Absolute magnitudes and photometry from the MPC catalog

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EU-ESA Workshop on Size Determination of Potentially Hazardous Near-Earth Objects
Nov 11 - 13, 2024

Minor Planet Center

https://www.minorplanetcenter.net/

CENTER FOR ASTROPHYSICS
HARVARD & SMITHSONIAN

NASA

PDS
Planetary Data System

PLANETARY DEFENSE COORDINATION OFFICE
HIC SERVARE DIEM

Running Tallies

Near-Earth Objects Discovered

THIS MONTH:	30
THIS YEAR:	2410
ALL TIME:	36548

Minor Planets Discovered

THIS MONTH:	27
THIS YEAR:	16317
ALL TIME:	1392084

Comets Discovered

THIS MONTH:	0
THIS YEAR:	51
ALL TIME:	4565

Observations

THIS MONTH:	639463
THIS YEAR:	29.7 million
ALL TIME:	464.4 million

Data availability

OLD:

https://minorplanetcenter.net/iau/MPCORB.html

MPCORB.DAT - orbits (subsets, e.g. NEA.txt)

https://www.minorplanetcenter.net/iau/ECS/MPCAT-OBS/MPCAT-OBS.html - observations

Online web interface (single orbit + observations):

https://www.minorplanetcenter.net/db_search

Mariadb - mysql (observations, orbits)

NEW:

Databases: SBN MPC Annex

https://sbnmpc.astro.umd.edu/

https://sbnmpc.astro.umd.edu/MPC_database/statusDB.shtml - replication

Postgres (obs_sbn , mpc_orbits)

https://data.minorplanetcenter.net/explorer/ MPC Explorer

Database schema:

https://data.minorplanetcenter.net/postgres-schema/schema.html

Magnitude reporting precision

MPC1992 format (obs80)

```
K24V01G* C2024 11 02.55763407 16 15.374+24 38 45.38          21.50wX      F52
K24V01G  C2024 11 02.56955407 16 15.776+24 39 23.22          21.59wX      F52
K24V01G  C2024 11 02.58151707 16 16.158+24 40 01.06          21.53wX      F52
K24V01G KC2024 11 03.05071807 16 37.20 +25 04 25.3           21.4 GV      L01
K24V01G IC2024 11 03.05287007 16 37.24 +25 04 31.1           21.2 GV      L01
K24V01G KC2024 11 03.06308907 16 37.57 +25 05 04.8           21.5 GV      L01
K24V01G HB2024 11 03.13301 07 16 40.13 +25 08 46.1           21.5 GV      204
K24V01G KB2024 11 03.16934 07 16 41.35 +25 10 40.8                        V
204
```

ADES XML

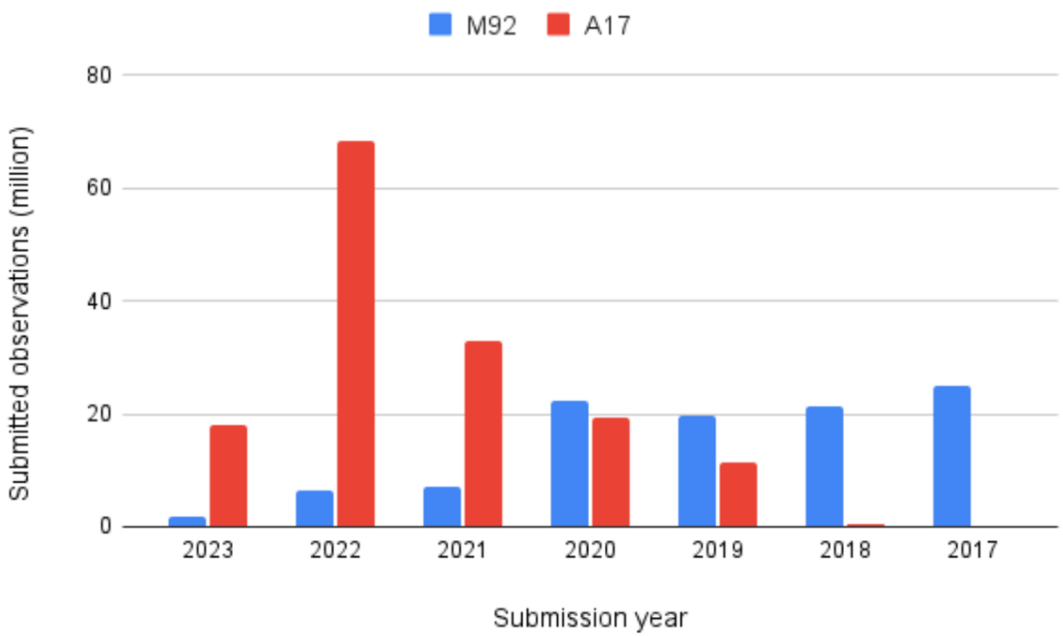
```
<?xml version='1.0' encoding='UTF-8'?>
<ades version="2017">
<optical>
<provID>2024 VG1</provID>
<trkSub>P221yVP</trkSub>
<obsID>LI1Dxw5r0000GOX5010000002</obsID
>
<trkID>00000IMnoF</trkID>
<mode>CCD</mode>
<stn>F52</stn>
<obsTime>2024-11-02T13:22:59.6Z</obsTime>
<ra>109.064058</ra>
<dec>24.645938</dec>
<rmsRA>0.113</rmsRA>
<rmsDec>0.053</rmsDec>
<astCat>Gaia3E</astCat>
<mag>21.50</mag>
<rmsMag>0.14</rmsMag>
<band>Pw</band>
<logSNR>0.89</logSNR>
<exp>45.0</exp>
<ref>MPEC 2024-V73</ref>
<disc>*</disc>
<subFmt>A17</subFmt>
</optical>
```

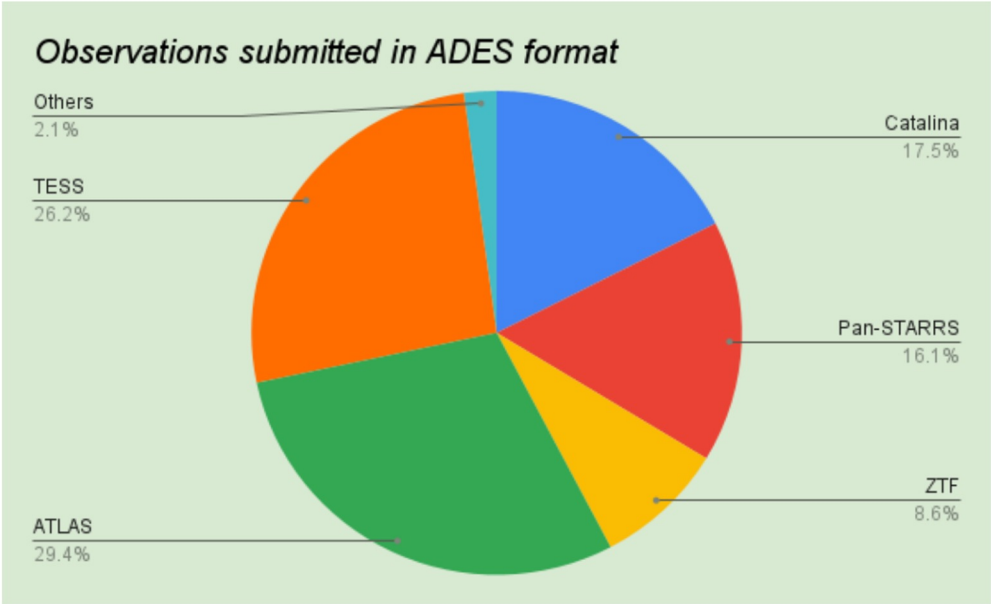
No magnitude

No decimal digits

One decimal digit

ADES submission





Magnitude reporting precision

Potential issues:

How do submitters measure the magnitude?

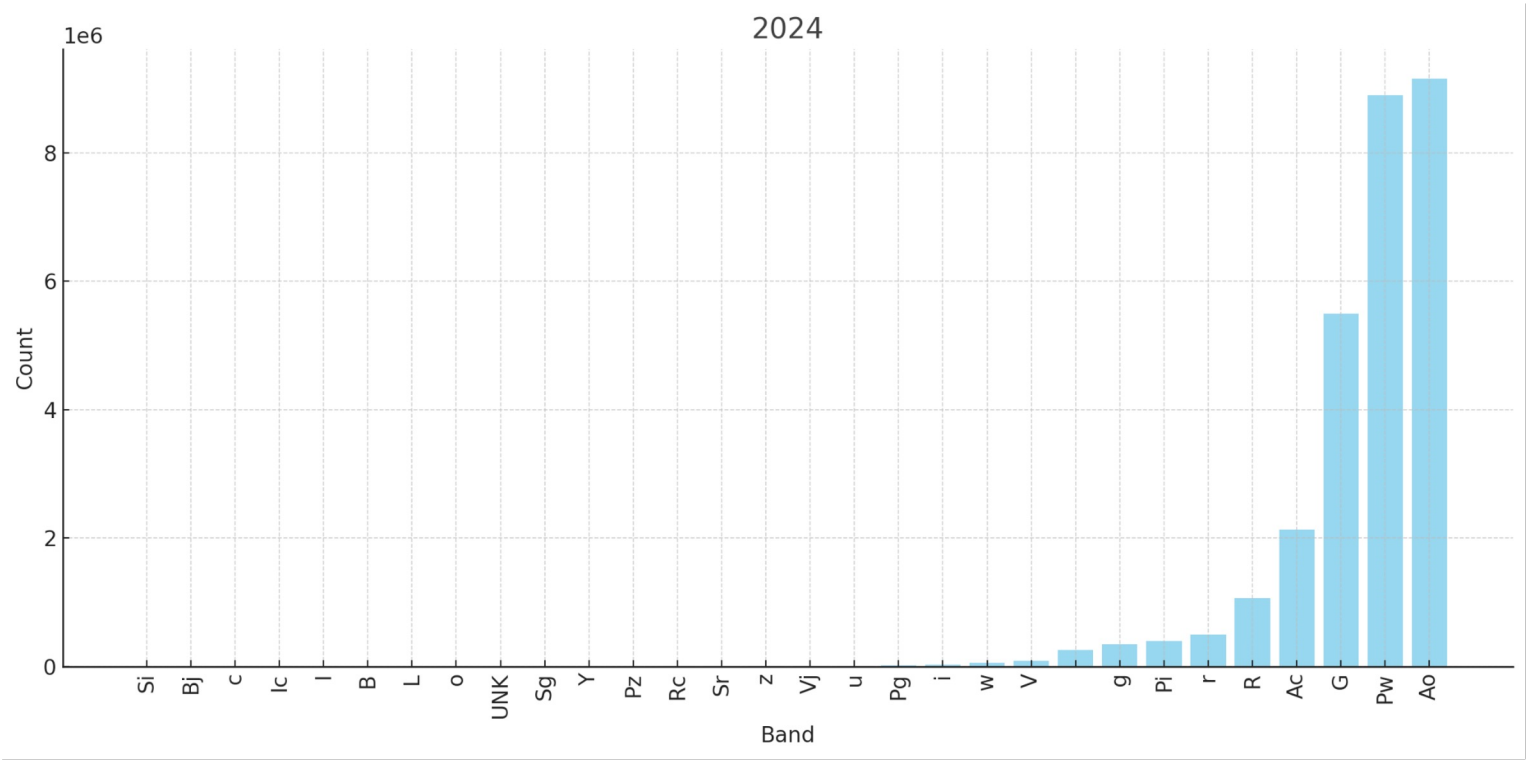
Issue of stacked observations/synthetic tracking

Trailed images

Conversion to V-band

The International Astronomical Union Minor Planet Center

https://cgi.minorplanetcenter.net/iau/info/BandConversion.txt



blank	-0.8
U	-1.3
B	-0.8
g	-0.35
V	0
r	0.14
R	0.4
C	0.4
W	0.4
i	0.32
z	0.26
I	0.8
J	1.2
w	-0.13
y	0.32
L	0.2
H	1.4
K	1.7
Y	0.7
G	0.28
v	0
c	-0.05
o	0.33
u	+2.5

ADES VALUES https://www.minorplanetcenter.net/mpcops/documentation/valid-ades-values/

Derived absolute magnitude

H - Bowell (89) H-G photometric system

$V(\alpha)=H-2.5\log_{10}[(1-G)\Phi_1(\alpha)+G\Phi_2(\alpha)] + 5\log_{10}(r\,\Delta)$

One decimal digit (old MPC orbit fitter) - 97,000

Two decimal digits (orbfit) - 1.32 million

No absolute magnitude: 286 (blank) or 136 (99.99)

Slope parameter: ~ all fixed at 0.15

No value - no H (286)

Absolute magnitude (H)

The International Astronomical Union Minor Planet Center

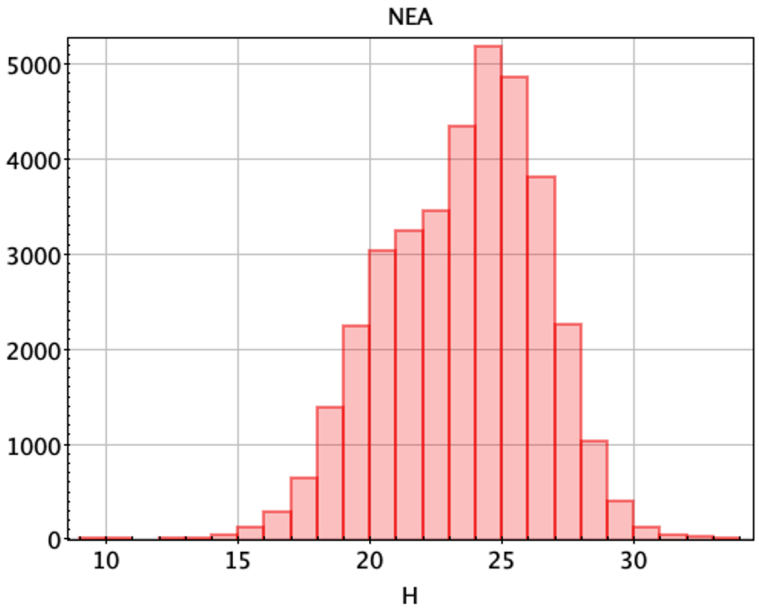
MPCORB.DAT

Des'n	H	G	Epoch	M	Peri.	Node	Incl.	e	n	a	Reference	#Obs	#Opp	Arc	rms	Perts	Computer
00433	10.41	0.15	K24AH	86.66754	178.91030	304.27434	10.82773	0.2226906	0.55974055	1.4581813	0 E2024-J61	14649	57	1893-2024	0.54	M-v 3Ek	MPCLINUX
00719	15.59	0.15	K24AH	148.45068	156.21553	183.85715	11.57526	0.5467796	0.23027518	2.6361571	0 E2024-D06	2053	22	1911-2024	0.57	M-v 3Ek	MPCLINUX
00887	13.84	0.15	K24AH	340.19843	350.47422	110.42303	9.39880	0.5710933	0.25350880	2.4725250	0 E2024-V74	3347	39	1918-2024	0.65	M-v 3Ek	MPCLINUX

Reference	#Obs	#Opp	a
1804			(433) Eros
20240416			
1804			(719) Albert
20240215			
1804			(887) Alinda
20241104			

Database

postgres: mpc_orbits: h, g
mariadb: orbits: absolute_magnitude, phase_slope



Additional ADES data

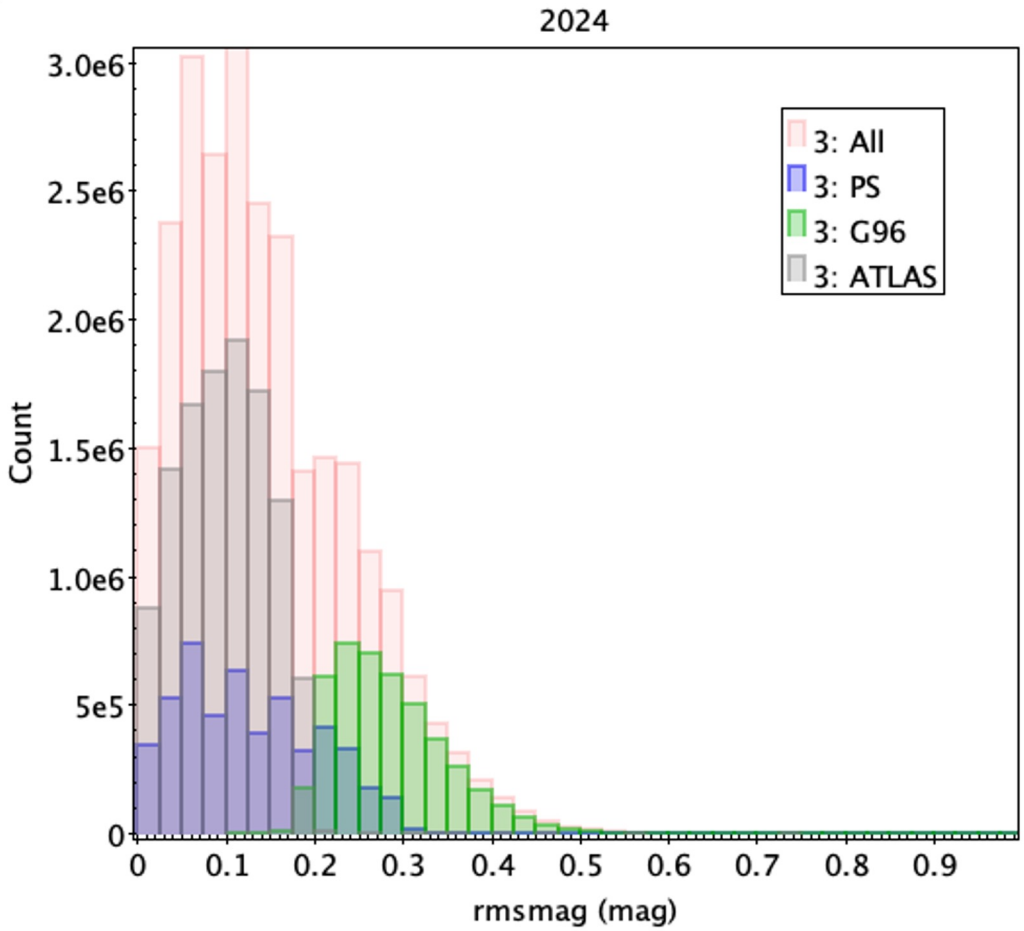
sbn_obs - database only (postgres)

mag

rmsmag

logsnr

band



ORBIT COMPARISON TOOL

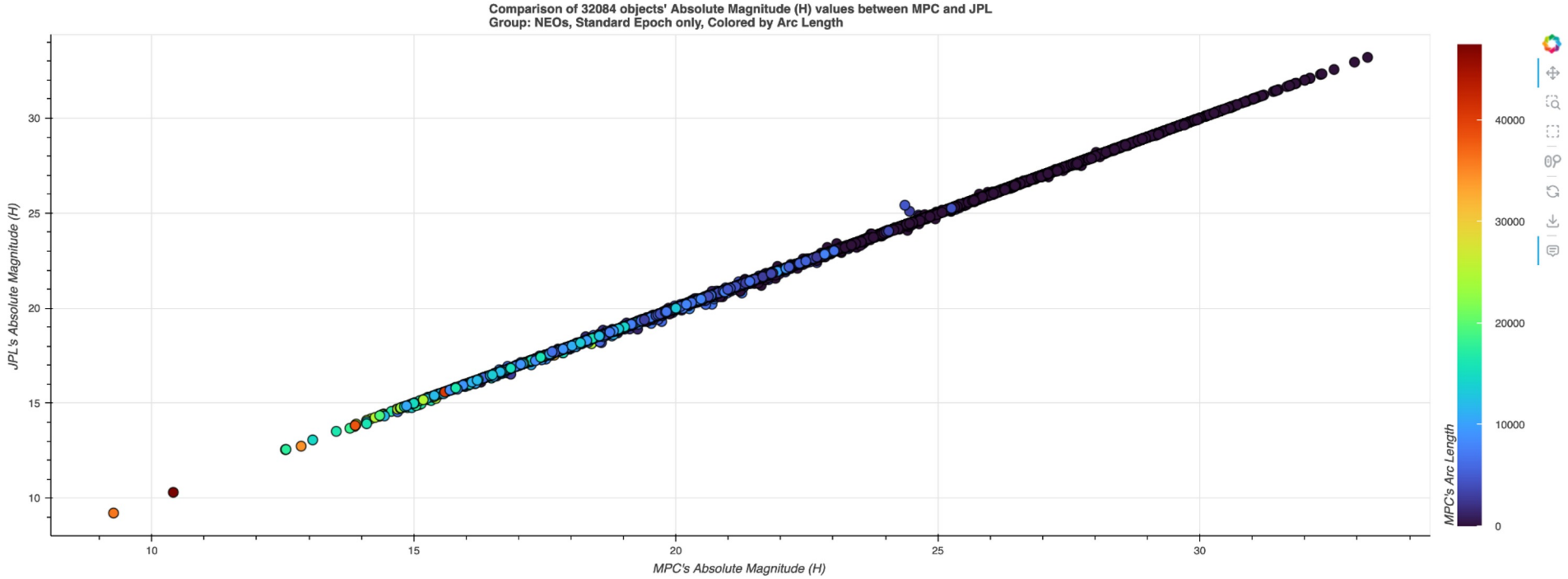
The International Astronomical Union Minor Planet Center

https://data.minorplanetcenter.net/comparison/index.html

For more information on this page, click here.

Group: NEOs | Comparison: Absolute Magnitude (H) | Y Axis Values: JPL | Show Uncertainties: True | Optional Third Axis: MPC's Arc Length

Epoch: Standard | Divergence Greater Than Threshold: e.g., 1, 1s, or 1% | Divergence Parameter: Semi-Major Axis (a) | Divergence Less Than Threshold: e.g., 1, 1s, or 1%



Download All Data | Download Selected Data

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ORBIT COMPARISON TOOL

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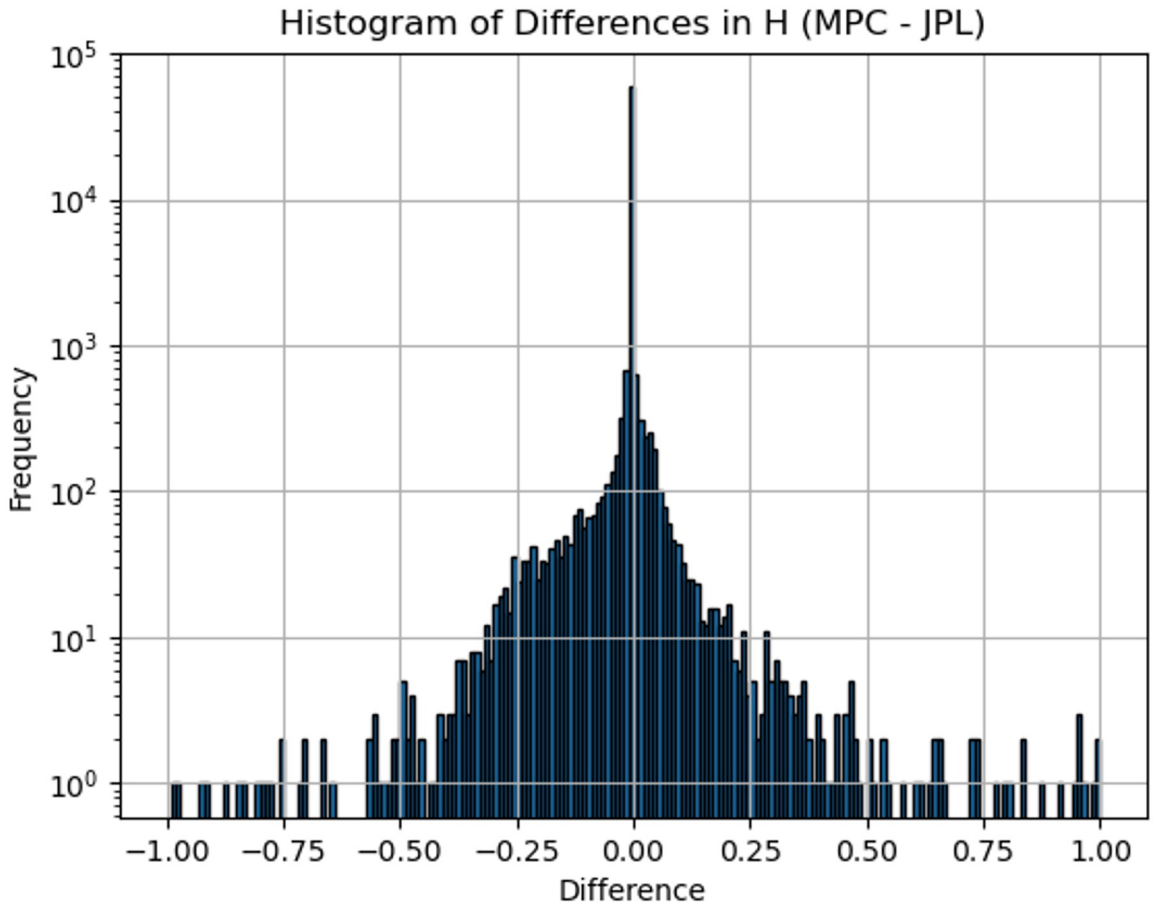


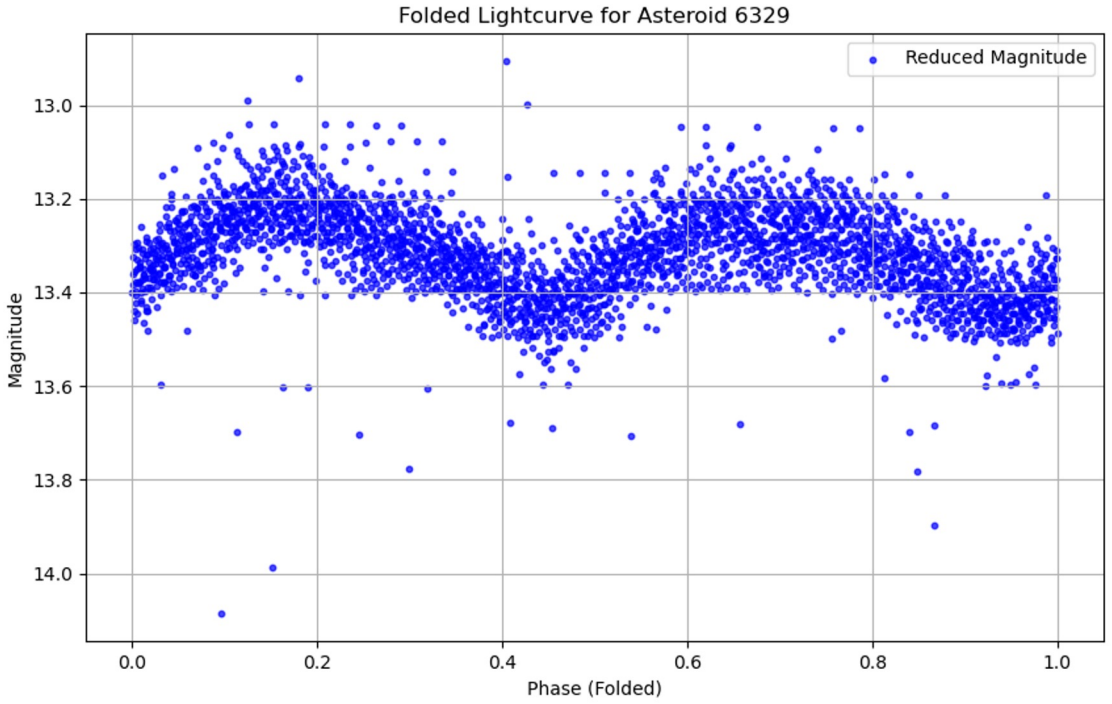
TESS

21 million positions of 42,000 objects

27 million positions unprocessed

ADES, good photometry and coverage

(despite large astrometric errors)



(near) future developments

Uncertainty determination for the absolute magnitude (H)

Fitting of the slope parameter (G)

Muinonens HG1G2 system results

New derived table with compute physical parameters (ORBIT TABLE IMPROVED)

Work on ….

Veres, et al. 2015. Absolute magnitudes and slope parameters for 250,000 asteroids observed by Pan-STARRS PS1 – Preliminary results. Icarus 261

Check the MPC Newsletter

https://minorplanetcenter.net/mpcops/new/newsletters/

MPC Status:

https://minorplanetcenter.net/iau/MPCStatus.html