

OBSERVATIONS OF SMALL-SIZE AND LOW-ELONGATION NEAS IN RI NAO

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Priority in the observation of NEAs

Potential hazardous asteroids
(PHA)

Newly discovered NEAs

Low elongation NEAs

Small-size NEAs

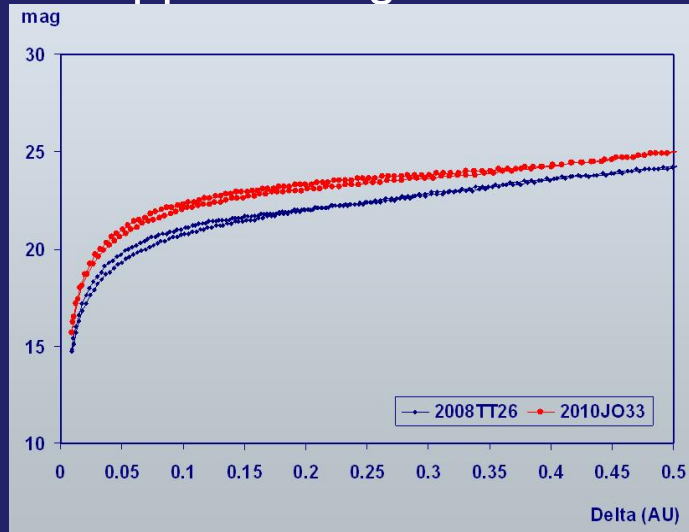
The numbers of the observed and estimated NEAs depending on the diameter are represented in the table (according to the IAU per October 2013)

Diameter m	Observed	Including PHA	Estimated
>1000	861	155	966± 45
> 140	5784	1424	~ 15000
>100	6448		~ 20000
>40	8398		~300000

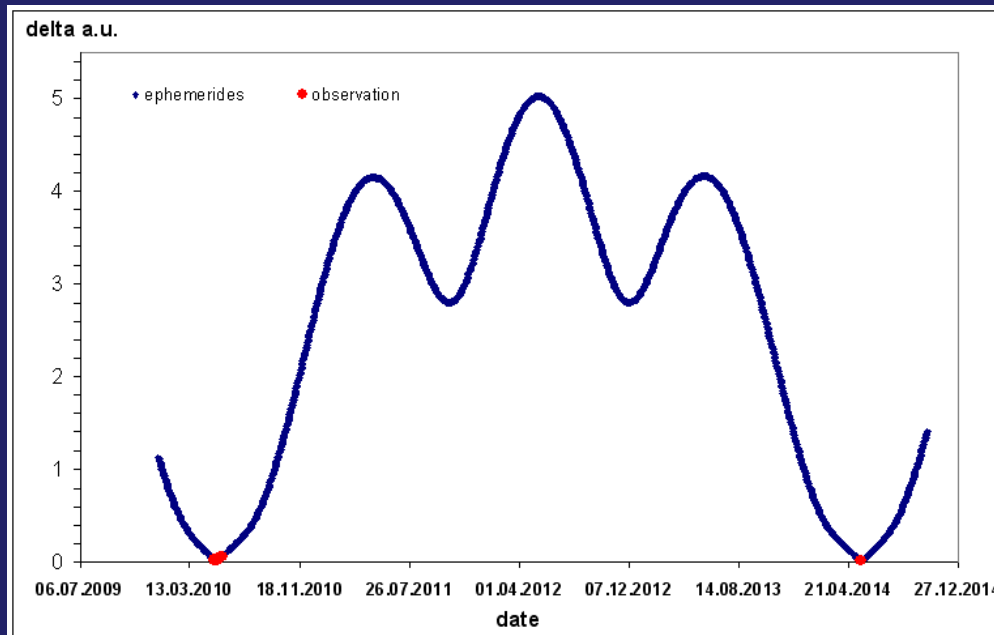
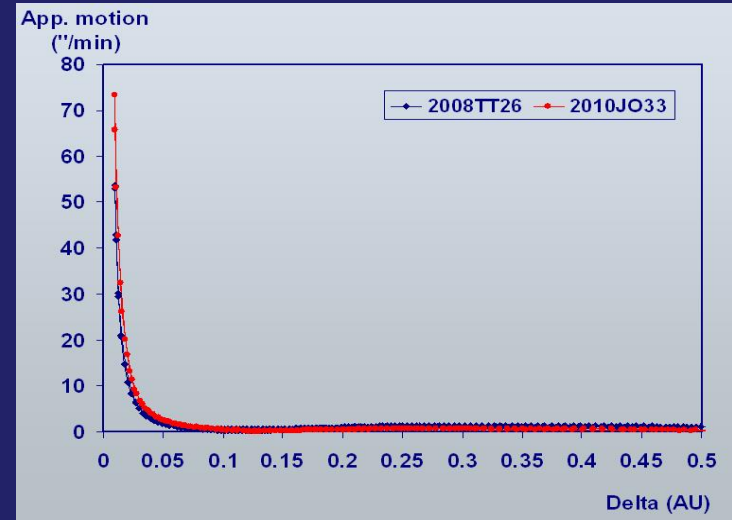
Observations of low diameter NEAs are necessary and possible only when approaching the Earth at a distance less than 0.05 a.u.!!!

Observation conditions of NEAs

Magnitude changes when NEA approaching the Earth



Apparent motion changes when NEA approaching the Earth

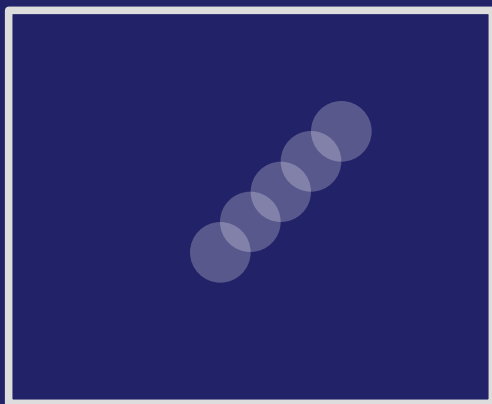


Observation of NEAS with high apparent motion on stable telescope (electronic tracking)

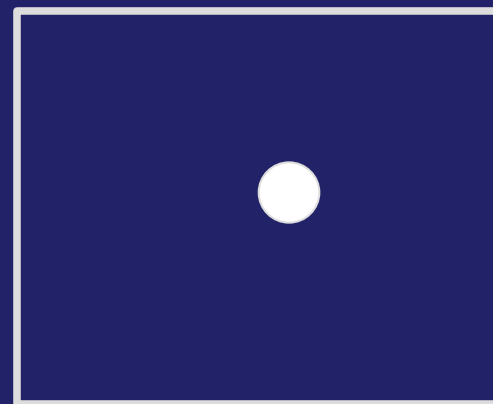
camera rotator

+

TDI CCD camera



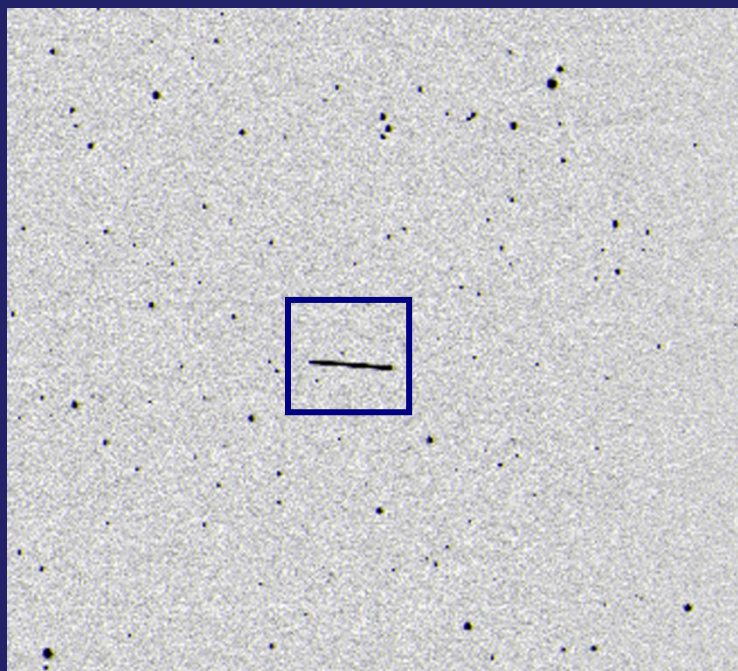
Stare mode



rotate + TDI

Comparison of two observation methods of NEA with high apparent motion

Sidereal tracking mode



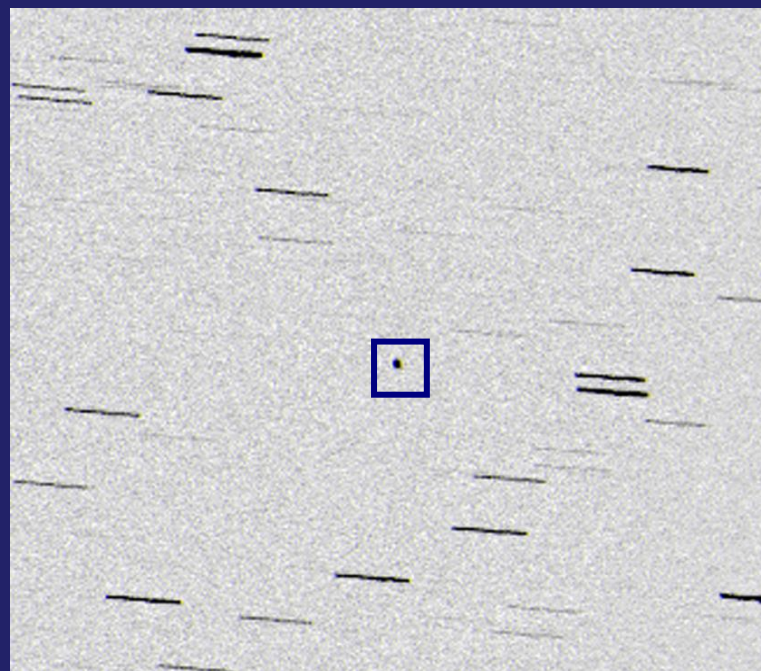
Telescope: KT-50

Provis. designation : 2003UV11

Date: 2010-10-29

Length of trail = 124"

Rotation + TDI mode
(electronic object tracking)



Mag = 11.9

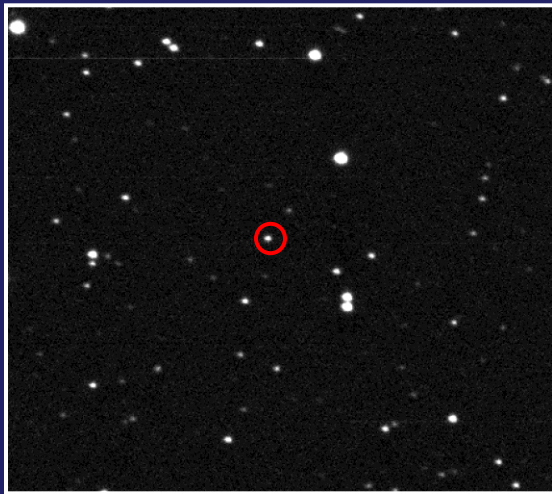
App. motion RA = -134 "/min

App. motion Dec = -11 "/min

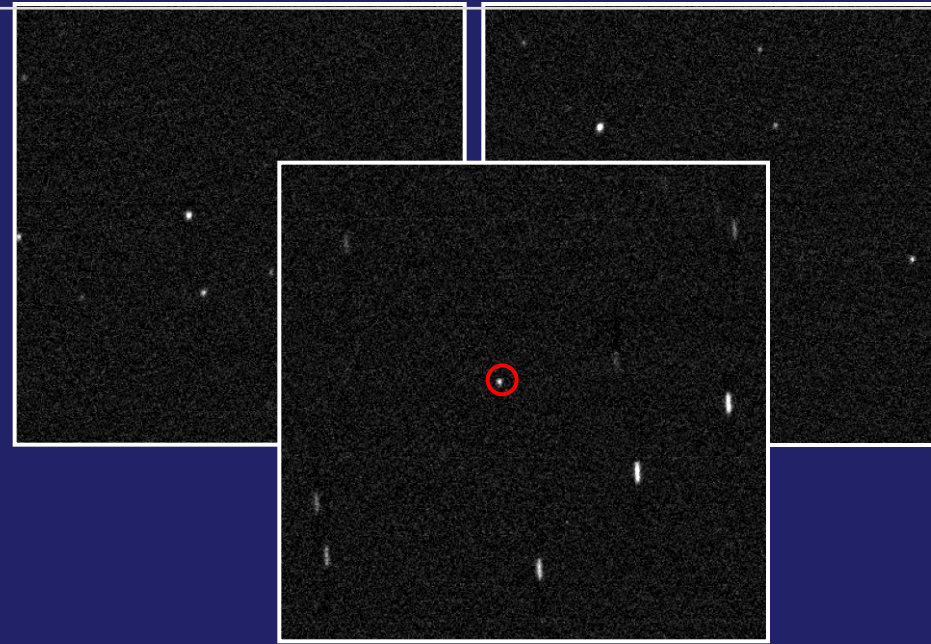
Exposure time = 50 s

Methods used in RI NAO for observation of NEA

App. motion < 3 Pixel size/ exposure time



App. motion > 3 Pixel size/ exposure time



NEA and stars on one image

2008 XE3

App. motion = 0.67 "/min

Exposure = 1 min

Pixel size = 0.83"

**NEA and stars on different images
(combined method)**

2005 GQ21

App. motion = 9.69 "/min,

Exposure = 1.5 min

Pixel size = 0.83"

KT-50 telescope



$F = 3000 \text{ mm}$, $D = 500 \text{ mm}$

CCD camera Apogee Alta U9000 3056×3056 , 12μ

Pixel size = $0.83'' \times 0.83''$

camera rotator

Field of view $0.7^\circ \times 0.7^\circ$

Results of observations

Observations of NEAs in Ukraine

№	Code	Name	Years of observations	positions	Positions for the last 10 years
1	61	Uzhgorod	1975	16	0
2	67	Lvov university observatory	1921	1	0
3	83	Golosseevo Kiev	2012	89	89
4	85	Kiev	1949 -1975	12	0
5	89	Nikolaev	1975 - 2014	4116	4046
6	94	Crimea-Simeiz	1928 -2014	440	372
7	95	Crimea-Nauchnij	1967 -2013	1266	604
8	121	Kharkov University, Chuguevskaya station	1996 -2013	559	96
9	583	Odessa- Mayaki	2009 -2014	719	719
10	585	Kiev comet station	1975 -2014	1617	1563
11	A50	Andrushivka Astronomical Observatory	2002 -2013	2520	1854
12	B17	AZT-8, Evpatoria	2009 -2013	837	837

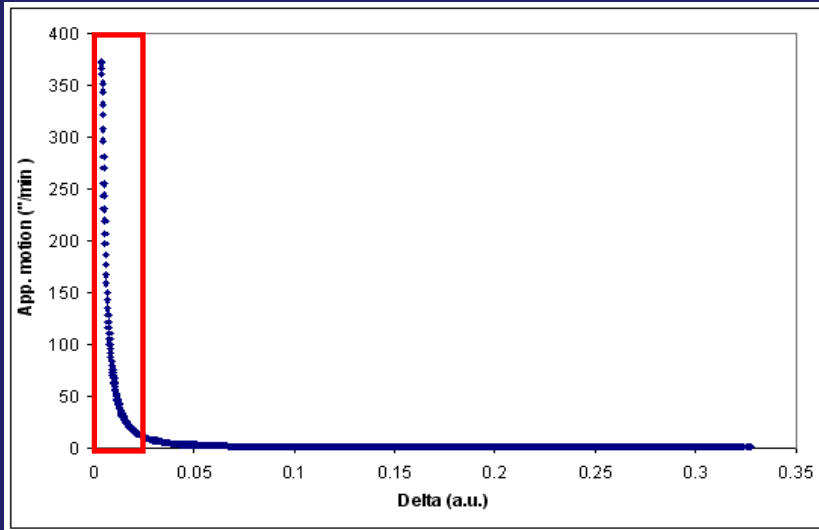
Observations of low-size NEA

Provisional designation	Diameter, m	N	N2 %	Delta a.e.	Mag	App. motion "/мин	(O-C) "	
							RA	DEC
2000WL63	20 – 40	263	2.7	0.18	17.8	4.7	0.13	0.22
2011JY1	30 – 80	106	6.6	0.03	18.5	16.0	0.01	0.04
2012EO8	40 – 90	119	5.0	0.01	17.1	82.8	0.11	0.02
2012FQ35	50 – 120	170	4.7	0.04	18.3	15.5	0.21	0.19
2012HM	40 – 100	521	3.6	0.01	15.7	46.3	0.18	-0.1
2012HP13	40 – 90	195	10.3	0.01	15.8	174.7	0.33	0.24
2012LJ	20 – 50	53	13.2	0.005	18.2	306.3	-0.03	0.09
2012TC4	10 – 30	301	4.0	0.001	16.5	19.1	0.15	-0.05
2012XH112	10 – 20	48	41.7	0.01	17.2	90.4	0.00	0.05
2013GK69	50 – 110	65	4.6	0.04	18.1	20.5	0.15	-0.01
2013XY8	30 – 60	248	8.5	0.01	14.9	80.1	-0.35	0.28
2014FD	20 – 50	78	11.5	0.01	18.1	55.6	-0.33	-0.67
2014FO38	10 – 30	79	5.1	0.01	18.0	58.1	0.42	0.53
2014FR52	50 – 110	79	7.6	0.05	18.4	9.4	0.08	-0.3
2014HV2	10 – 40	70	12.9	0.02	18.6	8.1	-0.11	0.28

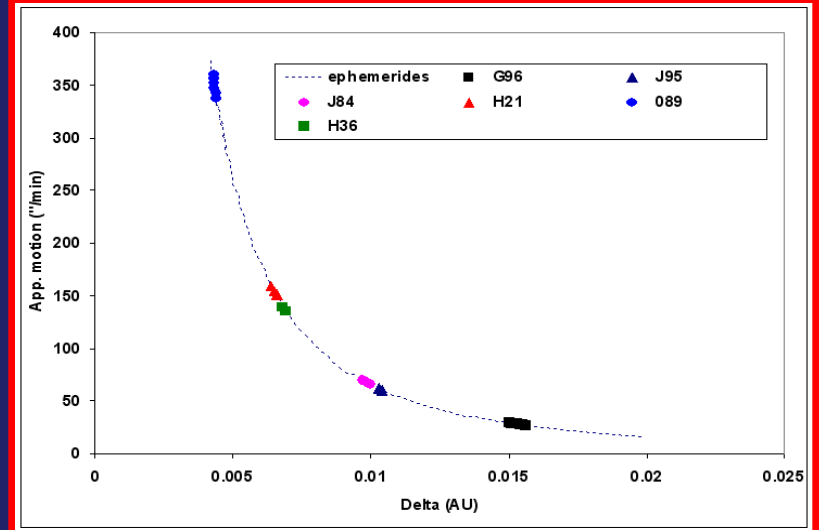
N – total numbers of positions, N2 – numbers of positions obtained in RI NAO (%)

NEA 2012LJ (20 - 50 m)

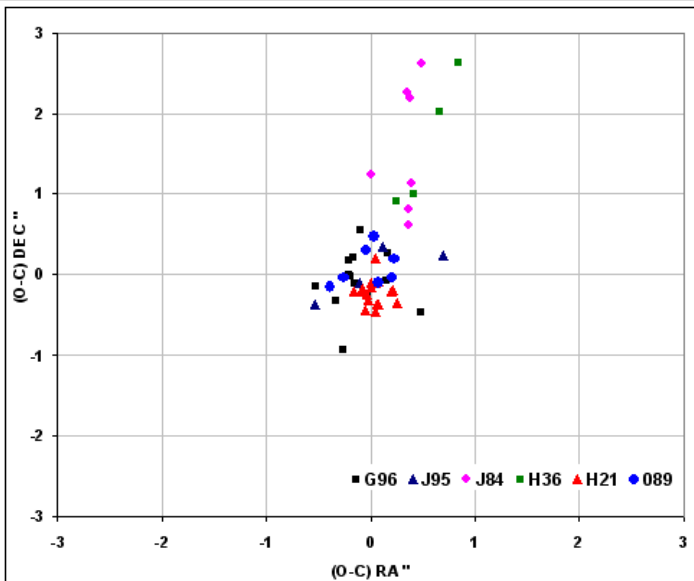
Ephemerides



Observations



(O-C)''



Observatory code	Observatory name
G96	Mt. Lemmon Survey
J95	Great Shefford
J84	South Observatory, Clanfield
H36	Sandlot Observatory, Scranton
H21	Astronomical Research Observatory, Westfield
089	Nikolaev Astronomical Observatory

Observation of low-elongation NEAs

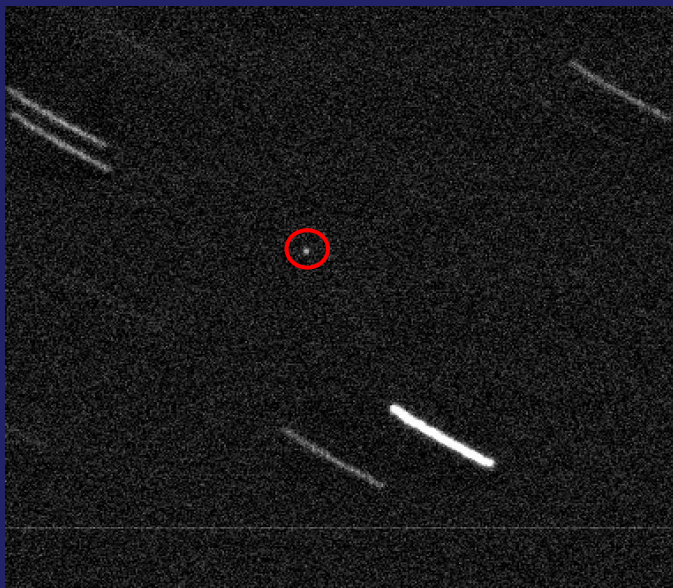
Observation conditions				(O-C)''
Number	Solar elongation °	mag	App. motion "/min	(O-C) Dec''
3199	36	17.6	2.5	<p>Legend: * other observatory • RINA O</p>
1999HF1	43	16.5	4.9	
2014HQ124	45	17	18.6	
2001PJ9	54	17.6	18.3	
2011WV134	58	16.6	9.7	
2002GT	59	18	4.6	
1999KW4	67	17.6	5.3	
2012LJ	67	17.6	346.4	

Observations of NEA 2014HQ124 were obtained within the framework of the GAIA-FUN-SSO campaigns of observation.

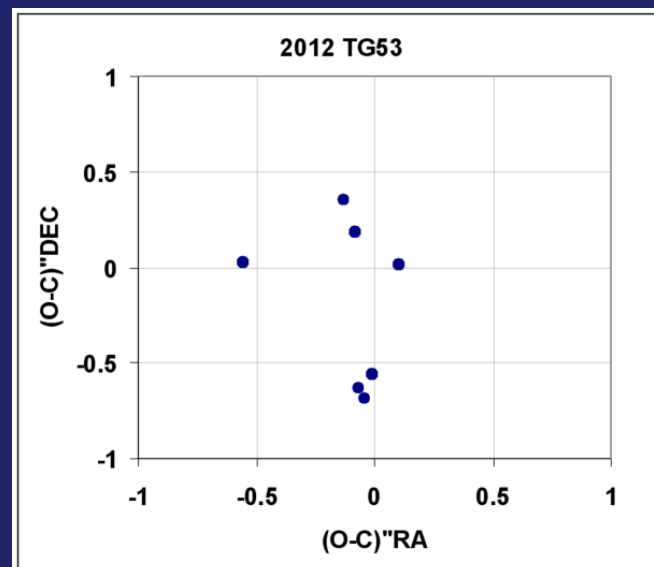
Follow up of newly discovered NEAs

Previously designation	Provisional designation	mag	Apparent motion "/min	Delta a.e	Diameter m
TT2E495	2012 TG53	17.3	27.5	0.03	60-150
TT2ED76	2005JU1	17.3	10.8	0.08	140-320
VJA8CAE	2014JO25	17.5	7.6	0.2	410-920
S003564	2014 KP4	16.5	5.6	0.16	700-1600

Image of NEA



(O-C)''



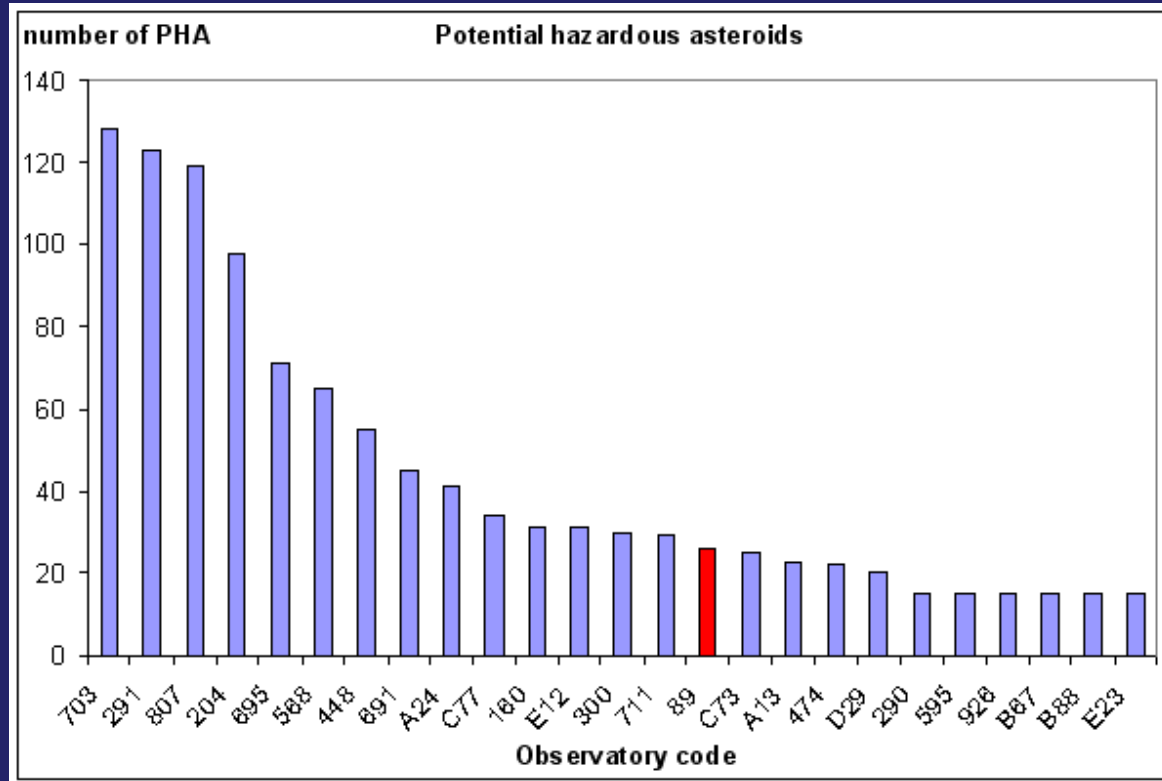
CSS wishes to acknowledge and thank the following observers (arranged by MPC observatory code) for making valuable follow-up observations of candidate NEOs

- [033 Karl Schwarzschild Observatory, Tautenburg.](#) Observer B. Stecklum. 1.34-m f/4 Schmidt + CCD.
- [089 Nikolaev.](#) Observers Y. Sybiryakova, Y. Kozyryev, N. Kulichenko, V. Vovk Measurers Y. Sybiryakova, O. V. Shulga. 0.5-m f/6.0 Maksutov + CCD.
- [104 San Marcello Pistoiese.](#) Observer P. Bacci. Measurers P. Bacci, L. Tesi, G. Fagioli. 0.60-m f/4 reflector CCD.
- [106 Crni Vrh.](#) Observer S. Maticic. 0.6-m f/3.3 Deltagraph + CCD.
- [113 Volkssternwarte Drebach, Schoenbrunn.](#) Observers G. Lehmann, K. Lehmann. 0.5-m f/4.6 reflector + CCD.
- [118 Modra.](#) Observer S. Gajdos. 0.6-m f/5.5 reflector + CCD.
- [151 Eschenberg Observatory, Winterthur.](#) Observer M. Griesser. 0.40-m f/5.9 Hypergraph + CCD.
- [160 Castelmartini.](#) Observers M. Jaeger, E. Prosperi, S. Prosperi, W. Vollmann. Measurer E. Prosperi. 0.35-m f/Schmidt-Cassegrain + CCD.
- [203 GiaGa Observatory.](#) Observers S. Foglia, G. Galli. Measurer G. Galli, 0.28-m f/6.8 Schmidt-Cassegrain + CCD
- [204 Schiaparelli Observatory.](#) Observer L. Buzzi. 0.60-m f/4.64 reflector + CCD.
- [246 Klet Observatory-KLENOT.](#) Observers J. Ticha, M. Tichy, M. Kocer, M. Honkova. Measurer M. Tichy. 1.06-m KL Telescope + CCD.
- [291 LPL/Spacewatch II.](#) Observer R. A. Mastaler. 1.8-m f/2.7 reflector + CCD.
- [300 Bisei Spaceguard Center--BATTeRS.](#) Observers A. Asami, S. Urakawa. 1.0-m f/3.0 reflector + CCD.
- [448 Desert Moon Observatory.](#) Observer B. L. Stevens. 0.3-m Schmidt-Cassegrain + CCD.
- [461 University of Szeged, Piszkesteto Stn. \(Konkoly\).](#) Observer K. Sarneczky.
- [474 Mount John Observatory, Lake Tekapo.](#) Observers A. C. Gilmore, P. M. Kilmartin. Measurer P. M. Kilmartin. 1.0-m f/7.7 reflector + CCD.
- [510 Siegen.](#) Observers M. Jung, H. Bill. Measurer M. Jung. 0.43-m f/4.5 reflector + CCD.
- [585 Kiev comet station.](#) Observer A. Baransky. 0.7-m f/4 reflector + CCD.
- [595 Farra d'Isonzo.](#) Observers E. Pettarin, F. Piani. Measurer E. Pettarin. 0.61-m f/4.0 reflector + CCD.
- [621 Bergisch Gladbach.](#) Observer W. Bickel. 0.60-m f/5.2 reflector + CCD.
- [673 Table Mountain Observatory, Wrightwood.](#) Observer J. Pittichova.
- [691 Steward Observatory, Kitt Peak.](#) Observer J. V. Scotti, R. S. McMillan. 0.9-m Spacewatch telescope + CCD.
- [711 McDonald Observatory.](#) Observer J. G. Ries. 2.1-m reflector + CCD + focal reducer.
- [718 Terele.](#) Observer P. Wiggins. 0.35-m f/5.5 Schmidt-Cassegrain + CCD.

Observation of potential hazardous asteroids

Since 2008 observations of 62 potential hazardous asteroids were carried out in RI NAO.

Amount of PHA with were observed in 2013 in different observatory of the world according to the MPC circulars

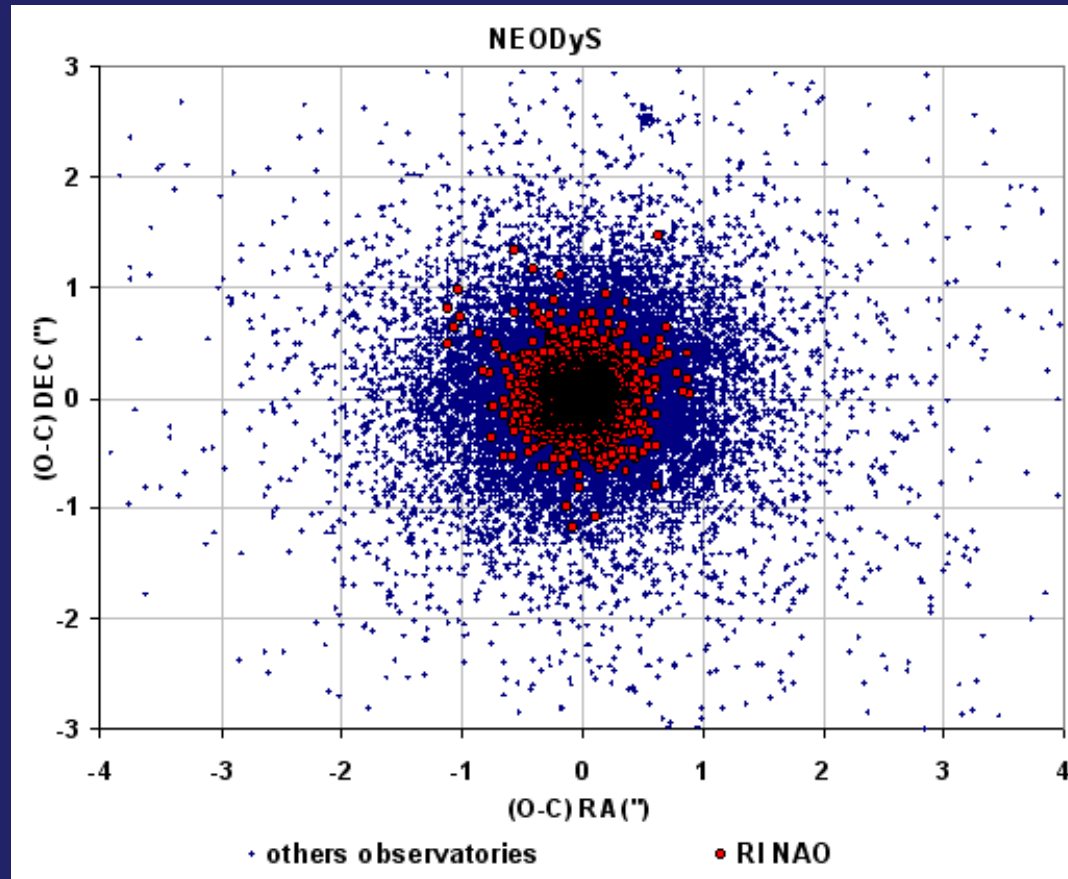


RI NAO occupies 15 th place in the world by result of observation of PHA in 2013!!!!

Observation of NEAs Apophis, 2002 GT, 2005 YU55, 2013 TV135, 2014 HQ124 were carried out in framework of the GAIA-FUN-SSO campaigns

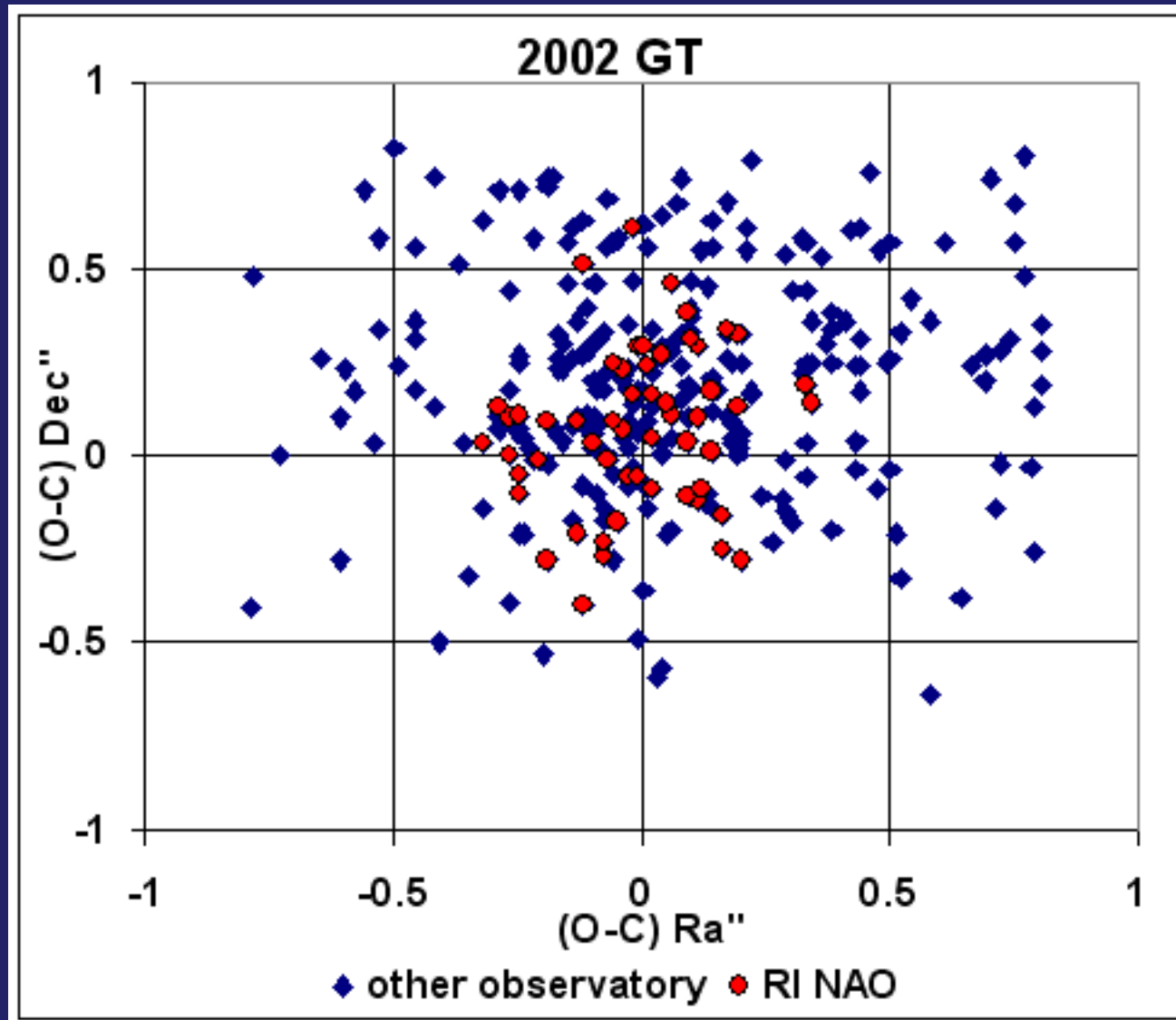
Accuracy of NEA positions

For 2008-2014 4043 positions of 219 NEAs were obtained in RI
NAO



99% of RI NAO residuals of observations is within the $\pm 1''$ and uniformly distributed around zero which shows the absence of systematic error.

Observation NEAs in GAIA framework



Thank you for your
attention!