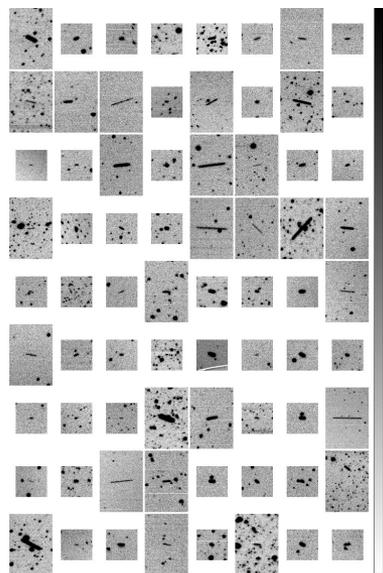


Routine Observation



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- Approximately 1400 GEO objects and other types of objects are tracked down utilizing 6 telescope arrays across China
- New object correlation pipeline is under test, most of the URTs are orbit keeping maneuvers, also including new objects and false detections



GEO	1397
GTO	1646
MEO	415



Multi-color Survey



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- Physical properties are required for object classes identification and space environment models development, besides the orbits
- simultaneous surveys for GEO region in g'r'i' bands were performed utilizing the CHanging Event Survey (CHES) system



Aperture	280 mm
Lens Type	Refraction
Field of view	$7^\circ \times 7^\circ$
Size of frame	3056×3056
F-Ratio	1.07
Pixel scale	8.25"

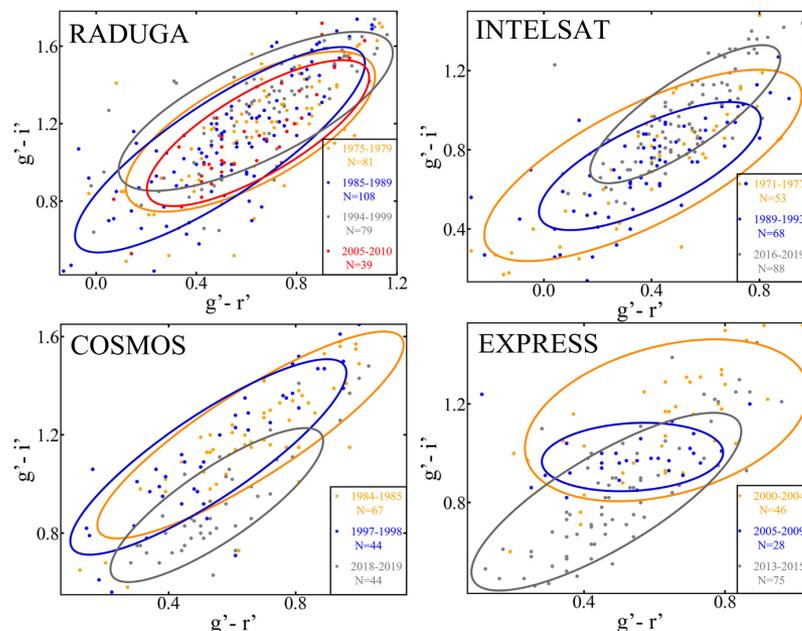
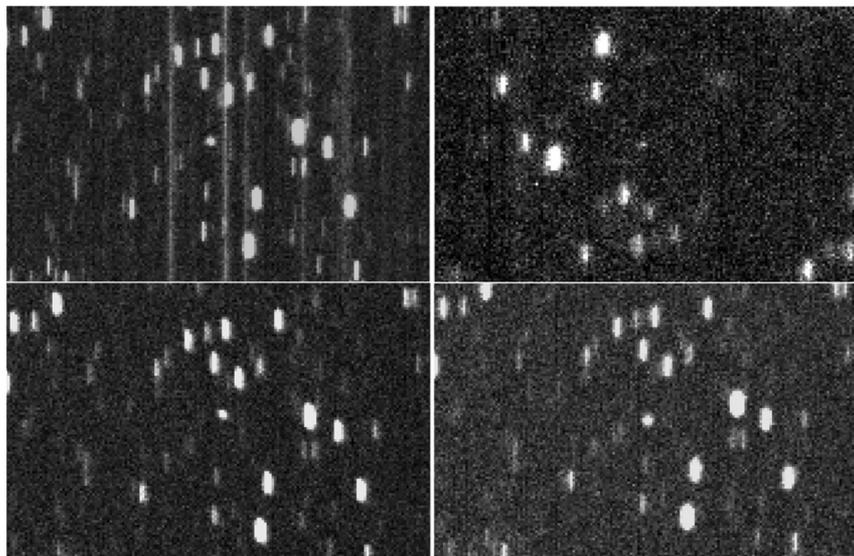


Multi-color Survey



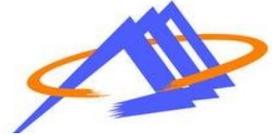
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- Survey is performed only at photometric nights
- Color data of 1697 objects is obtained, color index distribution, clustering and evolution with launch age are investigated



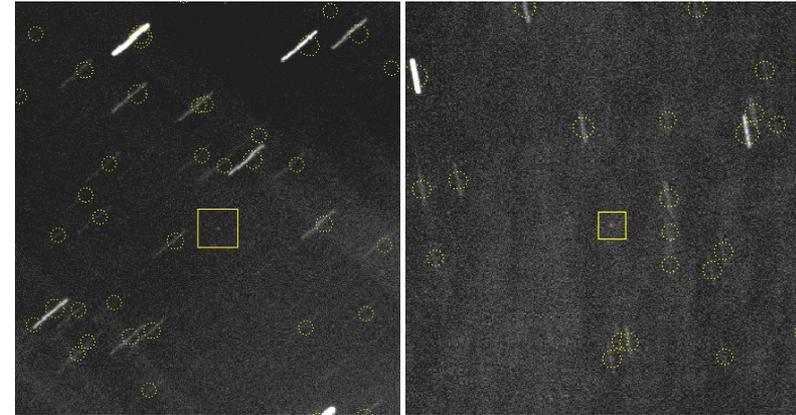


Space Events



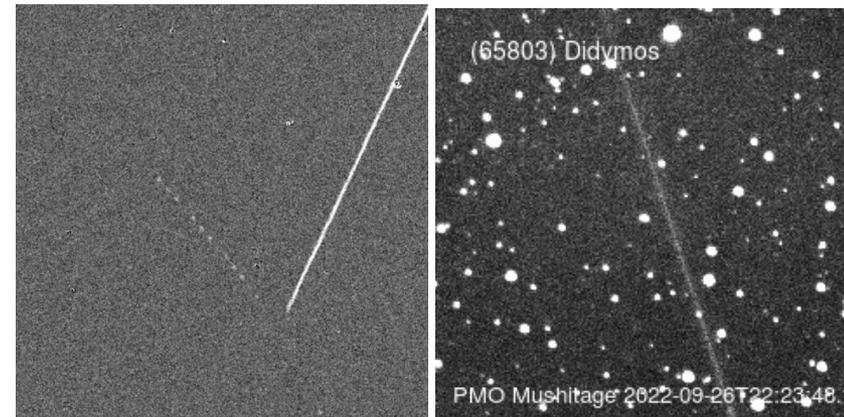
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- **2022/05/09 two faint debris. Possibly related to the SL-12 R/B breakup event on April 15, 2022**



- **Lunar impact on 2022/03/04**

- **DART MISSION on 2022/09/26**



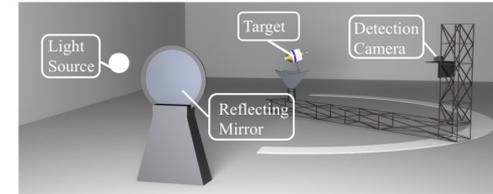


Photometry Simulation

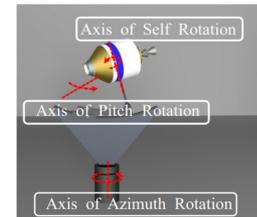
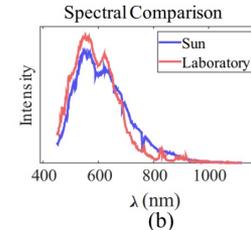


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- Research of photometric consistency calibration of space debris based on numerical simulation and laboratory simulation
- 1:9 CZ-4C upper stage model
 - Laboratory simulation with solar simulator
 - Numerical simulation using Povray with different environment condition
 - VR scans of real model from Vray
- To improve the numerical simulation performance of telescope observation directly



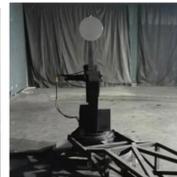
(a)



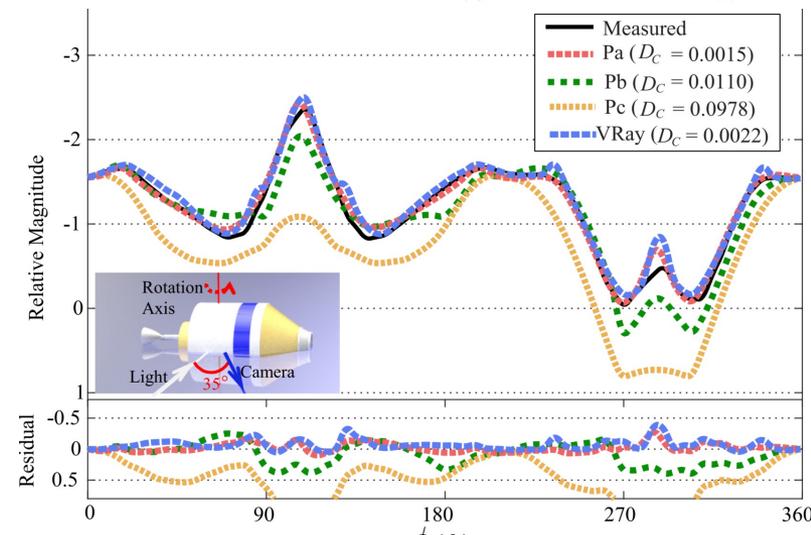
(c)



(d)

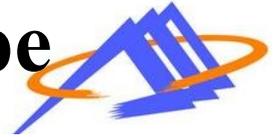


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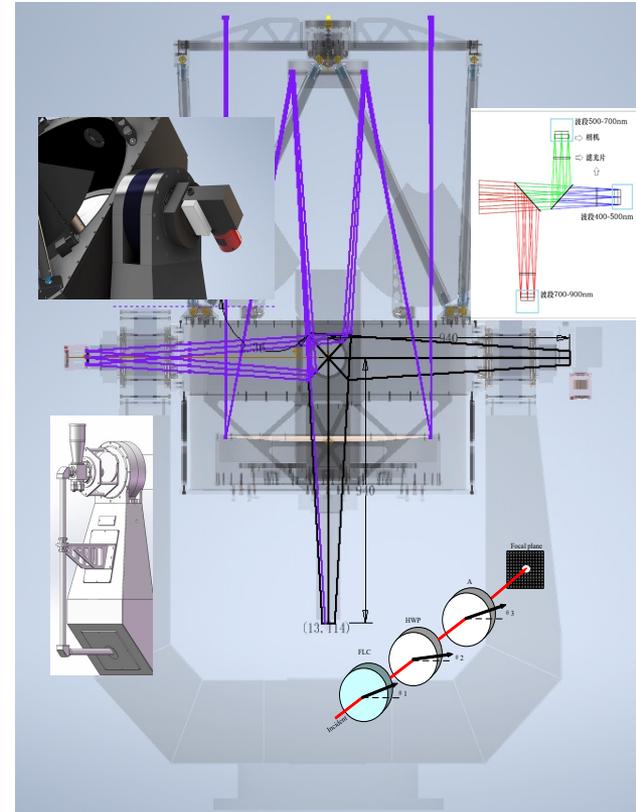


New 800mm Space Debris Telescope



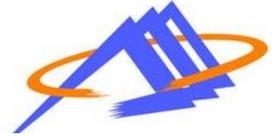
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- 800mm f/7 telescope for high precision and multi-purpose optical measurements of space debris
- Low resolution spectrometer, triple channel simultaneous photometer, laser ranging system with independent transmitter





Future works



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- **Keep on the routine observation**
- **Keep using meter class telescopes and optical arrays for debris survey on higher orbits**
- **Test new telescope and participate future AIs**



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Thank you for your attention!