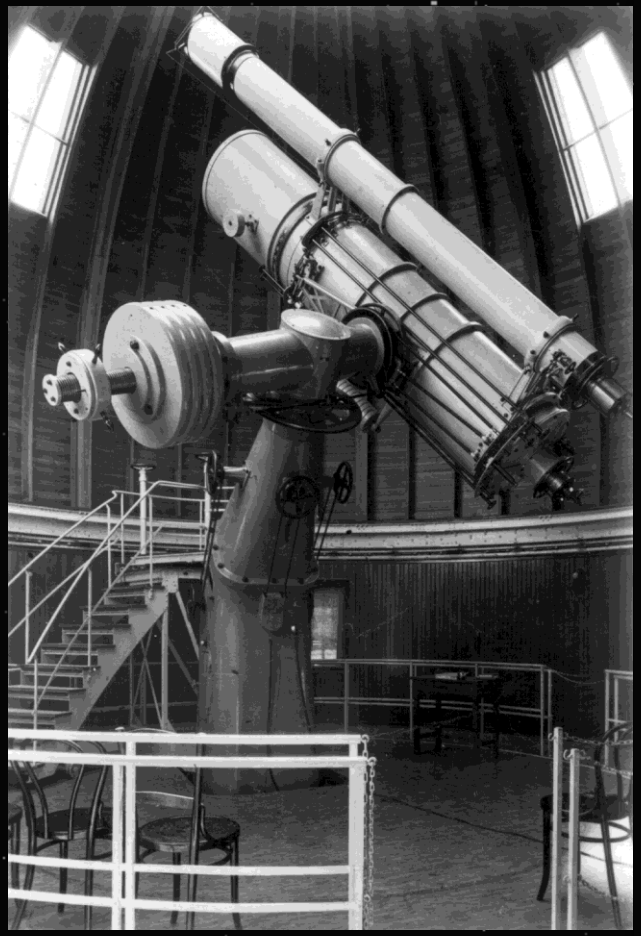
The true story of the discovery of 2022 EB5

Krisztián Sárneczky
Konkoly Observatory, Budapest

ESA ESOC, 2022.12.12.

The first Hungarian asteroids



György Kulin

1936-1942

(1436) Salonta
(1441) Bolyai
(1442) Corvina
(1444) Pannonia
(1445) Konkolya
(1452) Hunnia
(1489) Attila
(1513) Mátra
(1537) Transylvania
(1538) Detre
(1546) Izsák
(1710) Gothard
(2043) Ortutay
(2058) Roka
(2242) Balaton
(2712) Keaton
(2738) Viracocha
(3019) Kulin
(3380) Awaji
(3427) Szentmártoni
(3579) Rockholt
(7317) Cabot
(10258) Sárneczky

1936.12.11.

Piszkéstető Observatory

1959-1962

The 60/90/180-cm Schmidt Telescope

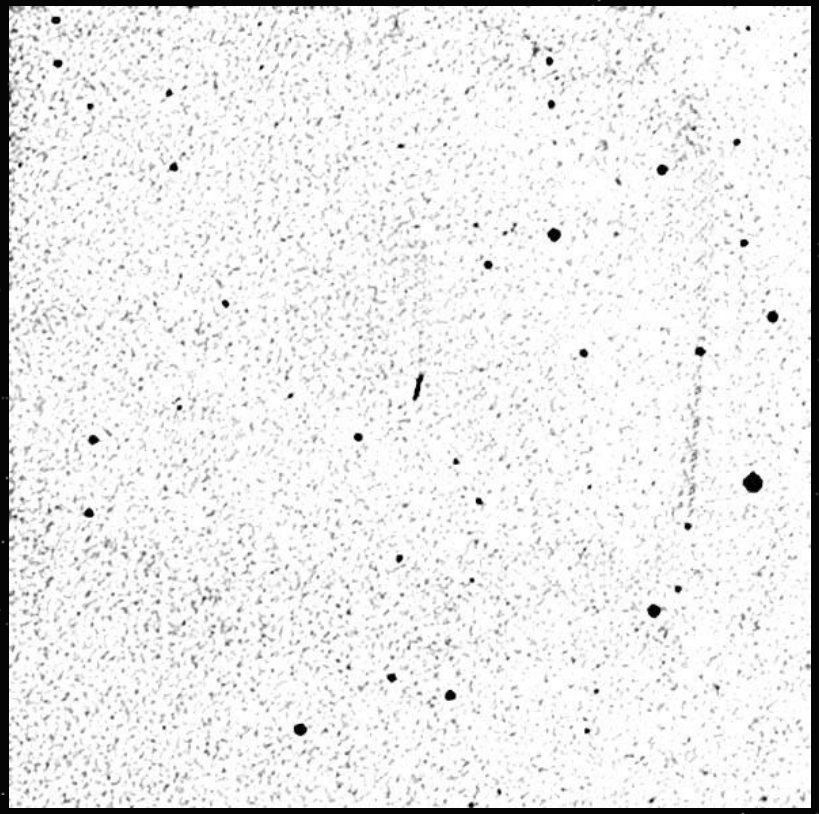
Carl Zeiss Jena, 5 deg FOV, 1962.06.15.

Miklós Lovas era

(42 supernovae, 5 comets, 2 minor planets)

The first Hungarian NEO

(3103) Eger

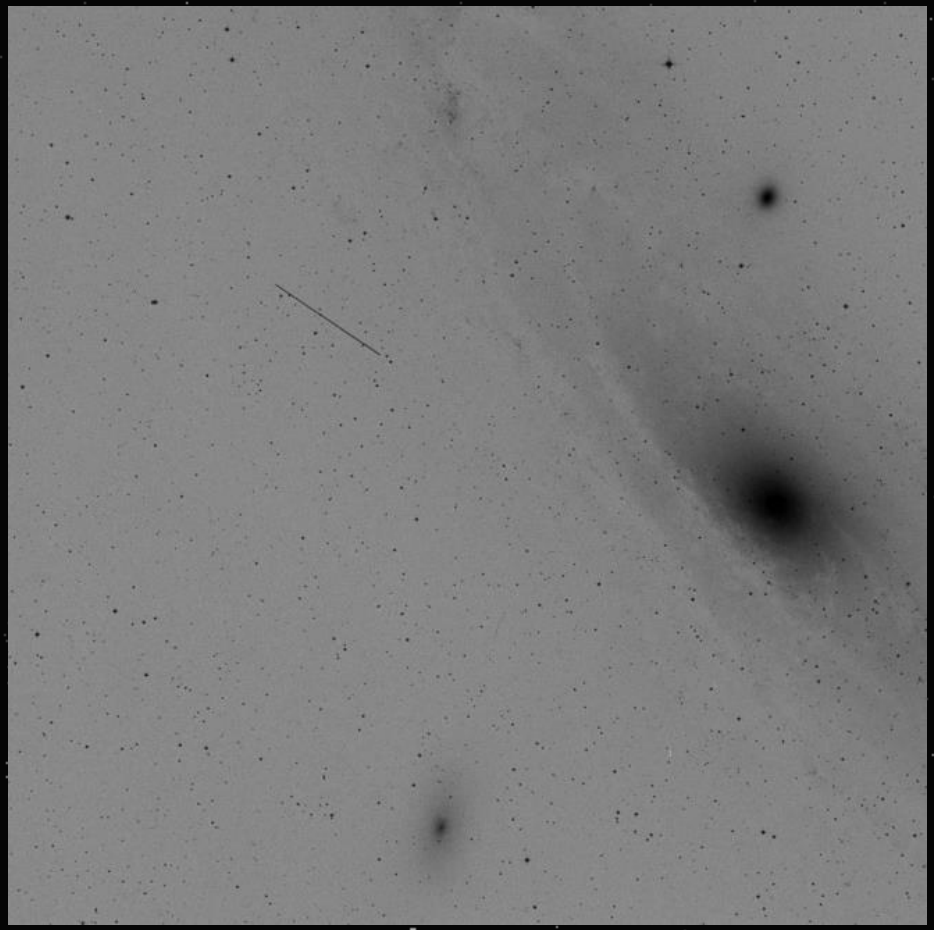


1982.01.20.

D=1,5 km, P=1,67 y, q=0,907 AU

A missed opportunity

(3200) Phaethon



1974.12.15.

10 + 11 min

CCD revolution

1997 autumn

1024x1536

(18’x26’ FOV, 1997-2010)

4096x4096

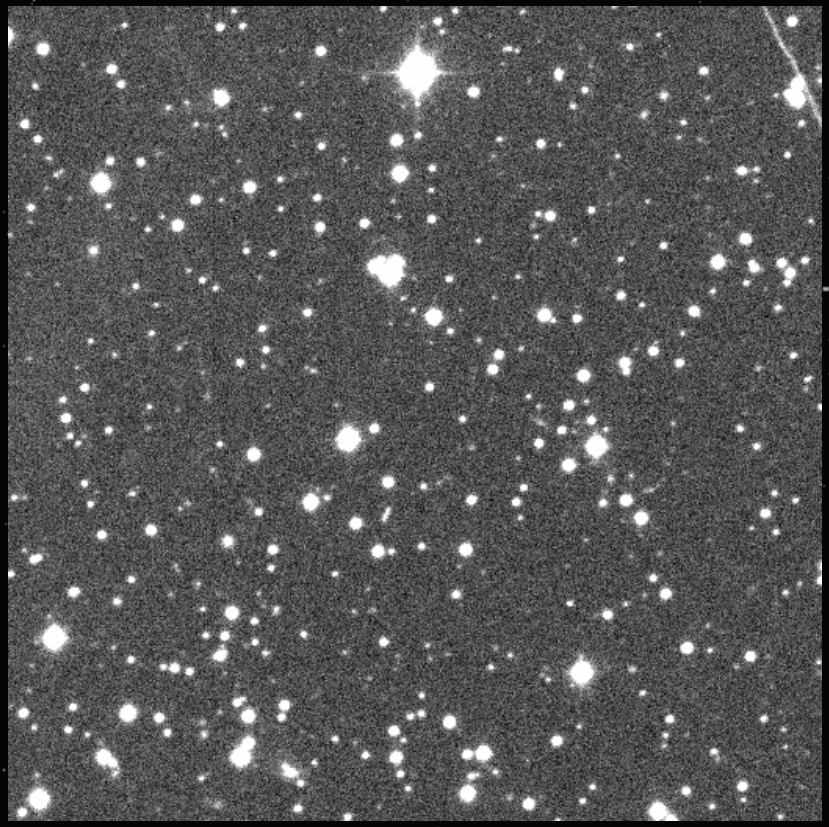
(70’x70’ FOV, 2010-2020)

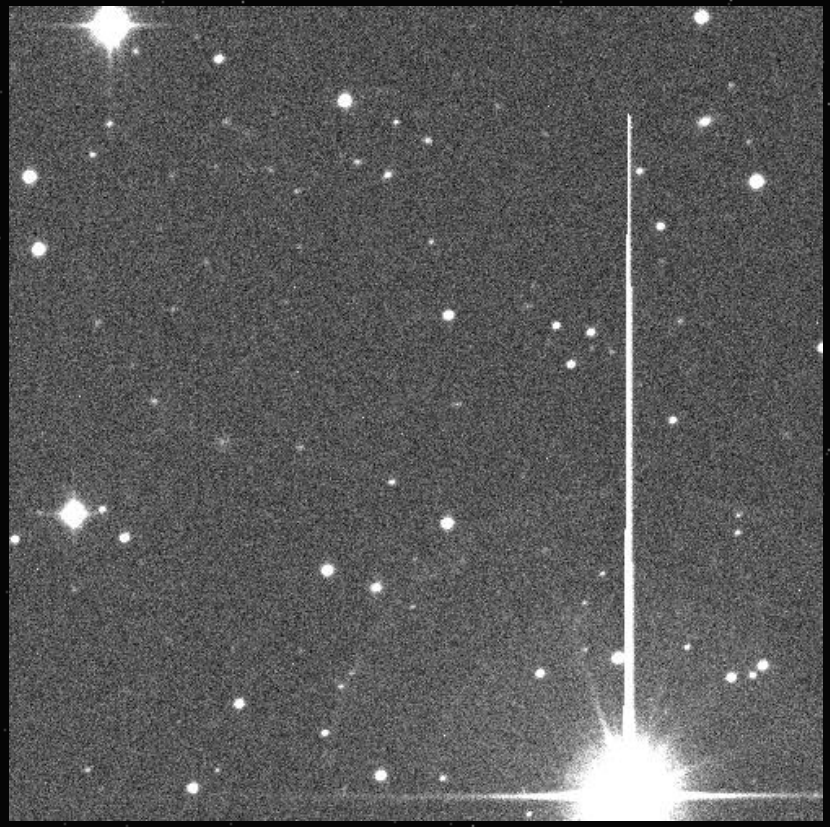
New kids on the block

1998-

My first eight NEOs

2008 UZ201, 2011 ET29, 2011 SU232, 2012 LG11, 2013 PU13, 2015 CA40, 2017 BW, 2018 TY5

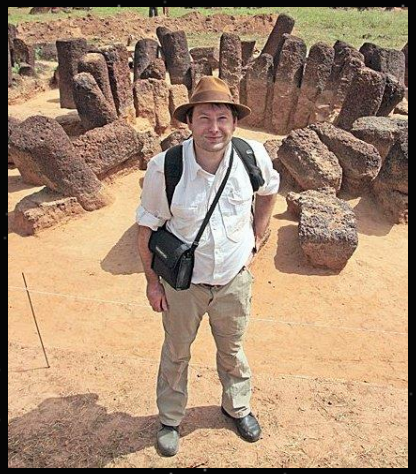




1998-2020

Neural network

Stefan Kürti
(2012 LG11, 2018 TY5)



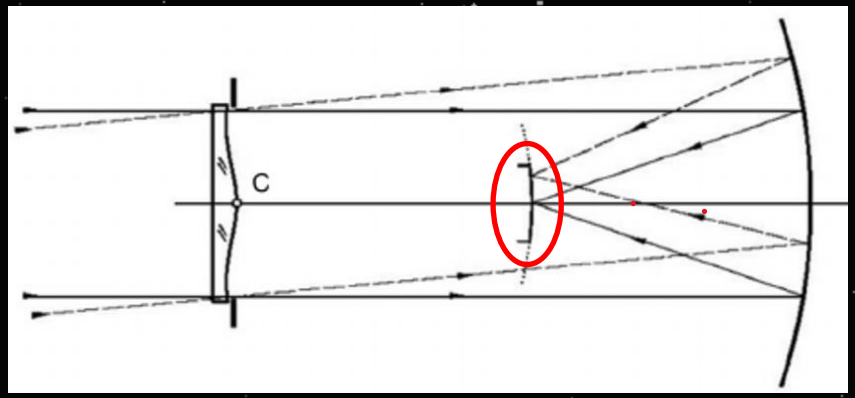
Marco Langbroek
(2015 CA40)

Tomas Vorobjov

Martin Mašek

Tibor Csörgei

10560x10560 STA 1600L



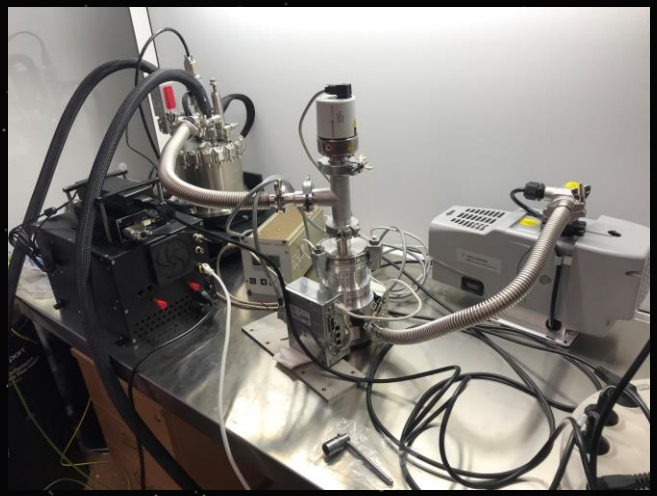
ASA GmbH

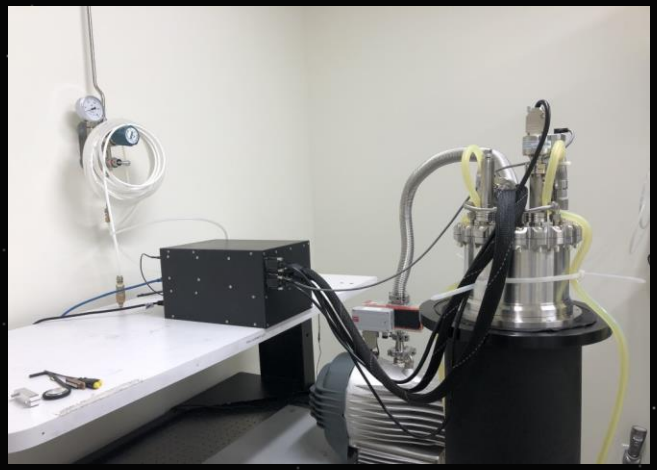
Ing. Philipp Keller

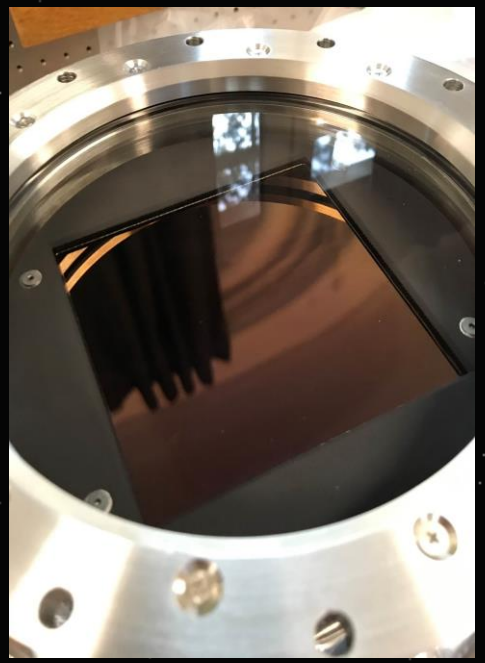
one of the millions of factory

STA, Inc.

10560x10560 STA 1600L

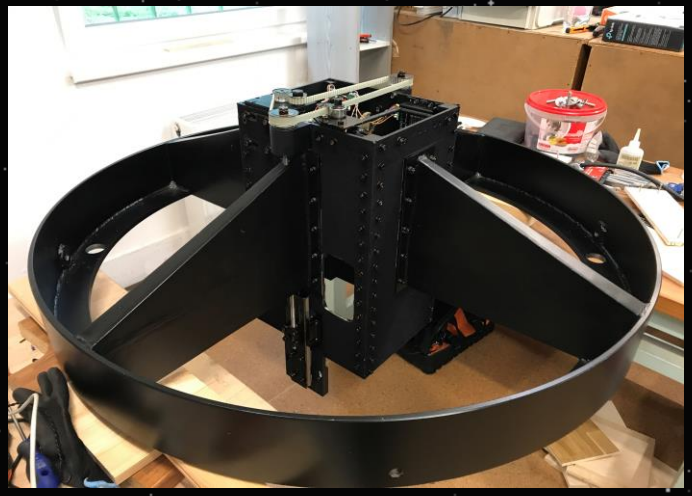




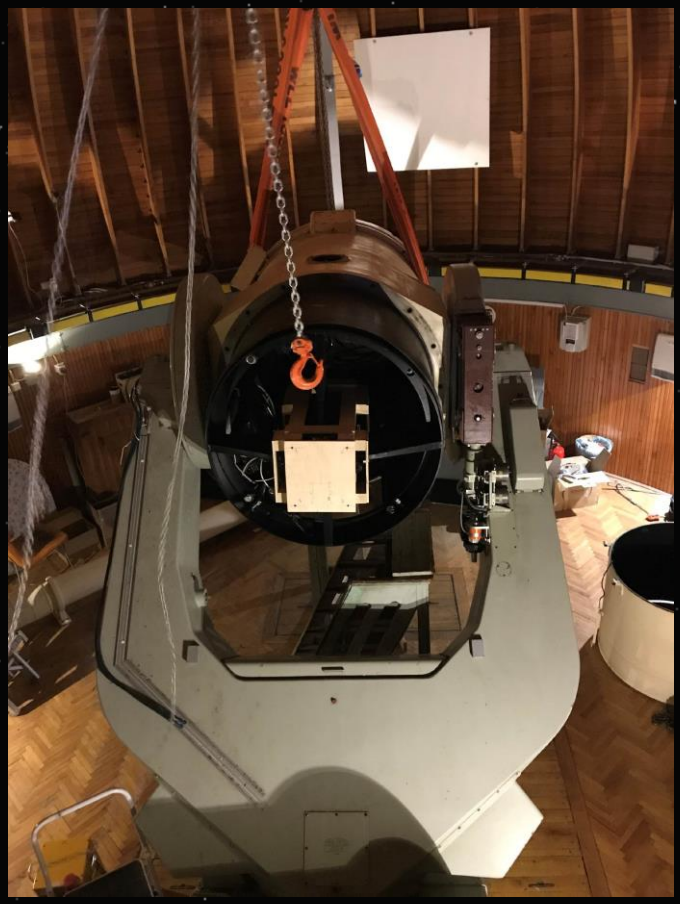


2020 spring

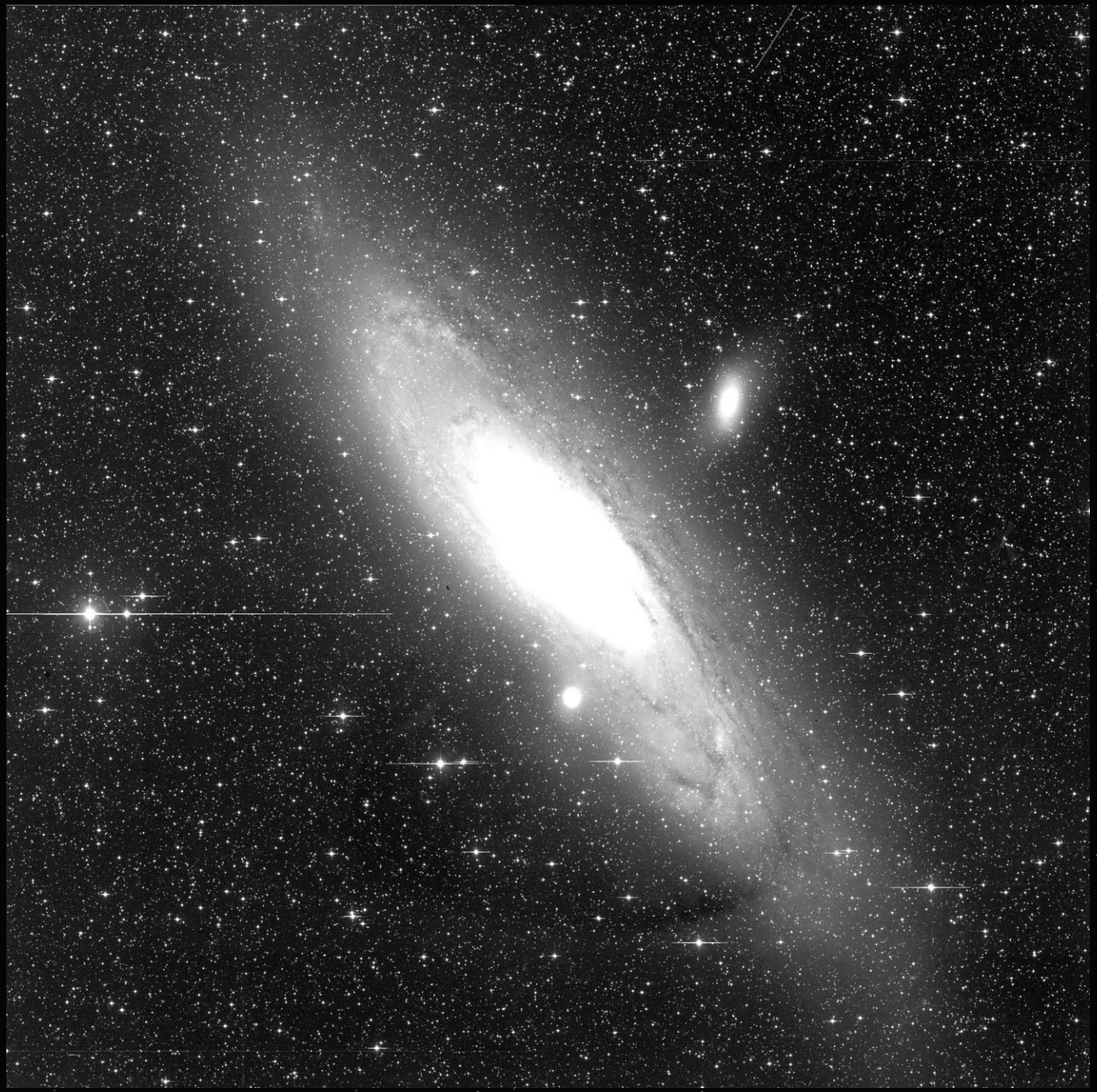
New hardwares



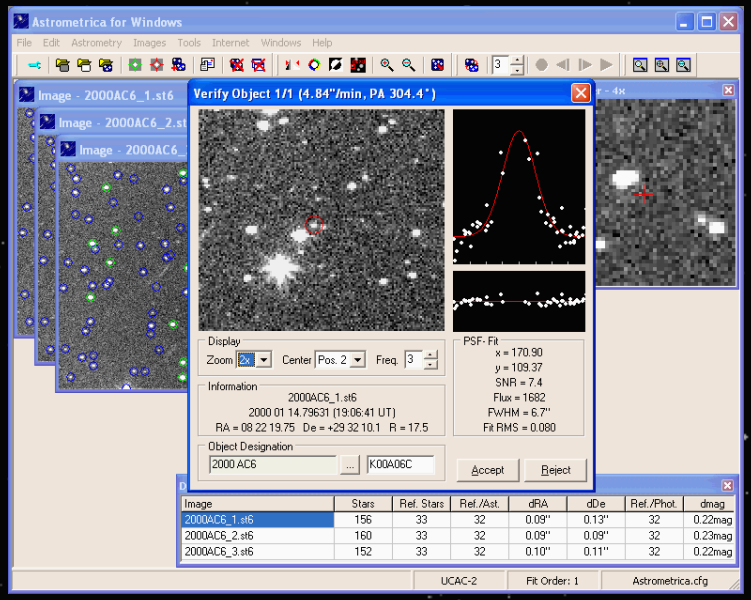
A halved Schmidt☹



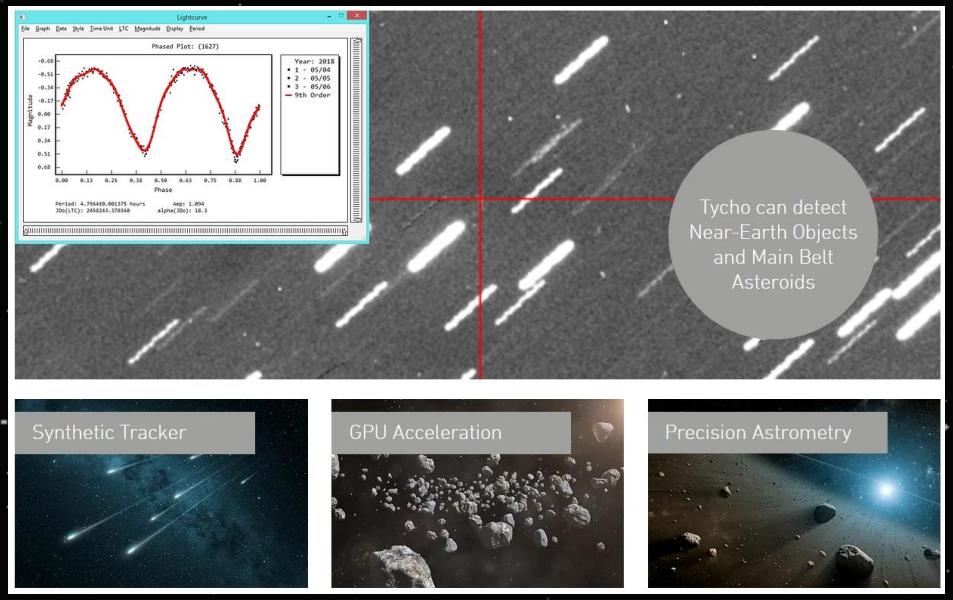
2020 summer



Softwares, methods

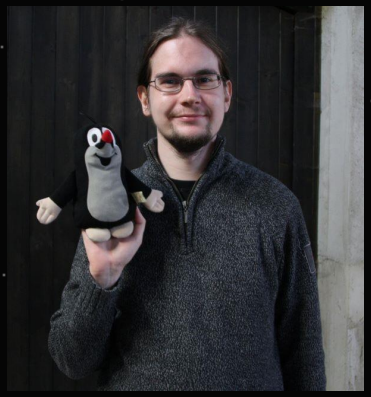


4x6 sec

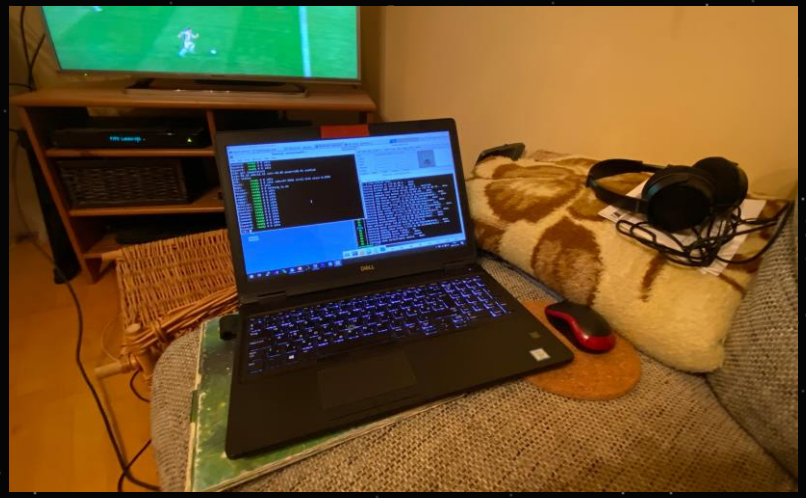


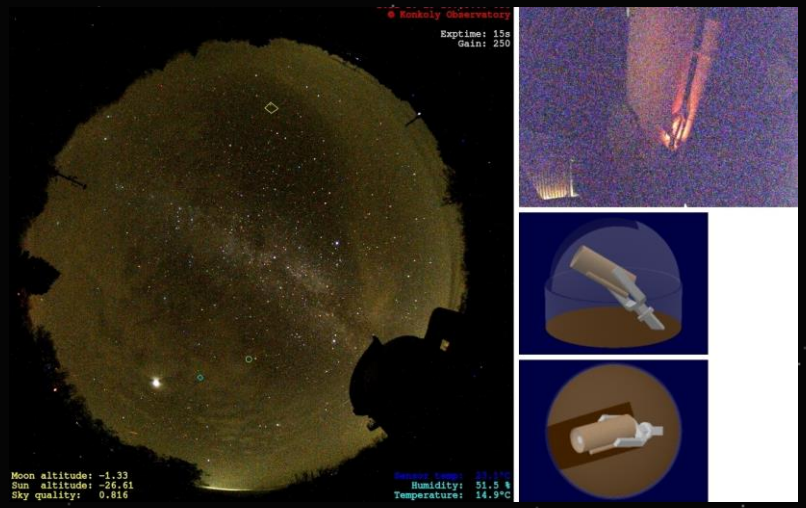
12-18x25 sec

2021 GS6
2021 RA8,
2021 XM20
2022 UK24



My workstation





Lister - [c:\siraly\obs\ccdsh\20220311B.ccdsh]

Fájl Szerkesztés Beállítások Kikódolás Súgó

```
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sequence -U -x -n neoscan-1024+3000-2 [time=6]
sequence -U -x -n neoscan-1024+3000-3 [time=6]
sequence -U -x -n neoscan-1024+3000-4 [time=6]
sequence -U -x -n neoscan-1024+3300-1 {ra=10:24:00,dec=+33:00},[time=6]
sequence -U -x -n neoscan-1024+3300-2 [time=6]
sequence -U -x -n neoscan-1024+3300-3 [time=6]
sequence -U -x -n neoscan-1024+3300-4 [time=6]
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sequence -U -x -n neoscan-1024+3600-2 [time=6]
sequence -U -x -n neoscan-1024+3600-3 [time=6]
sequence -U -x -n neoscan-1024+3600-4 [time=6]
sequence -U -x -n neoscan-1024+3900-1 {ra=10:24:00,dec=+39:00},[time=6]
sequence -U -x -n neoscan-1024+3900-2 [time=6]
sequence -U -x -n neoscan-1024+3900-3 [time=6]
sequence -U -x -n neoscan-1024+3900-4 [time=6]
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sequence -U -x -n neoscan-1024+4200-4 [time=6]
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sequence -U -x -n neoscan-1036+3000-3 [time=6]
sequence -U -x -n neoscan-1036+3000-4 [time=6]
sequence -U -x -n neoscan-1036+3300-1 {ra=10:36:00,dec=+33:00},[time=6]
sequence -U -x -n neoscan-1036+3300-2 [time=6]
sequence -U -x -n neoscan-1036+3300-3 [time=6]
sequence -U -x -n neoscan-1036+3300-4 [time=6]
sequence -U -x -n neoscan-1036+3600-1 {ra=10:36:00,dec=+36:00},[time=6]
sequence -U -x -n neoscan-1036+3600-2 [time=6]
sequence -U -x -n neoscan-1036+3600-3 [time=6]
sequence -U -x -n neoscan-1036+3600-4 [time=6]
sequence -U -x -n neoscan-1036+3900-1 {ra=10:36:00,dec=+39:00},[time=6]
sequence -U -x -n neoscan-1036+3900-2 [time=6]
sequence -U -x -n neoscan-1036+3900-3 [time=6]
sequence -U -x -n neoscan-1036+3900-4 [time=6]
sequence -U -x -n neoscan-1036+4200-1 {ra=10:36:00,dec=+42:00},[time=6]
sequence -U -x -n neoscan-1036+4200-2 [time=6]
sequence -U -x -n neoscan-1036+4200-3 [time=6]
sequence -U -x -n neoscan-1036+4200-4 [time=6]
sequence -U -x -n neoscan-1036+4500-1 {ra=10:36:00,dec=+45:00},[time=6]
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sequence -U -x -n neoscan-1036+4500-3 [time=6]
```
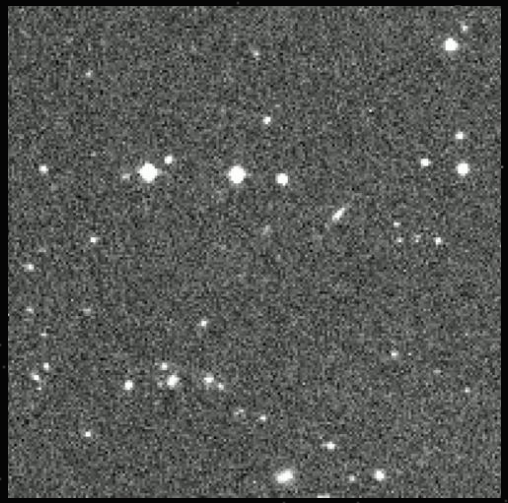
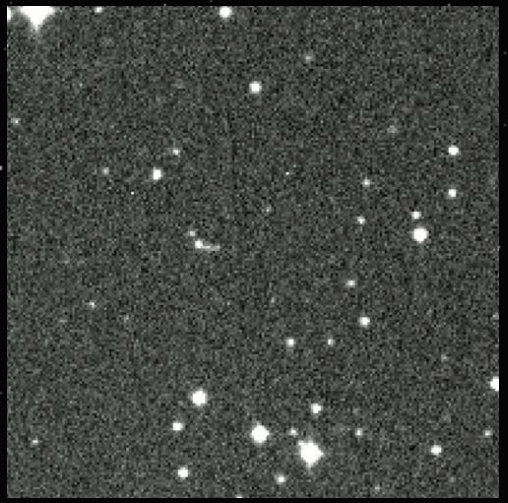
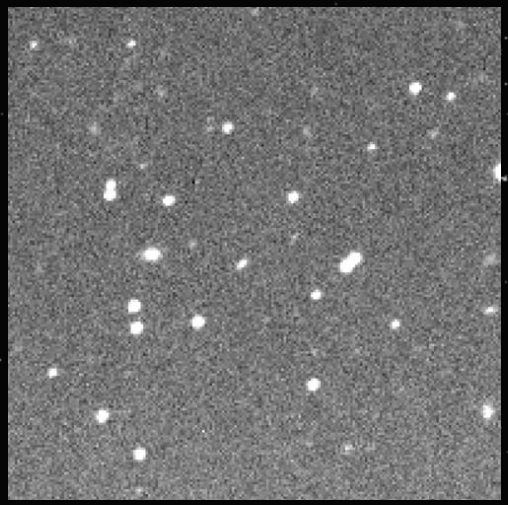

9th to 104th







Eurasian sites NEOs

Piszkésteto, Hungary 104

La Sagra Sky Survey, Spain 97

Tokyo-Kiso, Japan 45

Purple Mountain Obs., China 33

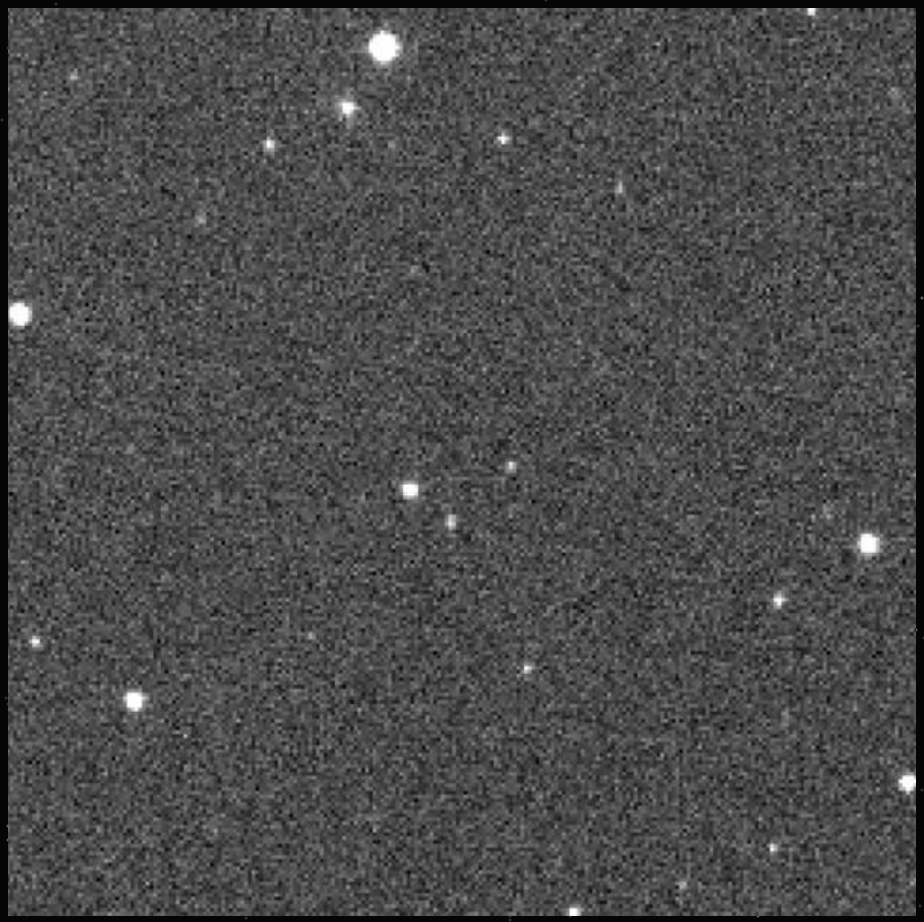
Crni Vrh, Slovenia 27

ESA Optical Ground Station, Tenerife, Spain 24

2020 VL1, 2020 WH1, 2020 WJ3, 2021 AB4, 2021 BJ3, 2021 CW7, 2021 CW8, 2021 CG9, 2021 DA2, 2021 EA, 2021 EC, 2021 ED, 2021 EX1, 2021 ER3, 2021 FB, 2021 FK1, 2021 FE4, 2021 HG, 2021 RB, 2021 RH, 2021 RA1, 2021 RX2, 2021 RK4, 2021 RW4, 2021 RS5, 2021 RA8, 2021 RD10, 2021 RU10, 2021 RL15, 2021 TR1, 2021 TQ9, 2021 TA10, 2021 TC14, 2021 UC, 2021 UT, 2021 VF2, 2021 UZ2, 2021 UW3, 2021 UO4, 2021 UT5, 2021 UD6, 2021 UQ7, 2021 VX4, 2021 WG, 2021 XM2, 2021 XC4, 2021 XM6, 2021 YR, 2022 AB, 2022 AC, 2022 BJ, 2022 BN, 2022 BS, 2022 CM3, 2022 DV, 2022 EB5, 2022 FD1, 2022 FO1, 2022 FE2, 2022 FT2, 2022 FP3, 2022 FG4, 2022 GV1, 2022, HD, 2022 HM, 2022 HN, 2022 HU3, 2022 MR, 2022 MS, 2022 OG, 2022 OK, 2022 QB, 2022 QP6, 2022 QU7, 2022 SF6, 2022 TH1, 2022 US, 2022 UD, 2022 UW1, 2022 UA3, 2022 UU10, 2022 UV10, 2022 UN11, 2022 UE14, 2022 UK16, 2022 UA21, 2022 UK21, 2022 UY21, 2022 UK24, 2022 VD2, 2022 WB2, 2022 WP3, 2022 WR3, 2022 WD4, 2022 WR5, 2022 XL

2020 August-2022 December

The 64th



2022.03.11. 19:24 UT

Impact?

Orbit Simulator View

Astrometry:

```
     Sar2593* C2022 03 11.80848 10 29 48.21 +39 52 09.6          17.6 R      K88
     Sar2593  C2022 03 11.80874 10 29 47.88 +39 52 28.9          17.6 R      K88
     Sar2593  C2022 03 11.80900 10 29 47.52 +39 52 49.1          17.7 R      K88
     Sar2593  C2022 03 11.80926 10 29 47.15 +39 53 08.5          17.7 R      K88
```

Station data:

(K88) GINOP-KHK, Piszkéstető (N47.917619 E19.893600) Hungary. Observer K. Sárneczky. 0.60-m Schmidt + CCD.

Orbital elements: Sar2593

```
   Perigee 2022 Mar 11.89525 TT = 21:29:09 (JD 2459650.39525)
Epoch 2022 Mar 11.5 TT = JDT 2459650.0                        Auto-Find
q  2903.69467km                      (J2000 equator)
H   32.3  G 0.15   Peri.  152.96778
                   Node   169.28496
e   2.5889047      Incl.  105.28255
From 4 observations 2022 Mar. 11 (67.4 sec); mean residual 0".62
```

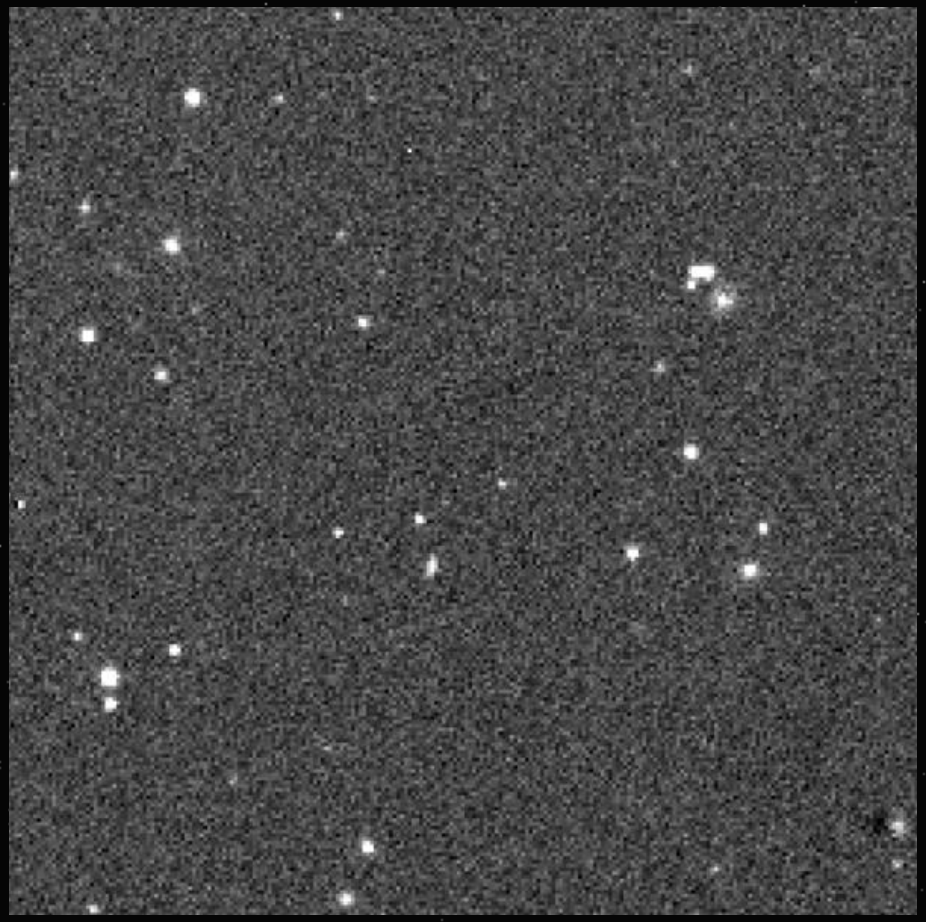
IMPACT at 11 Mar 2022 21:22:46.52 lat +70.07264 lon W9.04530

Residuals in arcseconds:

```
220311 K88  .05-  .87+    220311 K88  .01+  1.1+
220311 K88  .13+  .61+    220311 K88  .20-  .77+
```

2022.03.11. 19:38 UT

Confirmation (+27 min)



2022.03.11. 19:51 UT

Impact!!!

Orbit Simulator View

Astrometry:

```
     Sar2593* C2022 03 11.80848 10 29 48.21 +39 52 09.6          17.6 R      K88
     Sar2593  C2022 03 11.80874 10 29 47.88 +39 52 28.9          17.6 R      K88
     Sar2593  C2022 03 11.80900 10 29 47.52 +39 52 49.1          17.7 R      K88
     Sar2593  C2022 03 11.80926 10 29 47.15 +39 53 08.5          17.7 R      K88
     Sar2593  C2022 03 11.82712 10 29 12.81 +40 21 29.5          17.2 R      K88
     Sar2593  C2022 03 11.82766 10 29 11.40 +40 22 34.8          17.3 R      K88
     Sar2593  C2022 03 11.82793 10 29 10.64 +40 23 08.0          17.3 R      K88
     Sar2593  C2022 03 11.82820 10 29 09.90 +40 23 40.8          17.3 R      K88
     Sar2593  C2022 03 11.82847 10 29 09.17 +40 24 14.2          17.3 R      K88
     Sar2593  C2022 03 11.82874 10 29 08.40 +40 24 48.7          17.3 R      K88
     Sar2593  C2022 03 11.82902 10 29 07.64 +40 25 23.2          17.2 R      K88
     Sar2593  C2022 03 11.83508 10 28 48.29 +40 39 23.9          16.8 R      K88
     Sar2593  C2022 03 11.83531 10 28 47.47 +40 39 58.9          16.8 R      K88
     Sar2593  C2022 03 11.83553 10 28 46.66 +40 40 33.4          16.8 R      K88
```

Station data:

(K88) GINOP-KHK, Piszkéstető (N47.917619 E19.893600) Hungary. Observer K. Sárneczky. 0.60-m Schmidt + CCD.

Orbital elements: Sar2593

```
   Perigee 2022 Mar 11.89539 +/- 0.000222 TT = 21:29:22 (JD 2459650.39539)
Epoch 2022 Mar 11.5 TT = JDT 2459650.0                        Auto-Find
q  2971.81579 +/- 88.9              (J2000 equator)
H    32.3  G 0.15                   Peri.  152.27031 +/- 0.9
                                    Node   169.24134 +/- 0.06
e    2.6640890 +/- 0.105            Incl.  105.21952 +/- 0.07
From 14 observations 2022 Mar. 11 (39.0 min); mean residual 0".22
```

IMPACT at 11 Mar 2022 21:23:02.46 lat +70.44915 lon W10.22779

Residuals in arcseconds:

```
220311 K88  .04-  .03+    220311 K88  .28+  .14-    220311 K88  .11+  .05+
220311 K88  .15+  .23-    220311 K88  .08-  .19+    220311 K88  .04-  .06-
220311 K88  .04+  .30+    220311 K88  .14-  .13-    220311 K88  .08+  .30-
220311 K88  .15-  .09-    220311 K88  .02+  .11-    220311 K88  .02-  .23+
220311 K88  .01+  .49-    220311 K88  .20-  .73+
```

2022.03.11. 20:09 UT

Social network

Electronic Telegram No. 5090

Central Bureau for Astronomical Telegrams
Mailing address: Hoffman Lab 209; Harvard University;
20 Oxford St.; Cambridge, MA 02138; U.S.A.
e-mail: cbatiau@eps.harvard.edu (alternate cbat@iau.org)
URL http://www.cbat.eps.harvard.edu/index.html
Prepared using the Tamkin Foundation Computer Network

COMET C/2022 A1 (SARNECZKY)

Krisztian Sarneczky, Konkoly Observatory, reports the discovery of a fast-moving comet during a visual inspection of three stacked 104-s unfiltered CCD survey images taken at the Piszkesteto Observatory in Hungary on Jan. 2.1 UT with the 0.60-m Schmidt telescope (discovery observations tabulated below). The object shows a compact inner region (condensed false nucleus) about 8" x 10" in diameter and a fan-shaped tail at least 20" long in a westward direction. On a 312-s stacked image, there is a faint outer diffuse coma about 40" in diameter, with two jets in p.a. 230 and 350 deg. The red magnitude was 18.5 as measured within a circular aperture of radius 10".

2022 UT	R.A. (2000)	Decl.	Mag.	Observer
Jan. 2.10924	9 06 28.99	+37 46 55.8	18.2	Sarneczky
2.10974	9 06 28.41	+37 46 54.8	18.1	"
2.11023	9 06 27.79	+37 46 52.8	18.0	"

Come on guys, let's run!!!

Or rather hiding!

A political theme question...

No

Asteroid impactl!

Half an hour

I found it on an hour ago

And where?

Just not to east…

By the way, the sky is excellent

1-2 meters

…

Closer and closer

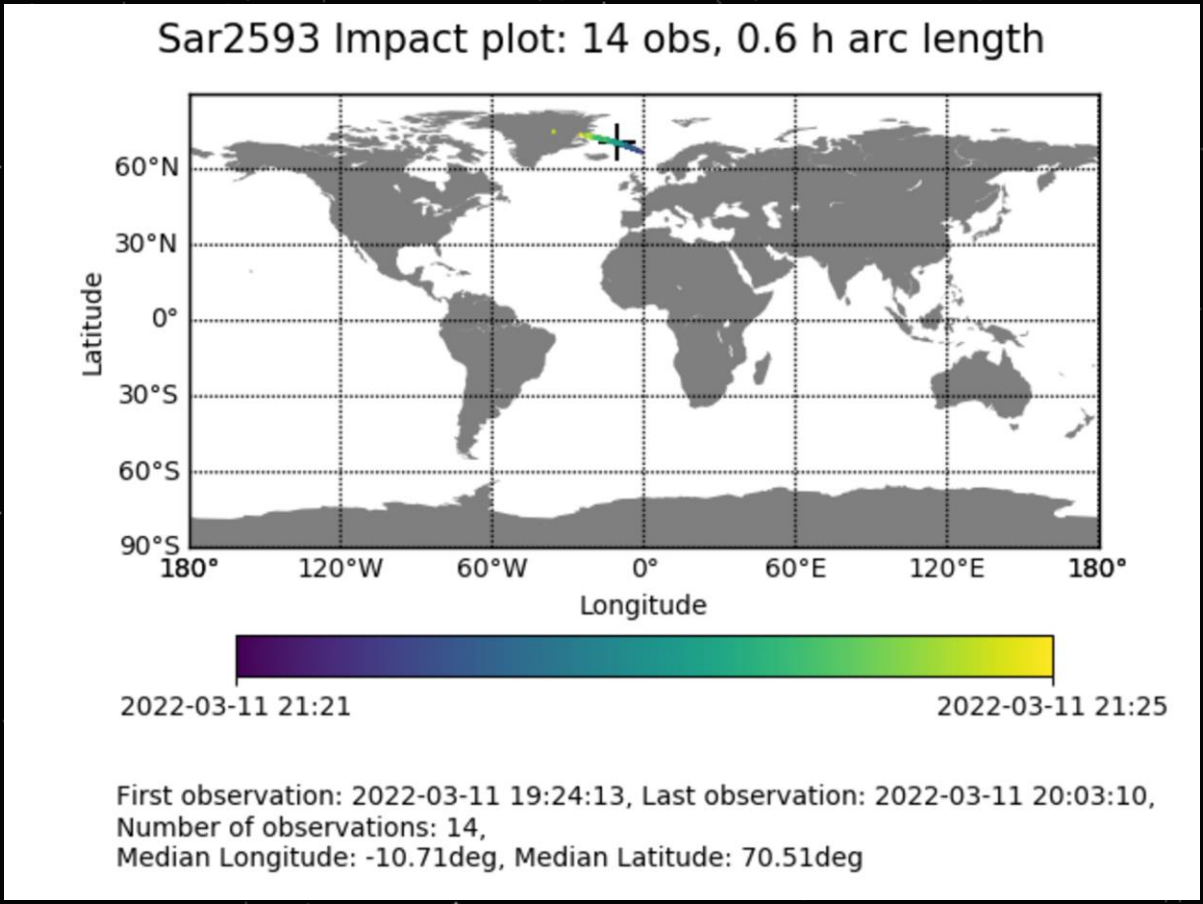
20:44, 20:50, 20:55, 21:05, 21:11 UT

T-38, 32, 27, 17, 11 minutes

37 000, 32 000, 27 000, 18 000, 12 000 km

The fifth impacted asteroid

ESA „Meerkat” alert system



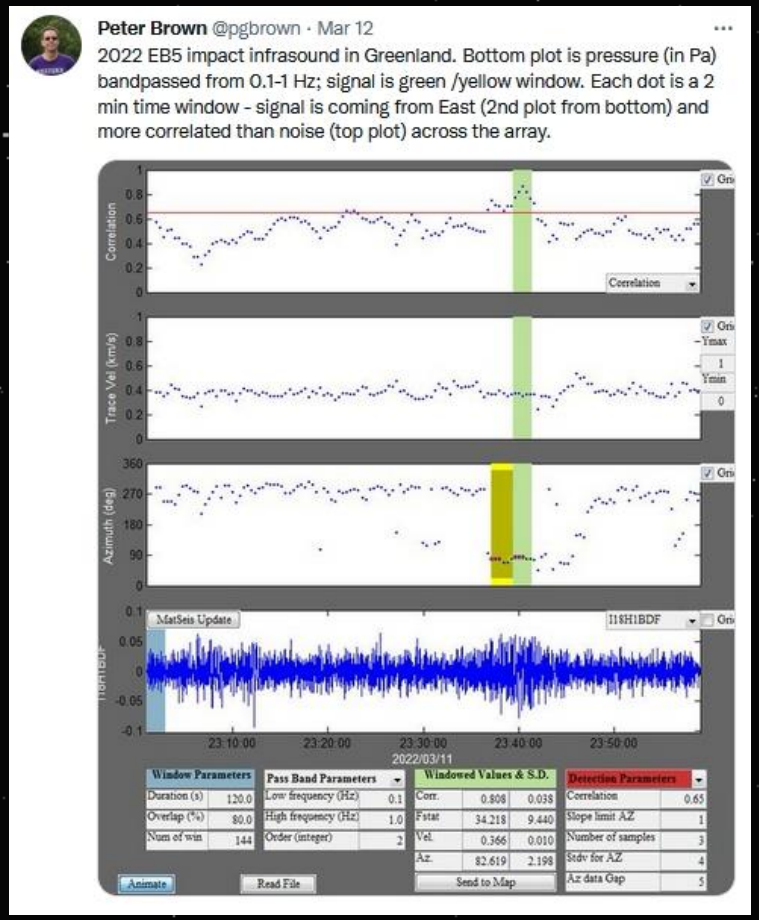
2022.03.11. 20:25 UT

The fifth impacted asteroid

ESA „Meerkat” alert system

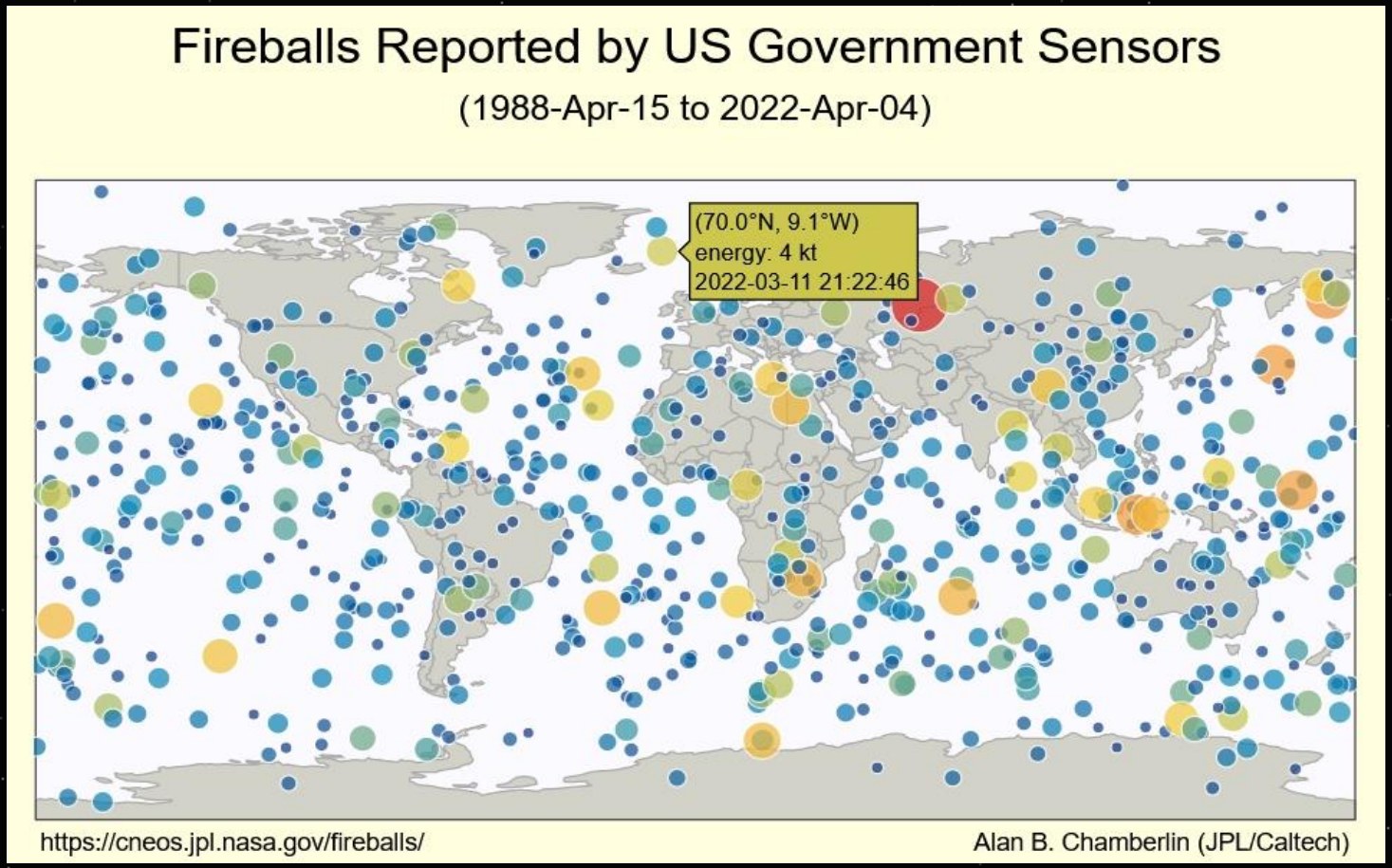
2022.03.11. 21:22:42 UT

Infrasound detections



(Thanks to Bence Gucsik)

The 30th largest airburst

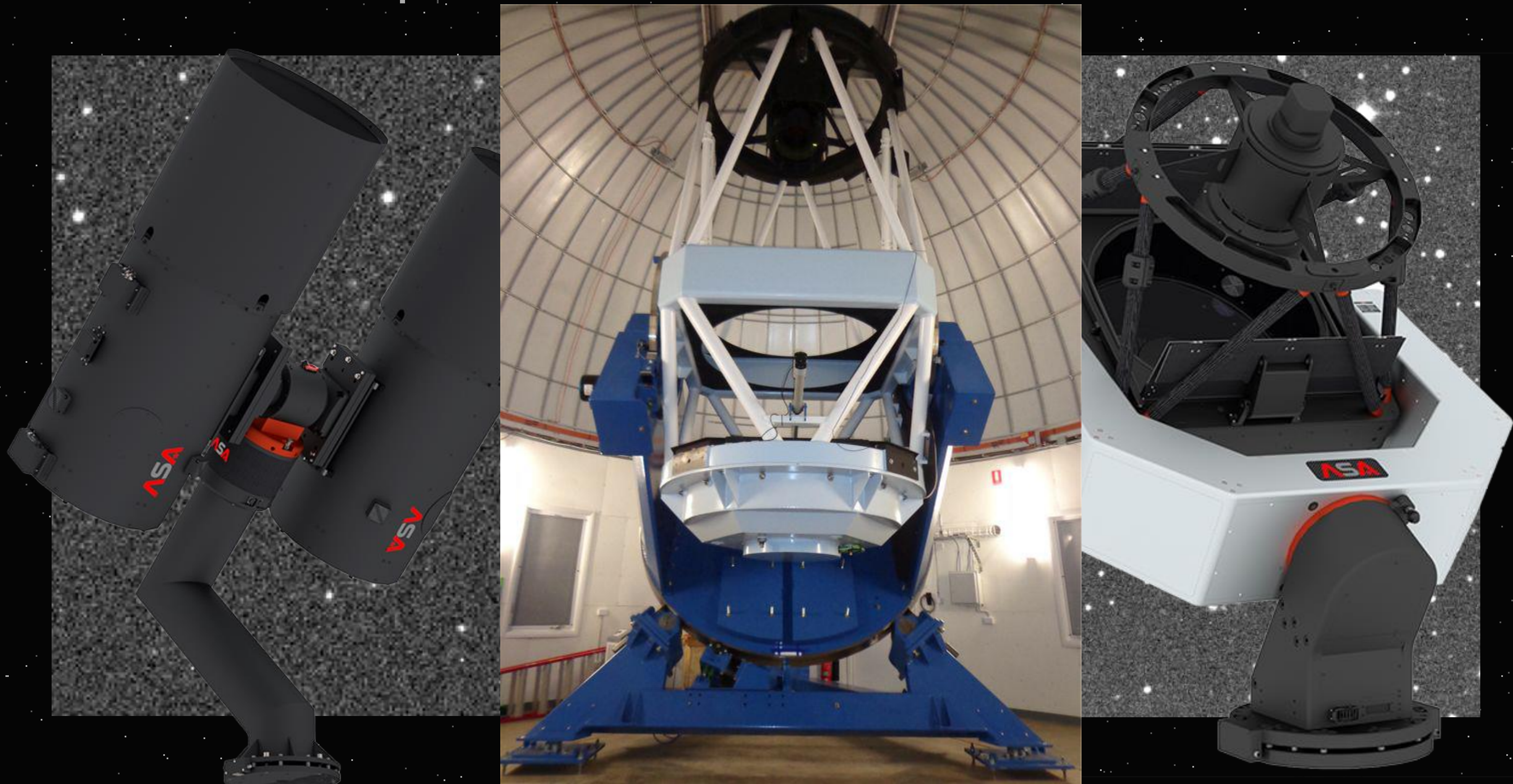


21:22:46 UT

3-4 m, 33 km, 17,2 km/s

„America is changing to the jungle system. Metric never.”

Plans



New equipments

Automatic [illegible] detection

Epilogue