Kajian Asteroid di Malaysia

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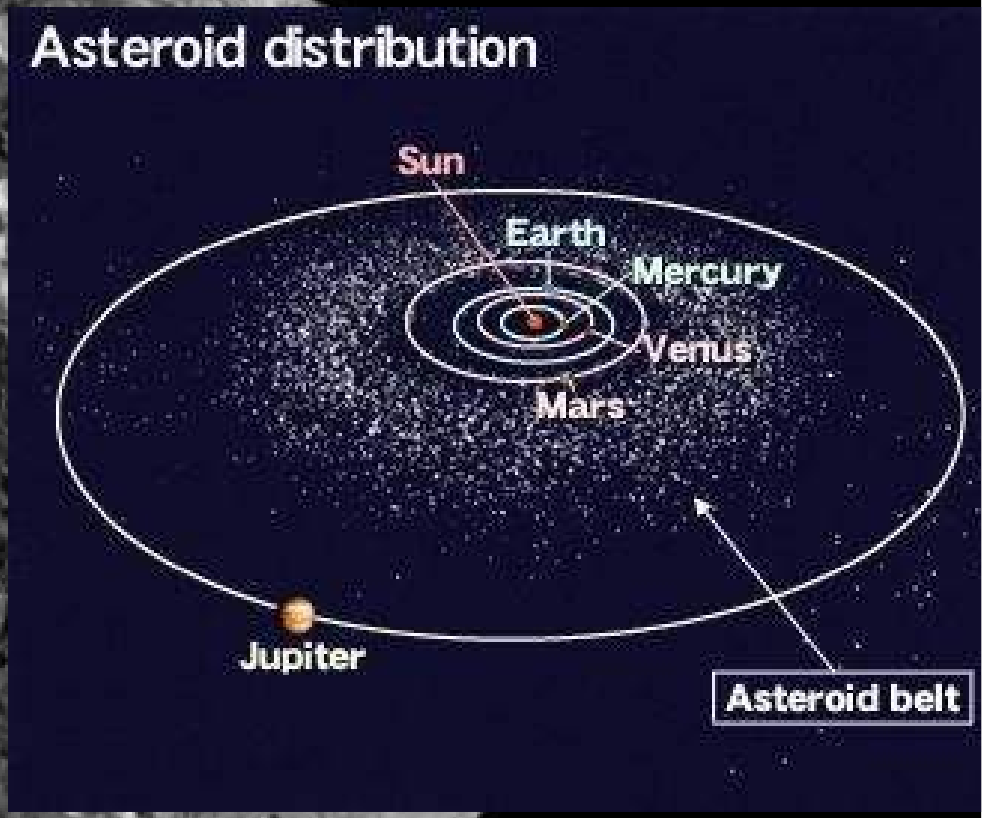
Meteor Chelyabinsk

Apa itu Asteroid?

- Batuan – logaman objek yang mengorbit Matahari
- Terlalu kecil untuk menjadi planet. Saiz: ~beberapa meter - ~1000 km
- Sisa bahan daripada pembentukan sistem suria
- Lokasi terutamanya di Lingkaran Asteroid (Marikh - Musytari)



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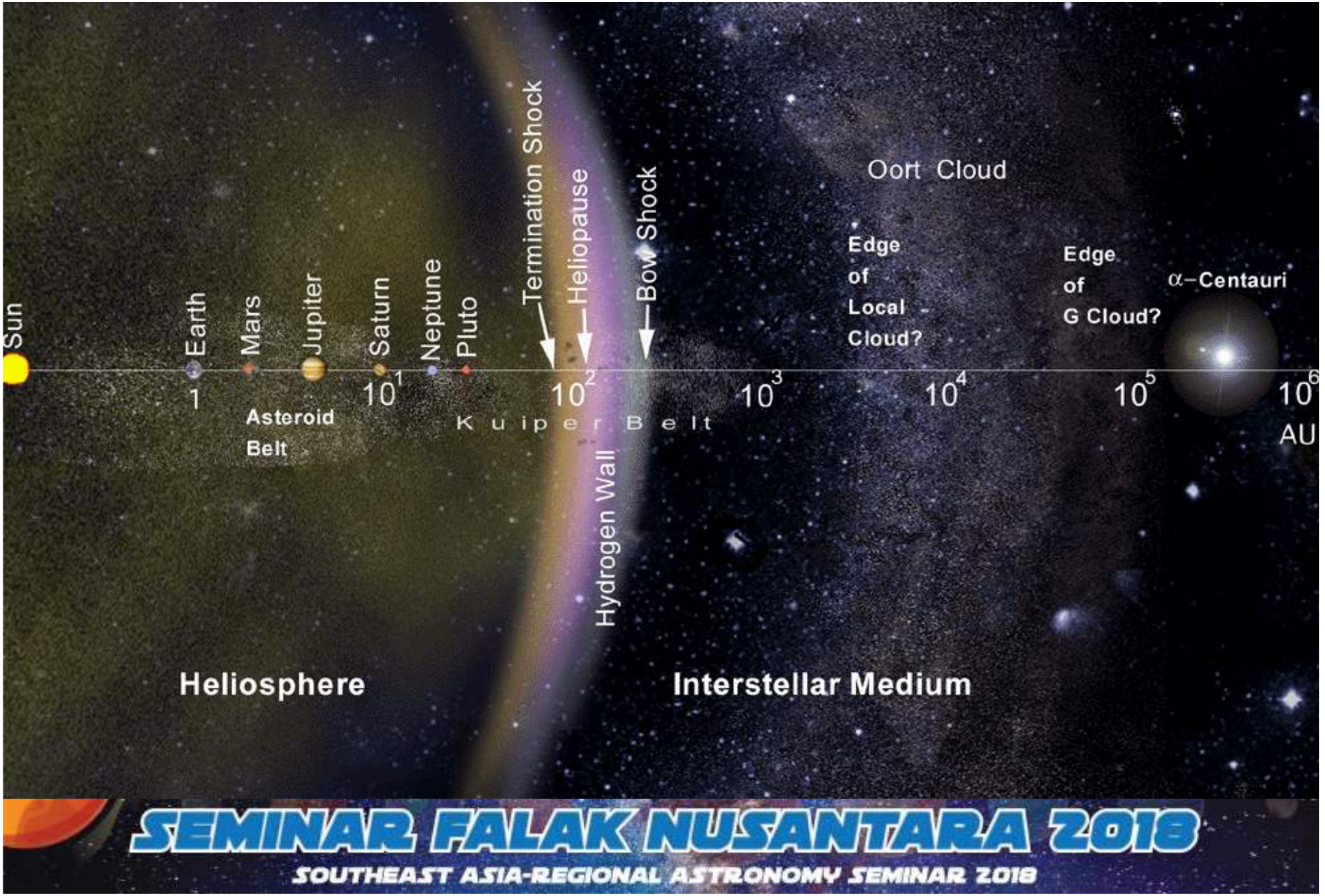
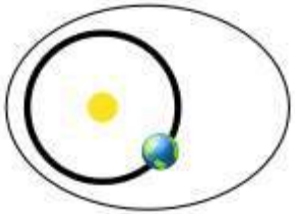


Near Earth Asteroids

Amors

Earth-approaching NEAs with orbits exterior to Earth's but interior to Mars' (named after asteroid (1221) Amor)



$$a > 1.0 \text{ AU}$$
$$1.017 \text{ AU} < q < 1.3 \text{ AU}$$

Apollos

Earth-crossing NEAs with semi-major axes larger than Earth's (named after asteroid (1862) Apollo)

$$a > 1.0 \text{ AU}$$
$$q < 1.017 \text{ AU}$$

Atens

Earth-crossing NEAs with semi-major axes smaller than Earth's (named after asteroid (2062) Aten)

$$a < 1.0 \text{ AU}$$
$$Q > 0.983 \text{ AU}$$

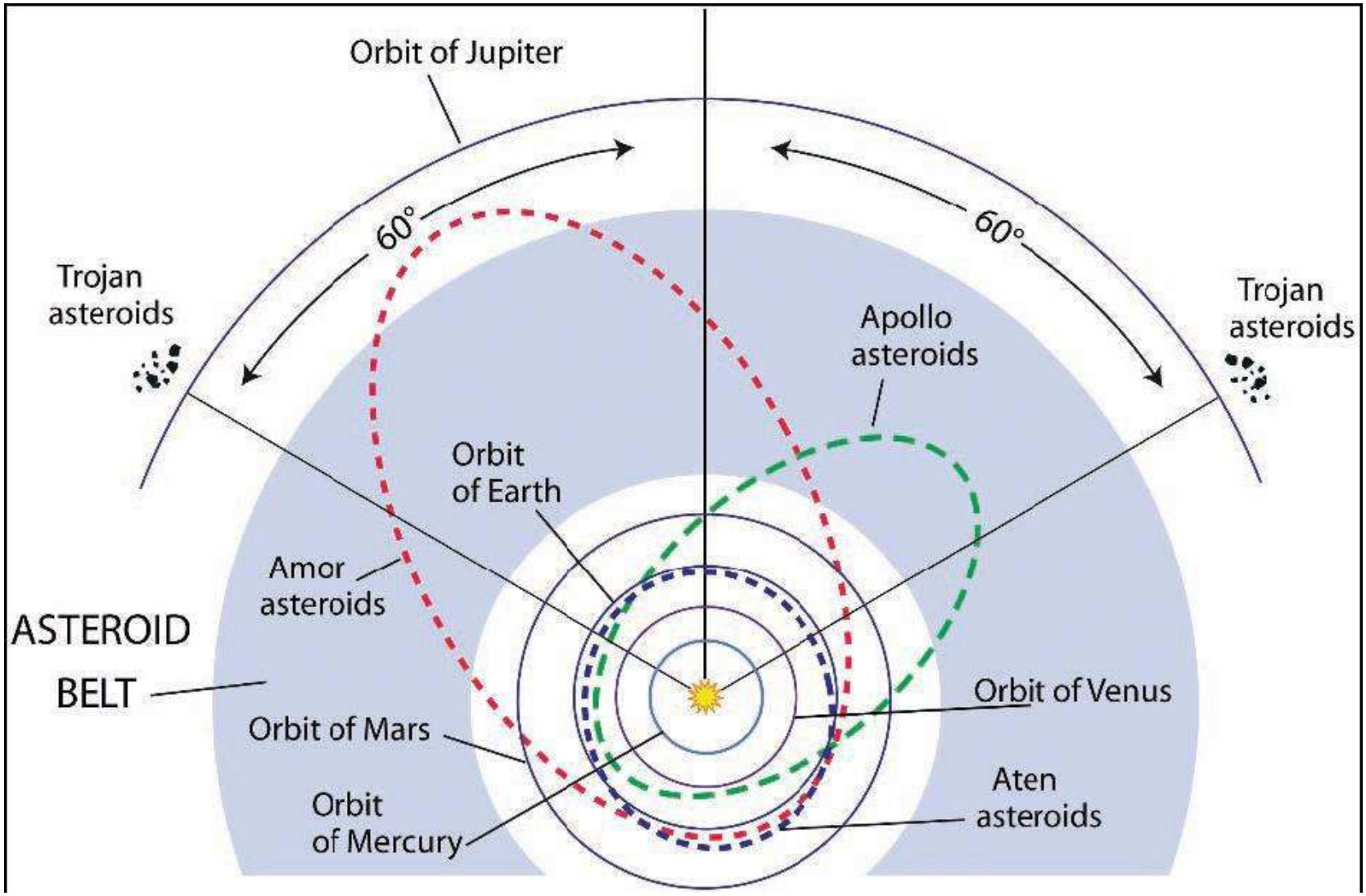
Atiras

NEAs whose orbits are contained entirely within the orbit of the Earth (named after asteroid (163693) Atira)

$$a < 1.0 \text{ AU}$$
$$Q < 0.983 \text{ AU}$$

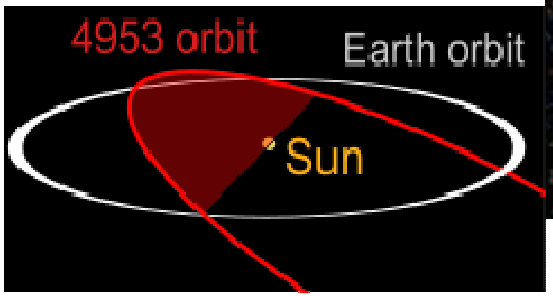
(q = perihelion distance, Q = aphelion distance, a = semi-major axis)

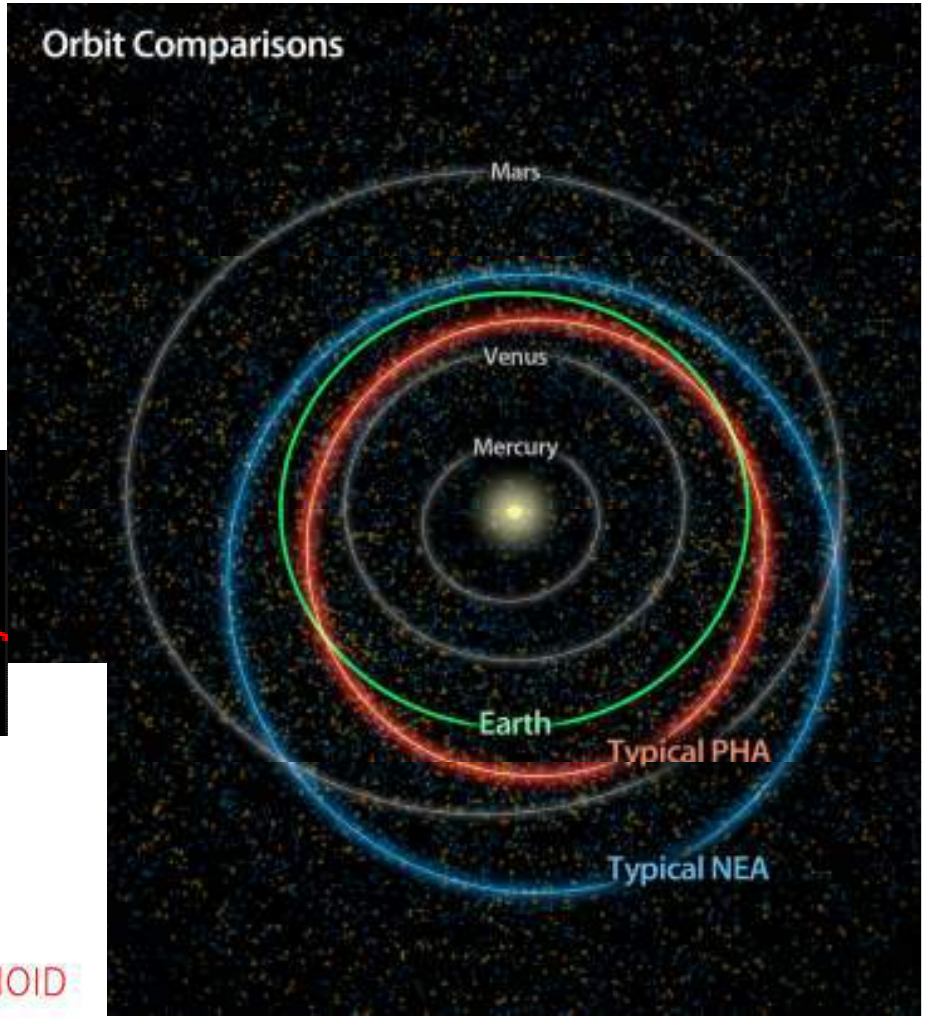
Elemen Orbit NEA's

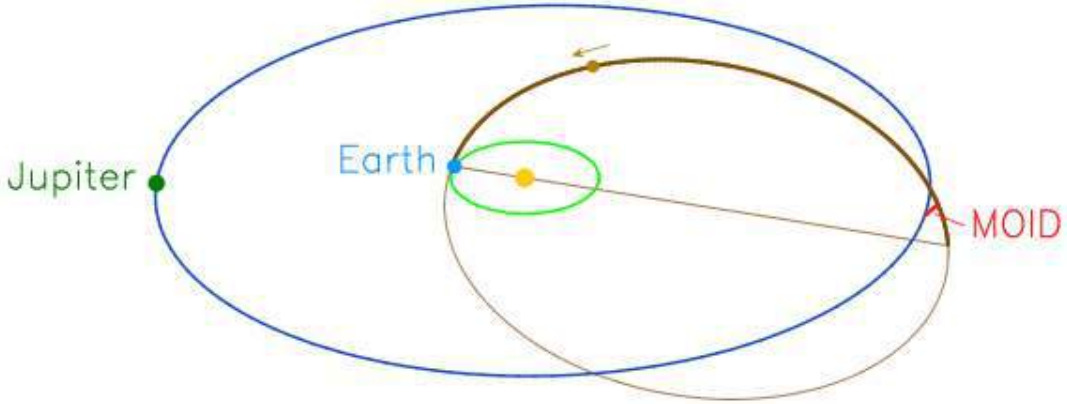


Potentially Hazardous Asteroids (PHA's)

- Asteroid's potential to make threatening close approaches to the Earth.
- Specifically, all asteroids with a minimum orbit intersection distance (MOID) of 0.05 au or less and an absolute magnitude (H) of 22.0 or less.







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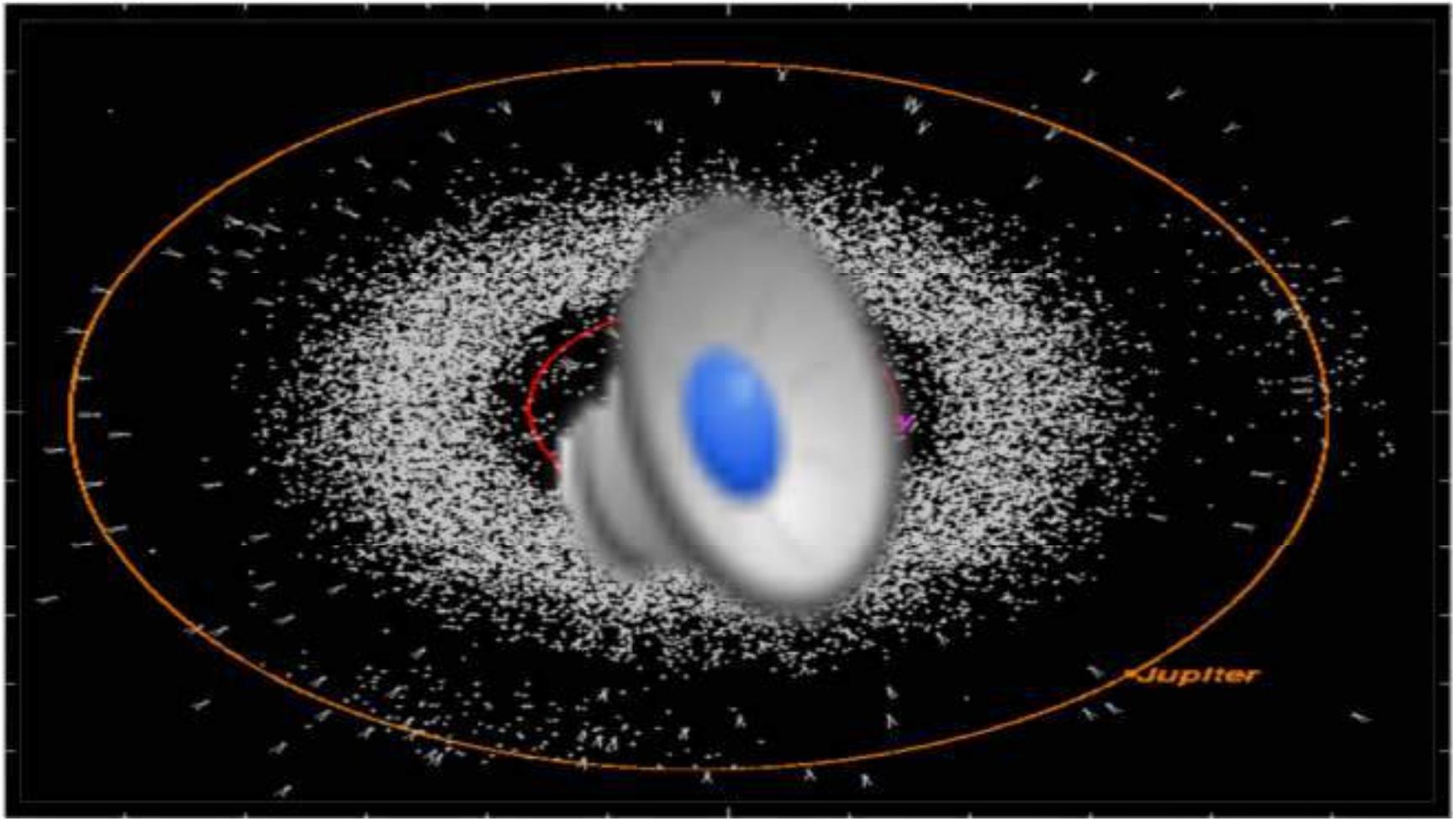
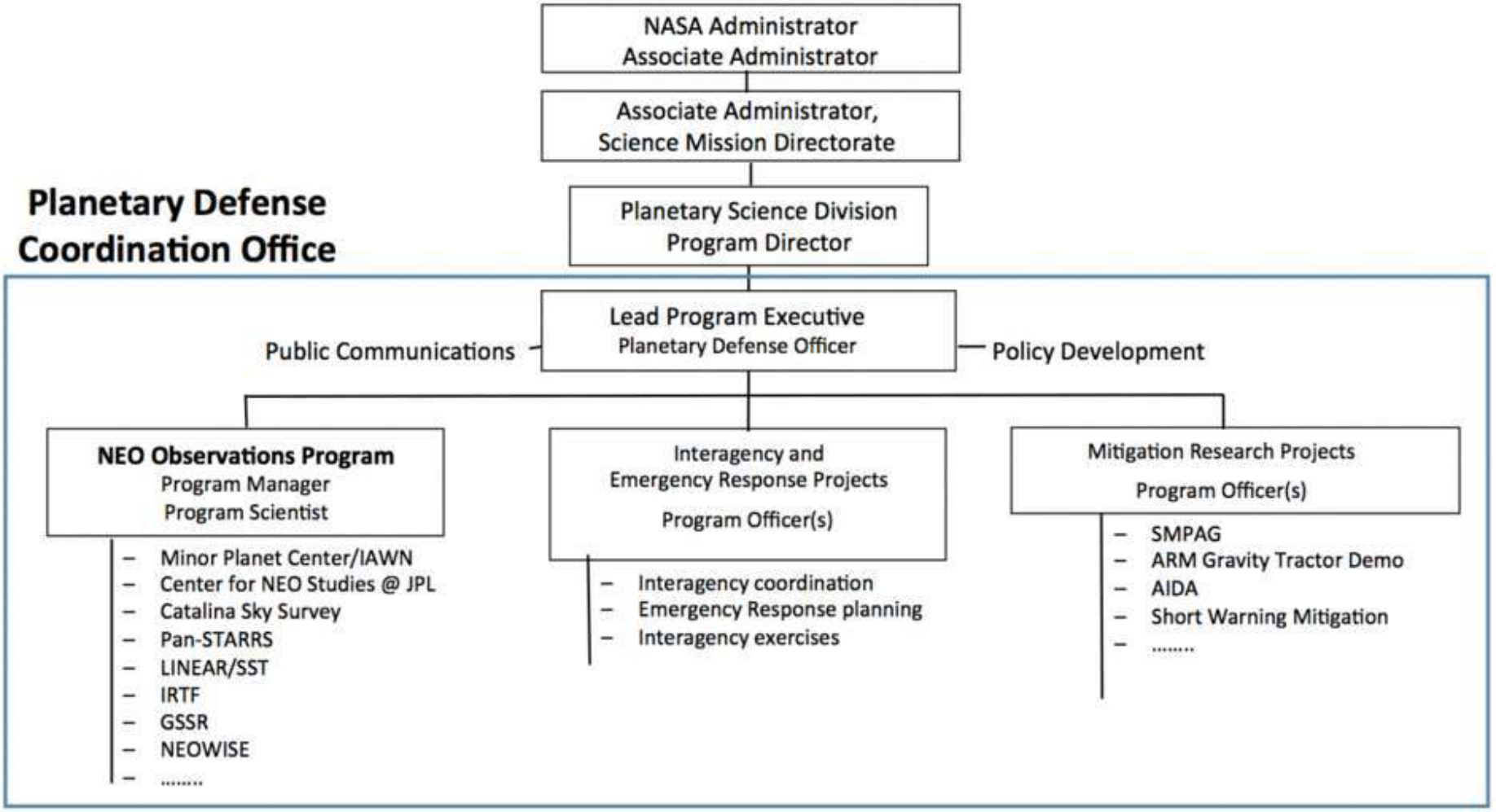
20 Tahun NASA Menjejaki Objek berdekatan Bumi

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Associate Administrator
Associate Administrator,
Science Mission Directorate
Planetary Science Division
Program Director
Planetary Defense
Coordination Office
Lead Program Executive
Planetary Defense Officer
Public Communications
Policy Development
NEO Observations Program
Program Manager
Program Scientist
– Minor Planet Center/IAWN
– Center for NEO Studies @ JPL
– Catalina Sky Survey
– Pan-STARRS
– LINEAR/SST
– IRTF
– GSSR
– NEOWISE
– .....
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Emergency Response Projects
Program Officer(s)
– Interagency coordination
– Emergency Response planning
– Interagency exercises
Mitigation Research Projects
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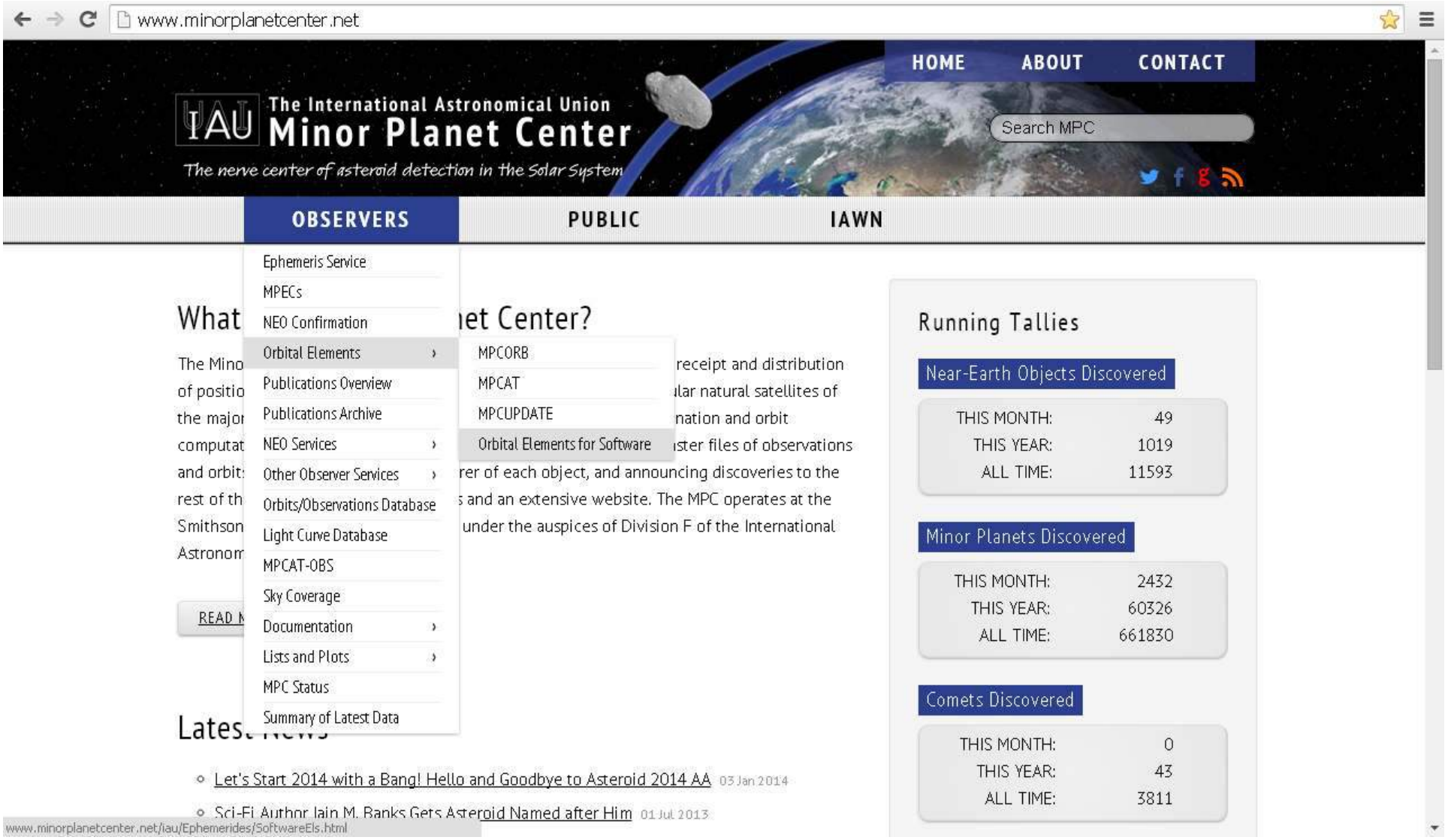
– SMPAG
– ARM Gravity Tractor Demo
– AIDA
– Short Warning Mitigation
– .....

Tanggungjawab PDCO

- Memastikan pengesanan awal bagi PHA's – asteroid dan komet yang orbitnya antara 0.05 AU; saiz yang besar cukup untuk sampai ke permukaan Bumi – ~ > 30-50 m
- Memantau dan mengenal pasti ciri-ciri PHA's dan memberi amaran tentang potensi hentaman.
- Memberi maklumat tepat dan masa yang sesuai mengenai PHA's sekiranya kemungkinan berlaku hentaman.
- Mengetuai koordinasi Kerajaan Amerika merancang pelan tindakan terhadap ancaman hentaman sebenar.

Minor Planet Center (MPC)

- Division F of the International Astronomical Union (IAU)
- Operates at the Smithsonian Astrophysical Observatory (SAO)
- Funded by NASA Grant
- Responsible for the designation of minor bodies in the solar system and for the efficient collection, computation, checking and dissemination of astrometric observations and orbit for minor planets and comets.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THIS YEAR: 1019
ALL TIME: 11593
Minor Planets Discovered
THIS MONTH: 2432
THIS YEAR: 60326
ALL TIME: 661830
Comets Discovered
THIS MONTH: 0
THIS YEAR: 43
ALL TIME: 3811
www.minorplanetcenter.net/iau/Ephemerides/SoftwareEls.html


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Astrometric Observation technique

- ❑ Identify the asteroid of interest - orbital element
- ❑ Digitizing the map of the asteroid and its position on the star chart
- ❑ Ready for the observation session
- ❑ Analysis the asteroid's positioning
- ❑ Submit the result to MPC

Kajian Asteroid di Malaysia

- Aktiviti cerapan asteroid di Balai Cerap Negara, Langkawi (ONL)

Cerapan asteroid:

✓ Cerapan Astrometri

✓ Cerapan pemantauan asteroid melalui teknik fotometri.

- Pemantauan keadaan kecerahan langit malam di ONL.

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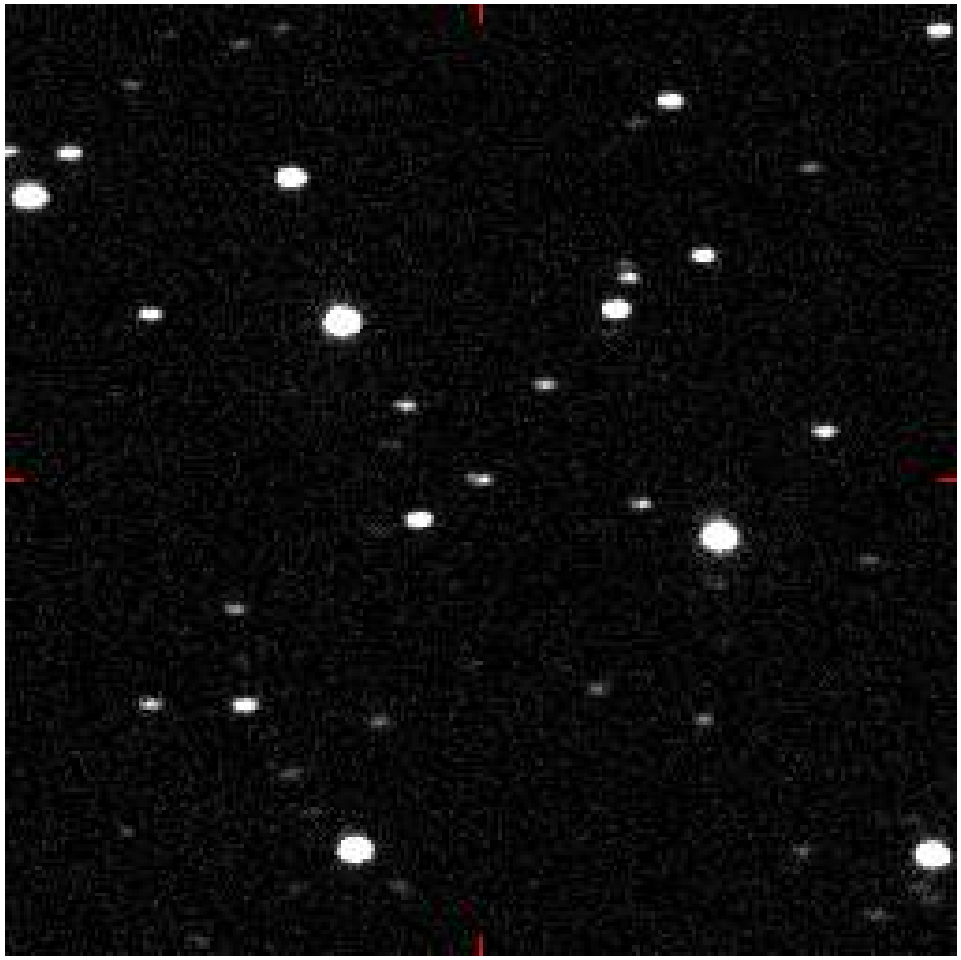
Cerapan Asteroid



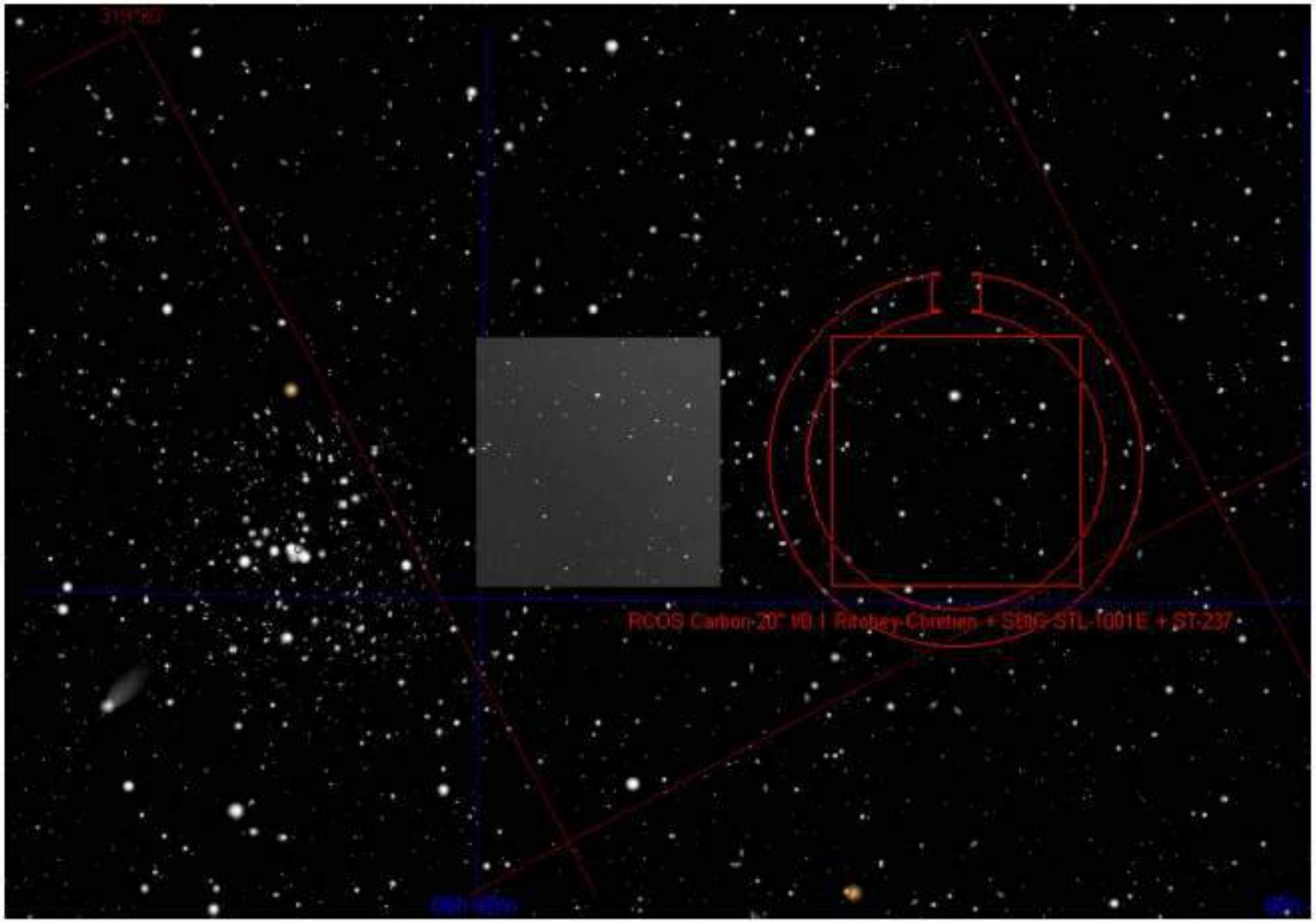
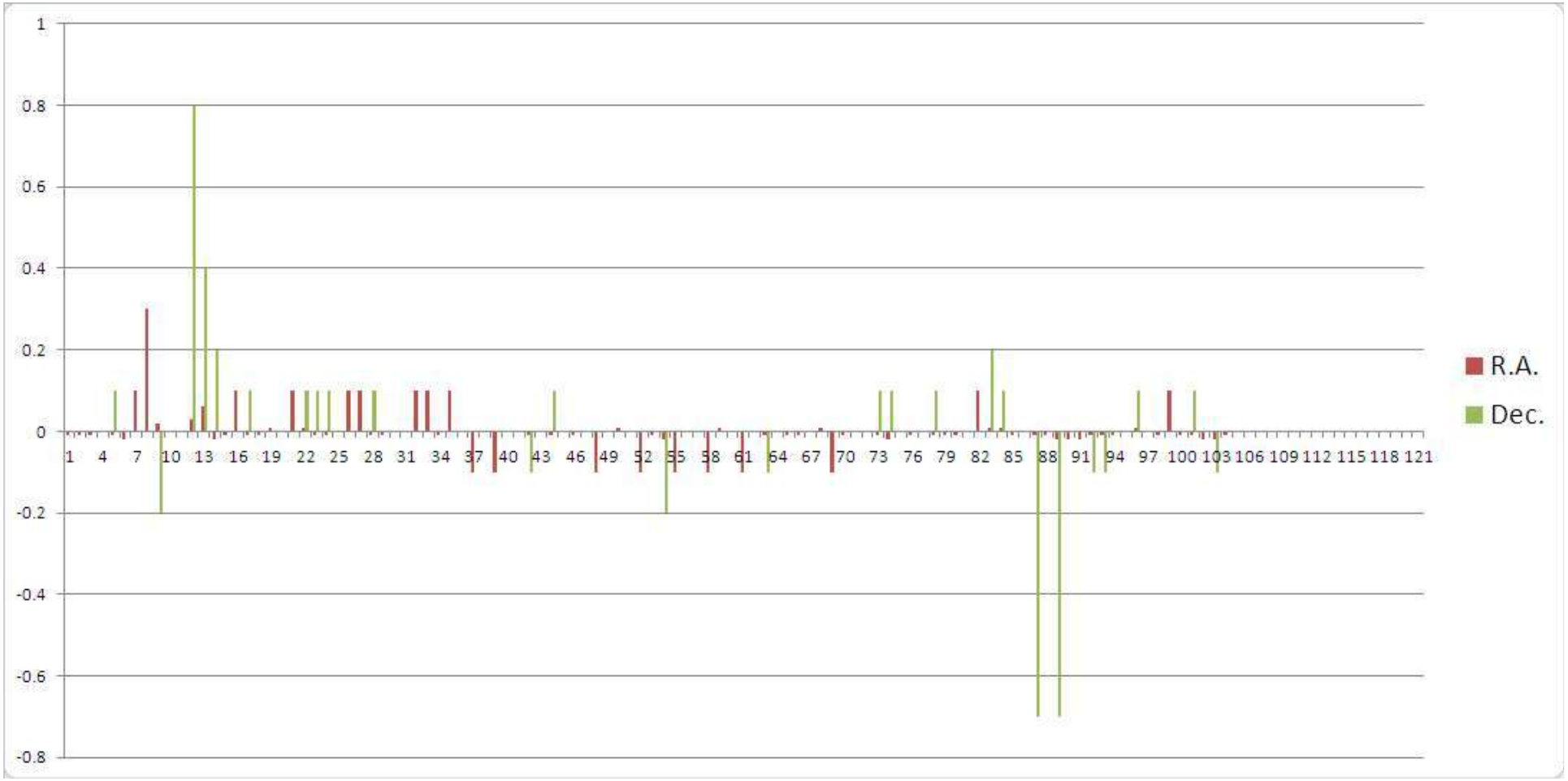

RCOS Carbon 20" f/8 | Ritchey-Chretien + SBIG STL-1001E + ST-237

Figure 4. Position of 506 Marion as observed on December 11, 2013 at 21:03UT (left), 21:44UT (middle) and 22:15UT (right).

The astrometric determination errors was verified by refer to NASA JPL HORIZONS Web-Interface*. Graph below shows the astrometric determination errors. As we can see that majority of the determination errors were small for both equatorial axis.



*NASA JPL HORIZONS Web-Interface.
http://ssd.jpl.nasa.gov/horizons.cgi

Astrometry Results

Astrometry results for 506 Marion:

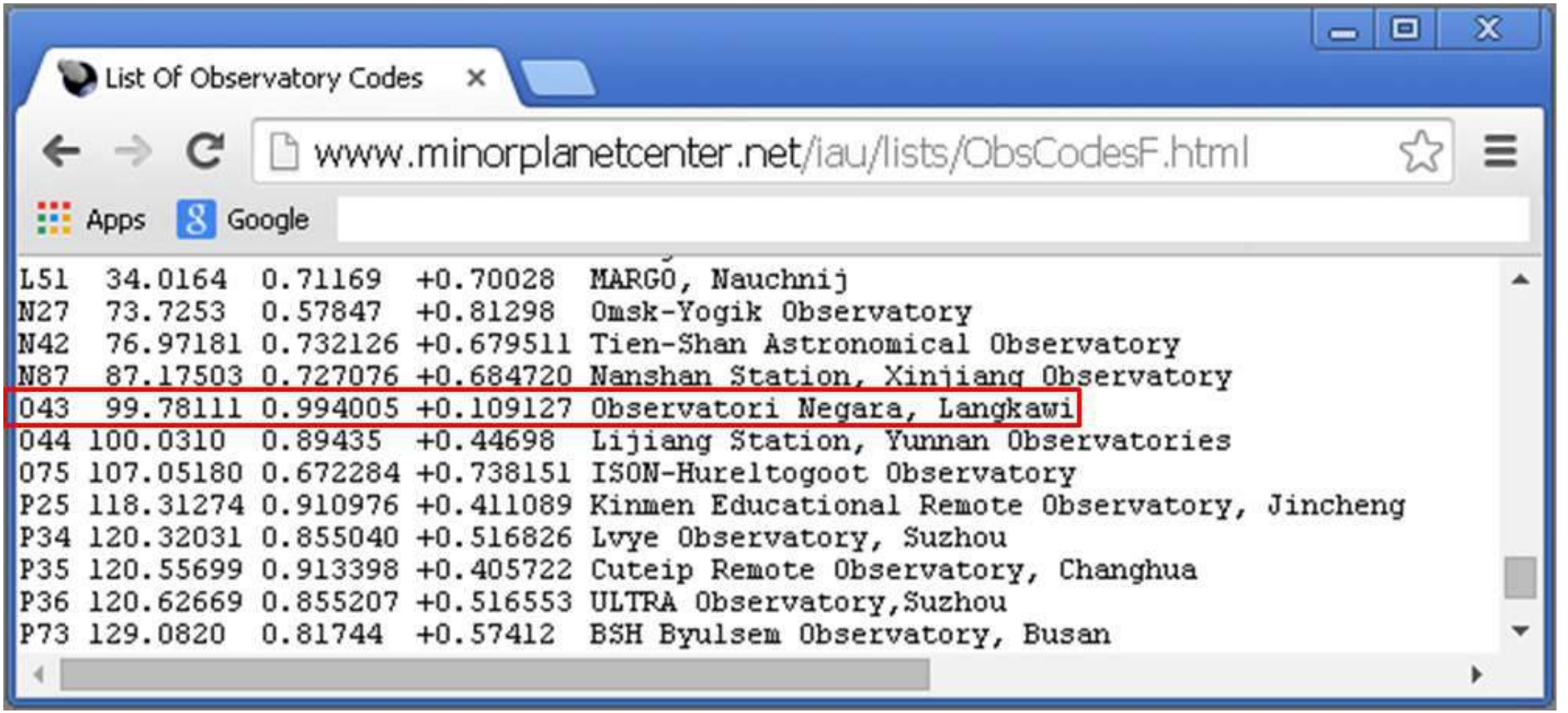
Observation Date: 2013-12-11

Observation Time: 21:03:37.516 UT	
Astrometry position from MAXIM DL:	07 38 28.06 +36 29 40.8
Astrometry position from JPL HORIZONS[1] :	07 38 28.01 +36 29 40.5
Observation Time: 21:44:20.578 UT	
Astrometry position from MAXIM DL:	07 38 26.91 +36 29 39.6
Astrometry position from JPL HORIZONS:	07 38 26.69 +36 29 39.1
Observation Time: 22:15:24.617 UT	
Astrometry position from MAXIM DL:	07 38 25.72 +36 29 38.3
Astrometry position from JPL HORIZONS:	07 38 25.69 +36 29 38.0

On March 5th – 7th, 2014, three asteroids have been chosen for astrometry observation in order to request Observatory Code from IAU's MPC. These asteroids are Azalea (1056), Aethusa (1064) and Hakone (1098).

The observation was done with Johnson R band filter. Data calibration was done in MAXIM DL. The plate solving and position determination was done in Astrometrica Software by using UCAC-4 catalog online.

Kod balaicerap negara, Langkawi : O43

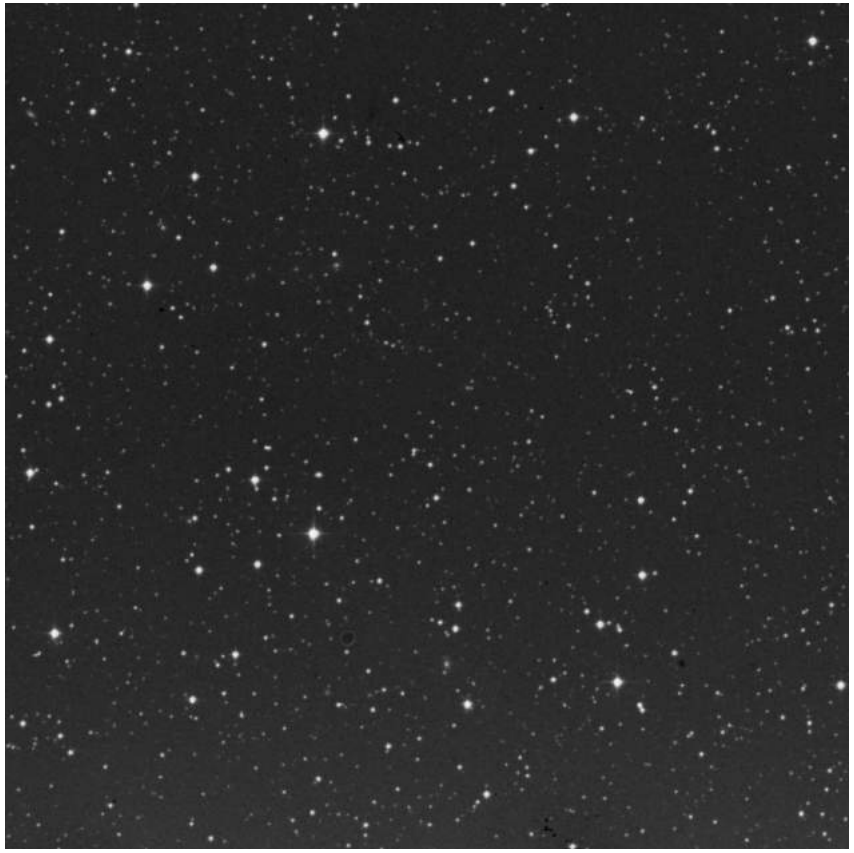


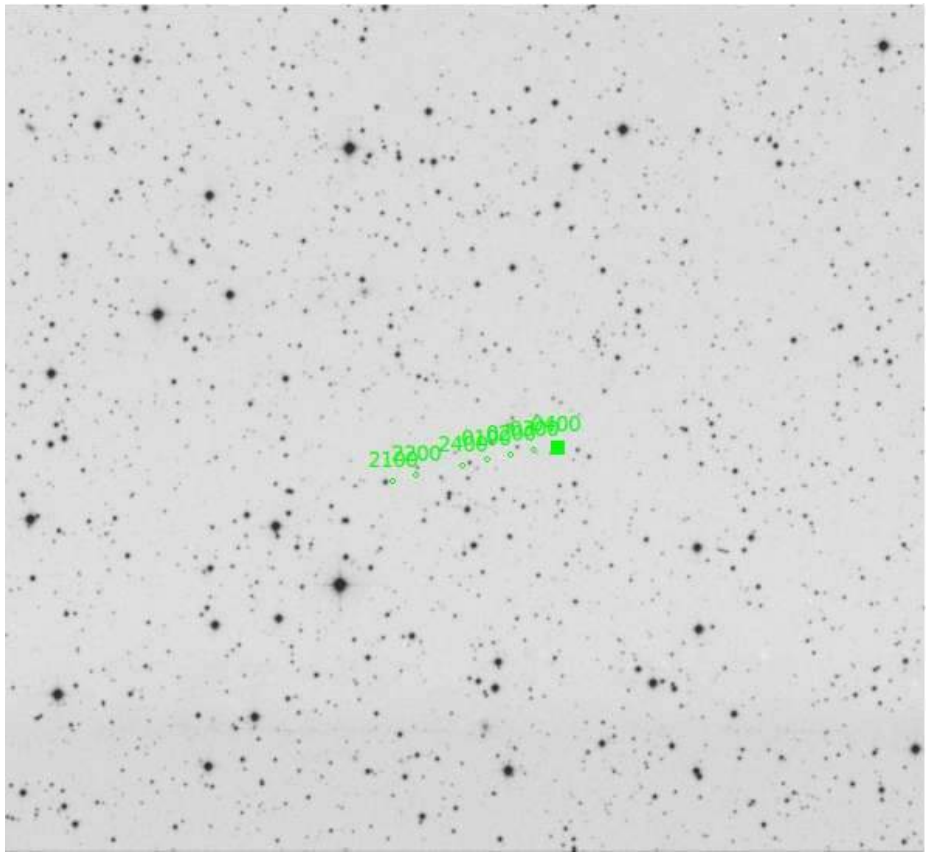
L51	34.0164	0.71169	+0.70028	MARGO, Nauchnij
N27	73.7253	0.57847	+0.81298	Omsk-Yogik Observatory
N42	76.97181	0.732126	+0.679511	Tien-Shan Astronomical Observatory
N87	87.17503	0.727076	+0.684720	Nanshan Station, Xinjiang Observatory
043	99.78111	0.994005	+0.109127	Observatori Negara, Langkawi
044	100.0310	0.89435	+0.44698	Lijiang Station, Yunnan Observatories
075	107.05180	0.672284	+0.738151	ISON-Hureltogoot Observatory
P25	118.31274	0.910976	+0.411089	Kinmen Educational Remote Observatory, Jincheng
P34	120.32031	0.855040	+0.516826	Lvye Observatory, Suzhou
P35	120.55699	0.913398	+0.405722	Cuteip Remote Observatory, Changhua
P36	120.62669	0.855207	+0.516553	ULTRA Observatory,Suzhou
P73	129.0820	0.81744	+0.57412	BSH Byulsem Observatory, Busan

Object Name	Equatorial Coordinate (2000J)	Equatorial Coordinate (Plate Solved)	Displacement Errors
SAO 96074	R.A.: 06h 45m 17.365s Dec.: +12° 53' 44.128"	R.A.: 06h 45m 16.3s Dec.: +12° 53' 28.9"	R.A.: 0.1s Dec.: 15.2"
SAO 114428	R.A.: 06h 47m 51.649s Dec.: +02° 24' 43.773"	R.A.: 06h 47m 48.9s Dec.: +02° 24' 32.7"	R.A.: 2.7s Dec.: 11.1"
SAO 152071	R.A.: 06h 54m 11.398s Dec.: -12° 02' 19.060"	R.A.: 06h 54m 08.3s Dec.: -12° 03' 17.1"	R.A.: 3.1s Dec.: 58.0"
SAO 1333269	R.A.: 06h 27m 15.591s Dec.: -00° 16' 33.598"	R.A.: 06h 27m 13.4s Dec.: -00° 16' 56.6"	R.A.: 2.2s Dec.: 23.0"
SAO 78423	R.A.: 06h 28m 57.787s Dec.: +20° 12' 43.679"	R.A.: 06h 28m 58.3s Dec.: +20° 12' 37.5"	R.A.: 0.5s Dec.: 6.2"
SAO 151283	R.A.: 06h 15m 44.886s Dec.: -13° 43' 06.290"	R.A.: 06h 15m 42.4s Dec.: -13° 43' 49.5"	R.A.: 2.5s Dec.: 43.2"
SAO 113001	R.A.: 05h 39m 11.146s Dec.: +04° 07' 17.281"	R.A.: 05h 39m 08.3s Dec.: +04° 07' 02.5"	R.A.: 2.8s Dec.: 14.8"
SAO 78571	R.A.: 06h 38m 23.007s Dec.: +28° 59'	R.A.: 06h 38m 23.6s Dec.: +28° 59'	R.A.: 0.6s Dec.: 10.9"

Ketepatan telescope *pointing*

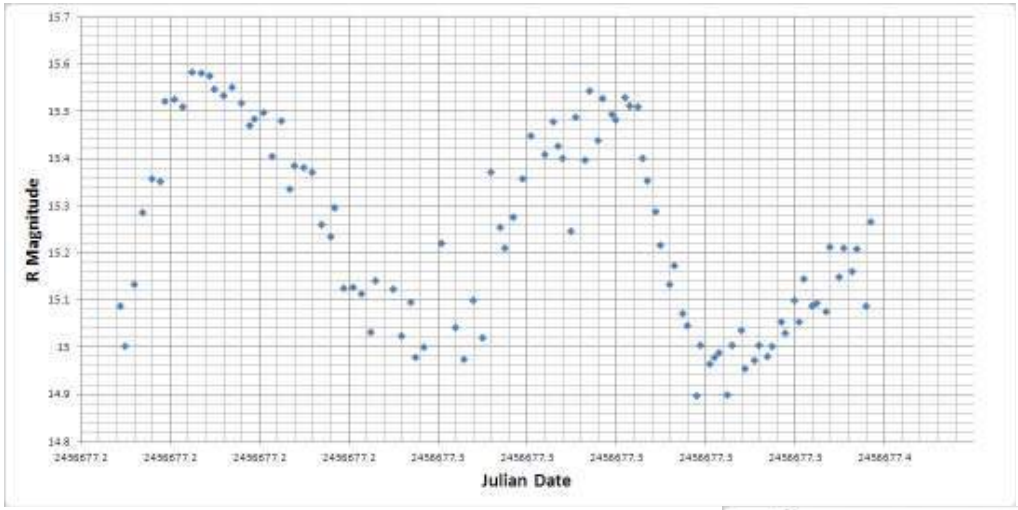
Cerapan Asteroid (Fotometri)





Asteroid : Furusho

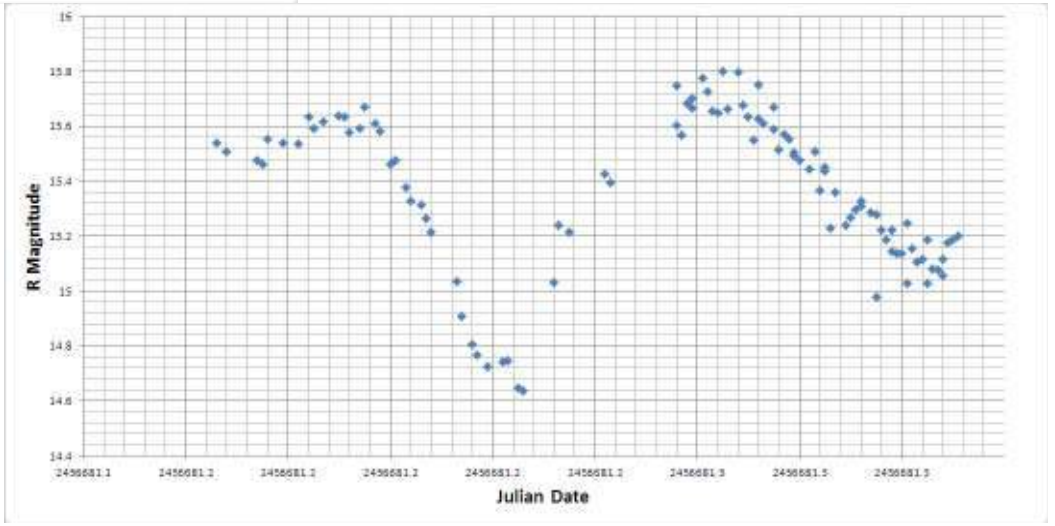
Lengkung cahaya (*light curve)*



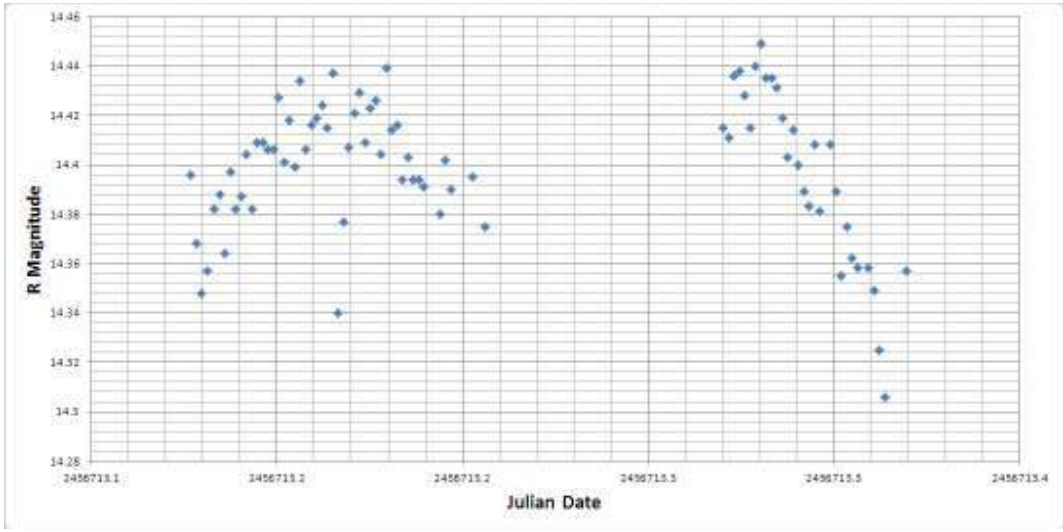
Lightcurve of Asteroid Furusho (7505) on January 19th, 2014

Properti fizikal Furusho :

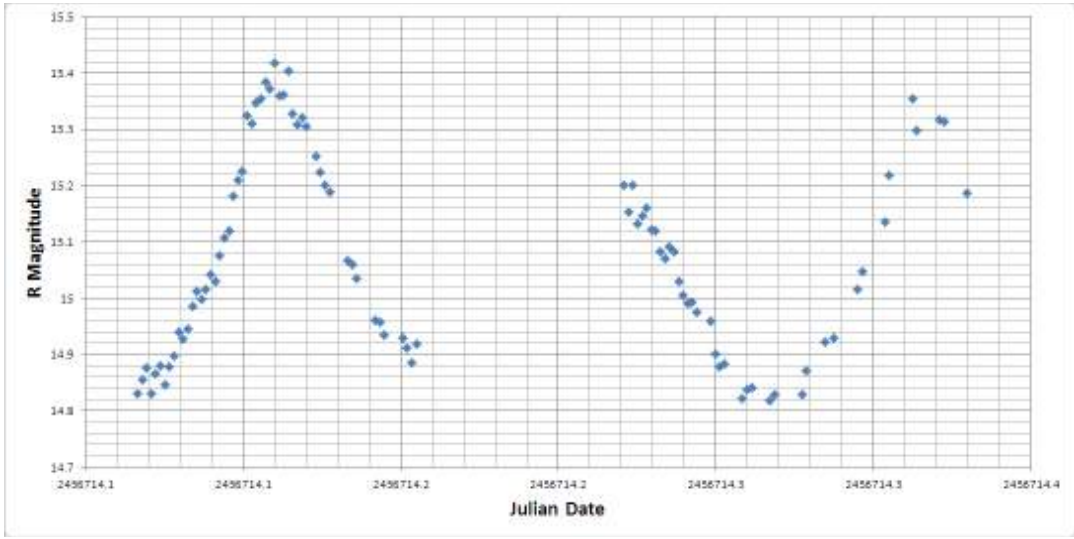
- ✓Rotation period : 4.14 hours
- ✓ Amplitude of light variation : 0.65 – 0.75



Lightcurve of Asteroid Furusho (7505) on January 23rd, 2014.



Lightcurve of Asteroid Swasey (992) on February 24th, 2014



Lightcurve of Asteroid Mertona (1299) on February 25th, 2014

Antara faktor yang perlu diambil kira dalam kajian Asteroid:

- Keadaan kecerahan langit malam yang semakin tercemar
- Kondisi sistem teleskop: *pointing, alignment, tracking*
- Alat pengesan yang kurang berkesan.
- Sistem teleskop yang mempunyai *'German Flip'*.
- Sumber manusia

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