The EURONEAR contribution to the European NEO Research

Ovidiu Vaduvescu

ING astronomer
IMCCE & IAC research associate

and the EURONEAR team

remote from ORM La Palma to
ESA/ESRIN meeting in Frascati, Italy
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What is EURONEAR?

The **EURO**pean **N**ear **E**arth **A**steroid **R**esearch

> A project to increase the European contribution in NEA research;

> Born in 2006 at IMCCE Paris (by O. Vaduvescu and M. Birlan);

> Proposing to improve orbital and physical properties of NEAs;

> The dream to establish one or two dedicated telescopes in both hemispheres was not fulfilled yet (understood our logo?)

> A collaborative project contributing to education and public outreach, including amateurs and students collaborators and paper co-authors.

The EURONEAR Consortium

> 14 nodes including more than 40 people from 8 EU countries and Chile.
Node leaders in yellow:

- Spain: ING La Palma (O. Vaduvescu) + IAC Tenerife (J. Licandro) + IAA Granada (J. L. Ortiz) + CSIC-IEEC Barcelona (J. M. Trigo)
- France: IMCCE Paris (M. Birlan) + OCA Cote d'Azur (P. Bendjova)
- Italy: Padova (M. Lazzarin, observer node)
- UK: Armagh (D. Asher)
- Germany: TLS Tautenburg (B. Stecklum)
- Slovakia: Modra, Bratislava (A. Galad)
- Poland: Poznan (T. Kwiatkowski)
- Romania: AIRA Bucharest (M. Popescu) + Univ. Craiova (R. Constantinescu) + Technical Univ. Cluj-Napoca (D. Gorgan)
- Chile: UAUA Univ. of Antofagasta (E. Unda-Sanzana)

+ 30 collaborators (students & amateurs from Romania, ING, other countries)

EURONEAR – Two Major Science Goals

A: Orbital amelioration via astrometry (since 2006)

1) Secure orbits of newly discovered PHAs and VIs
2) Recovery and follow-up of NEAs, PHAs and VIs in most need of data (one-opposition objects)
3) Data mining existing imaging archives available online
4) Incidental survey work: discovery of hundreds MBAs and 9 NEAs!

B: Physical properties via photometry and spectroscopy:
light-curves, taxonomy, size, binarity, albedo, mass (since 2014)

Both goals require regular observing time (more difficult to obtain and coordinate via normal time applications) or preferably one or two telescopes permanently dedicated to NEO research in Europe.

Observing runs within the EURONEAR network

1300+ NEAs observed from 5 countries with 20+ telescopes:

> Cerro Tololo, Chile - Blanco 4m (2n 2011);
> Isaac Newton Group, La Palma - WHT 4.2m (2011-2015 3n + few hrs D-time);
> Isaac Newton Group, La Palma - INT 2.5m (40n 2009-2016 + 100h ToO time);
> La Silla, Chile - ESO/MPG 2.2m with WFI camera (3n 2008);
> TLS Tautenburg, Germany - Schmidt 2m with CCD (40n 2012-2016);
> Las Campanas Observatory, Chile - Swope 1m (15n 2008);
> Cerro Tololo, Chile - Yale 1m + 0.9m telescopes (15n 2008, 2014);
> La Silla Observatory, Chile - ESO 1m (2n 2007, included in the FP7 proposal);
> Cerro Armazones Observatory, Chile - 0.84m (1n 2007);
> Haute Provence Observatory, France - 1.2m (15n 2007-2011);
> Pic du Midi Observatory, France - T1m 1m (40n 2006-2015);
> Teide Observatory, Tenerife - IAC80 and ESA-OGS 1m (65n 2015);
> ORM Observatory, La Palma – Mercator 1.2m (15n 2014-2015);
> Las Cumbres LCOGT Network – 1m and 2m (60h 2014-2015);
> San Pedro de Atacama Observatory, Chile – SON/UAUA 0.5m (7n 2014);
> AIRA Bucharest Observatory, Romania – 0.5m telescope (10n 2014-2015);
> Argelander Institute for Astronomy, Bonn, Germany - 0.5m (10n 2011-2013);
> Galati public outreach Observatory, Romania - 0.40m (100n 2011-2016);
> Bucharest Urseanu Observatory, Romania – 0.25+0.3m (50n 2006-2015).

Publications based on observing runs

7 published papers (astrometry) based on 20+ observing runs:
1000+ observed NEAs, PHAs and VIs, few thousand incidental known MBAs, few hundred MBA and few NEA discoveries with the INT.

1-2. "Observing NEAs with a small telescope"
> Major surveys overview, planning, data reduction, catalogs
> Sample run using the York Univ 0.6m telescope (Toronto)
> Romanian Astronomical Journal, Vaduvescu 2004 and 2005;

3. "EURONEAR: First Results"
> Two runs 1m telescopes France (Pic T1m and OHP 1.2m)
> Planning tools, reduction pipeline, astrometry QC (O-C calculator)
> P&SS 2008, Vaduvescu et al.

Publications based on observing runs

4. “More than 160 NEAs observed in the EURONEAR network”
> Using eight 1-2m telescopes: INT 2.5m, ESO 2.2m,
OHP 1.2m, Swope 1m, CTIO 1m, Pic 1m, ESO 1m, OCA 0.85m
> A&A 2010, Birlan et al., incl. 9 students/amateurs co-authors

5. ”EURONEAR – Recovery, follow-up and discovery of NEAs and MBAs using large field 1-2 m telescopes”
> Using 3 larger field 1-2m telescopes: Swope 1m, ESO 2.2m, INT 2.5m, runs 2008-2010
> MBA and NEA observability statistics using 1-2m telescopes
> P&SS 2011, Vaduvescu et al., incl. 13 students/amateurs

> 150+ MPC/MPEC publications including NEAs & MBAs;
> 15 communications in international conferences students/amateurs;

Publications based on observing runs

6. "739 observed NEAs and new 2-4 m survey statistics within the EURONEAR network"

> 10 runs observed with 9 telescopes: Blanco 4m MOSAIC-2, WHT 4.2m ACAM, INT 2.5m WFC, TLS Tautenburg 2m, OHP 1.2m, Pic du Midi T1m, plus 3 small educational/amateur telescopes: Bonn Univ 0.5m, Galati Obs 0.4m and Urseanu Obs 0.3m (Romania).

> P&SS 2013, Vaduvescu et al., including 24 students and amateurs from Romania, Chile, Germany, France, UK, Iran

7. "First EURONEAR NEA discoveries from La Palma using the INT"

> Our first (incidental – in the NEA recovery fields) NEA discoveries, first discovered from La Palma and with the INT!

> MNRAS 2015, Vaduvescu et al., including 20 students/amateurs reducers

Future publications based on observing runs

8. 2014-2016: the SP, UK and NL TACs granted me in total 150h INT ToO (1h/night override time, mostly in "soft" mode) to recover ~200 one-opposition (half all known objects) very faint NEAs (V=22-23.5). Includes a team of amateurs and students (data reducers) carefully blinking all frames (4 CCDs / WFC field FOV 34') some at S/N=2-3!
> To generate one paper in 2016 and include 10 students/amateurs;

9. In 2014-2015 EURONEAR was granted ~40 nights on Mercator 1.2m, INT 2.5m, LCOGT 1-2m network and WHT 4.2m, for physical properties of NEAs (photometry ~40 objects and spectroscopy ~60 objects);
> To generate two papers in 2016 and include 10 students/amateurs;

10. In Feb-Jul 2015 the IAC+ESA granted 50+ nights to EURONEAR for photometry of NEAs (IAC80 + ESA-OGS 1m telescopes in Teide); The Romanian amateur Radu Cornea raised 5000 EUR private sponsorship from his natal Sibiu city, to attend this first longer (6 mths) observing mission (40 objects, partially supported by IAC and ING);
> To become a paper in 2017 and possibly Radu's future BSc thesis

Publications based on data mining

4 published papers (astrometry) based on data-mining of image archives
500+ NEAs and PHAs were (p)recovered and many arcs extended

1. "EURONEAR: Data mining of asteroids and NEAs"
> Introducing PRECOVERY server (online in 2008)
> Application on the Bucharest Observatory plate archive (13,000 plates)
> AN 2009, Vaduvescu et al., including 2 student amateurs

2. "Mining the CFHT Legacy Survey for known NEAs"
> 25,000 MegaCam mosaic CFHT images (2003-2009)
> 143 NEAs and PHAs found and reported from 508 images;
> AN 2011, Vaduvescu et al., including 6 students and amateurs

Publications based on data mining

3. "Mining the ESO WFI and INT WFC archives for known NEAs. Mega-Precovery software" (online in 2010)

> 330,000 ESO/MPG 2.2m WFI and INT 2.5m WFC images (1998-2009);

> 152 NEAs and PHAs found in 761 images reported to MPC;

> Prolonged orbits and new opposition recoveries for 30 objects;

> In 2010 we introduced MEGA-PRECOVERY server and Mega-Archive:
66 instrument archives (ESO, CADC, NOAO, SMOKA, ING collections, etc) counting now 7 million images to query online!

> There is only one other such server in the world (CADC's SSOIS) but Mega-Precovery appeared first (2 years before SSOIS);

> AN 2013, Vaduvescu et al., co-authored by 13 students/amateurs;

> Few amateurs/students: Marcel Popescu (now professional astronomer), Lucian Curelaru, Iulia Comsa (Romania) and Farid Chad (Chile) developed Mega-Precovery server and databases under my supervision.

> This application and its associated Mega-Archive are growing daily!

Future publications based on data mining

4. "Mining the Subaru SuprimeCam Archive for NEAs"

> 70,000 SuprimeCam mosaic images taken with Subaru 8m (1999-2012);
> About 1000 known NEAs were searched on 5000+ candidate images!
> Some 100 known NEAs were found/measured on 500+ images;
> Additionally, we are scanning 100 selected SuprimeCam fields for new NEAs to check the NEA statistics at faint magnitudes;
> ACM2012 meeting in Japan (poster), Vaduvescu et al;
> To become a paper in 2016, collaboration with 14 students/amateurs.

5. "Mega-Precovery the Mega-Archive, and their applications"
> To become a dedicated paper in 2016+, Vaduvescu et al.;

6. "VIMP, the Virtual Impactor Mega-Precovery eliminator"
> Project under development with the Romanian student astronomer Bogdan Danila, probably to become a dedicated server and paper in 2016+

Other topics and papers related to EURONEAR

Six papers related to asteroids, comets and MBCs lead by some previous EURONEAR or other collaborators:

1. "Formation of asteroid pairs by rotational fission"
> Nature 2010, Pravec et al., including 3 of my former Chilean students;

2. "Binary asteroid population. 2. Anisotropic distribution of orbit poles of small, inner main-belt binaries"
> Icarus 2011, Pravec et al. 2011, including 2 of my former students;

3. "Spectroscopic observations of new Oort cloud comet 2006 VZ13 and four other comets"
> MNRAS 2011, Gilbert et al, collaboration with my former Canadian colleague P. Wiegert and his PhD student;

Other topics and papers related to EURONEAR

Papers related to Main Belt Comets (MBCs) lead by EURONEAR collaborators:

4. "Water-ice-driven Activity on Main-Belt Comet P/2010 A2 (LINEAR)?" (Moreno et al., ApJ 2010)

5. "(596) Scheila in outburst: A probable collision event in the Main Asteroid Belt" (Moreno et al., ApJ 2011)

6. "The dust environment of Main-Belt Comet P/2012 T1 PANSTARRS)" (Moreno et al., ApJ 2013)

Romanian and international premieres

1. 243 asteroids (DISCSTATUS, mostly MBAs) discovered with the ESO/MPG 2.2m in Mar 2008 and INT 2009-2016 (including ~25 students/amateurs remote reducers);

2. First Romanian discoverers of asteroids (2008) lead by two Romanian Diaspora astronomers with a team of 6 Romanian students and amateurs reducing data remotely daily;

3. First asteroids discovered by Romanians named after passed away Romanian astronomers and public outreach: (263516) Alexescu, (257005) ArpadPal, (320790) Anestin, (330634) Boico and (346261) Alexandrescu; and the process continues with others 4 recently proposed: (450931) Coculescu, (358894) Demetrescu, (365761) Popovici, (369088) Marcus

4. First 10 Romanian students observers in Chile and Canary Islands;

Romanian and international premieres

5. First Romanian discoverers of NEAs (2014-2015)
   First secured 9 NEA discoveries from La Palma and using the INT: 2014LU14, 2014NL52 (very fast rotator), 2014OL339 (the 4th known quasi-Earth satellite and 1st known Amor), 2014SG143 (big >1km), 2014VP, 2015HA117, 2015LT24, 2015VF65, and 2015VG66.
   First Romanian discoverers of NEAs, lead by the most prolific amateur Lucian Hudin (7 discoveries).

6. First ING student of Romanian origin (from a total of ~100 during 1998-2015) involved in EURONEAR (astrometry and photometry): Vlad Tudor (MSc Leicester UK, now PhD student in Australia).

7. Many other Romanian students (Bucharest Magurele) EURONEAR collaborators went to studies abroad: A. Tudorica, T. Badescu, M. Badea (Bonn), R. Toma (Bonn; Armagh), D, Lacatus, A. Paraschiv (Australia), I. Comsa, A. Dumitriu (UK), etc.

Data reduction: astrometry

Software for image processing, field correction and source recognition:

> THELI (Erben, Schrimer, Dietrich et al, 2005):

- Applied to correct the field to improve the astrometry;
- Mandatory for PF large field cameras (INT-WFC, Blanco-MOSAIC);

> SDFRED for Subaru SuprimeCam (Ouchi, Yagi, 2002, 2004);

> Our own IRAF pipeline for image reduction (O. Vaduvescu);

> FIND_ORB – great! (B. Gray) and ORBFIT (A. Millani) for orbital fits;

> Astrometrica (H. Raab):

- Easy Windows tool used remotely by students and amateurs;
- Blink, detect (as low as S/N=3-4), classify, measure, QC check and report all moving objects during next day by students & amateurs!

> Two MOPS under development (Romanian amateur and PhD student)

Data reduction: photometry and spectroscopy

Software for photometric, light-curves and spectroscopic reduction:

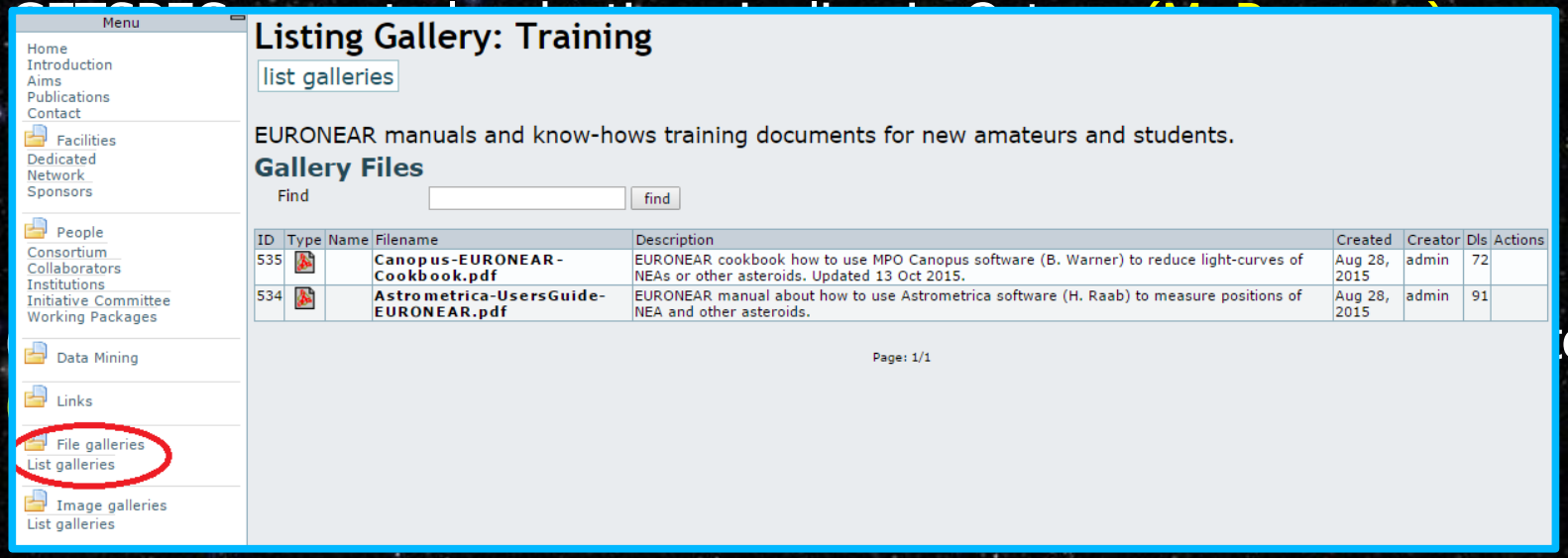
> MPO Canopus (B.Warner)

> LIDAS (student V. Tudor) for preliminary fast reduction:
mostly automated Python/IRAF pipeline to generate light-curves;

>

>

>



Epsilon-miu orbital model

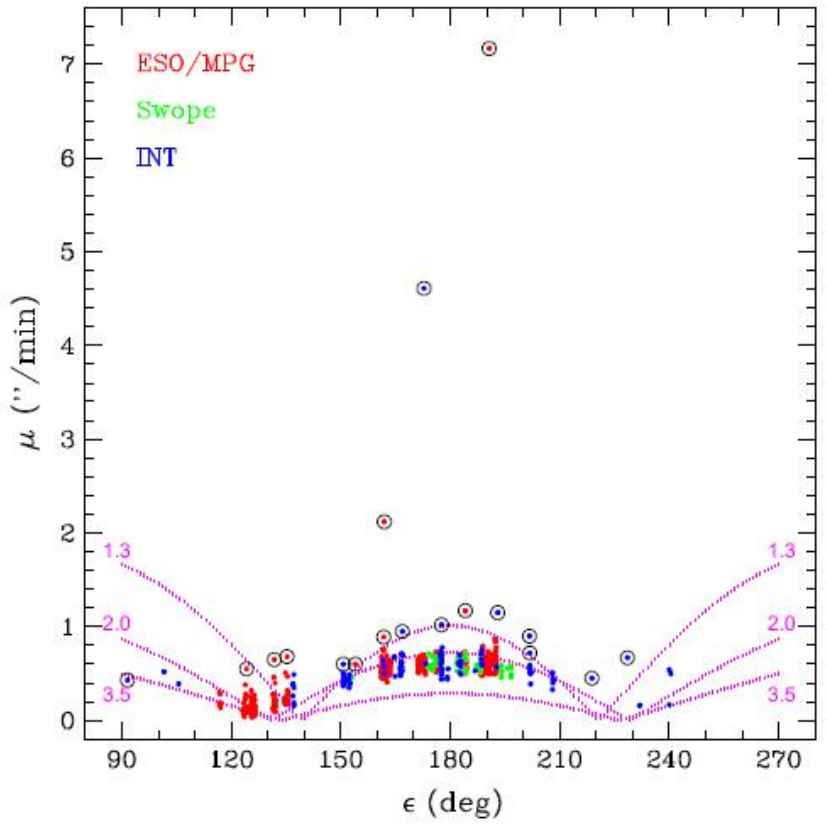
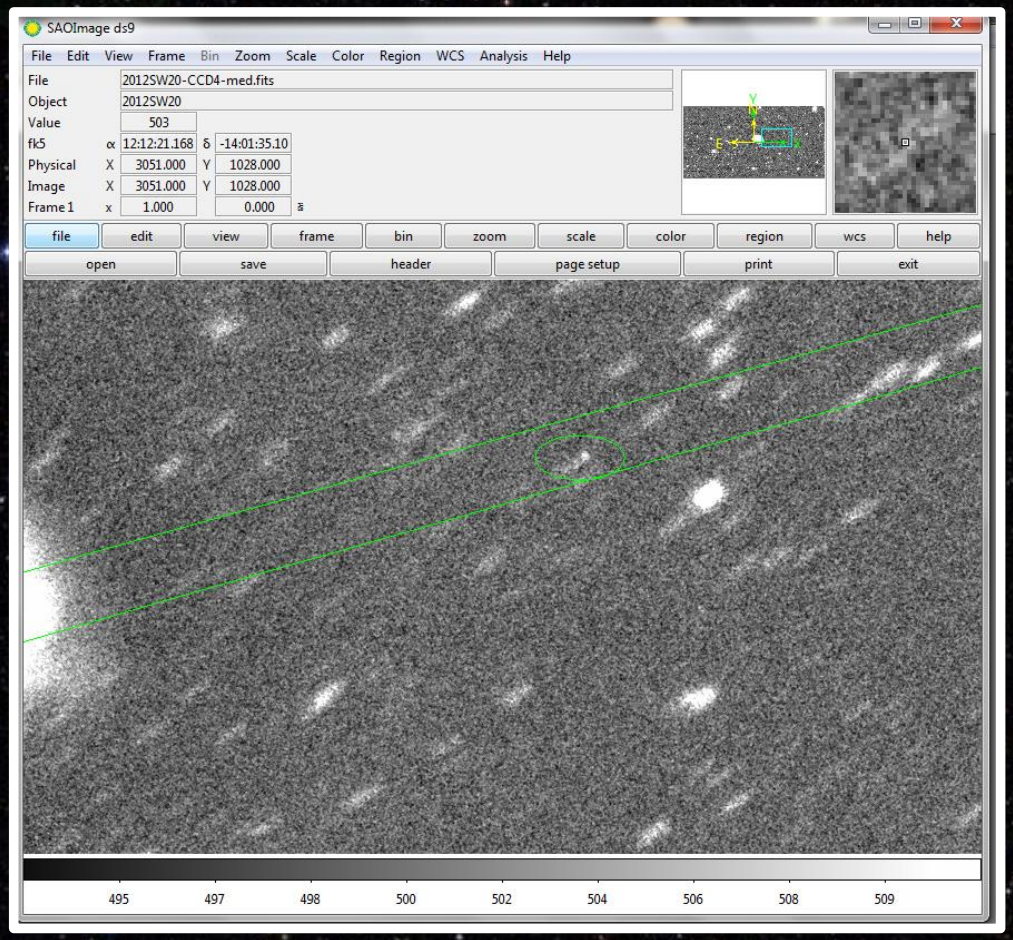


Fig. 5. Basic orbital model using the asteroid observed proper motion μ and the solar elongation ε. We plot all unknown objects observed at ESO/MPG (red), Swope (green) and INT (blue). The three overlaid dotted magenta curves correspond to asteroids orbiting between a=2.0 and a=3.5 AU (Main Belt) and a=1.3 (Near Earth Objects limit). The model allows us to easily flag NEO candidates in a survey. We mark with circles our NEO candidates and we include their properties in Table 4. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Simple orbital model to distinguish between MBAs and NEA candidates around opposition based on their proper motion (miu) and Solar elongation (epsilon)

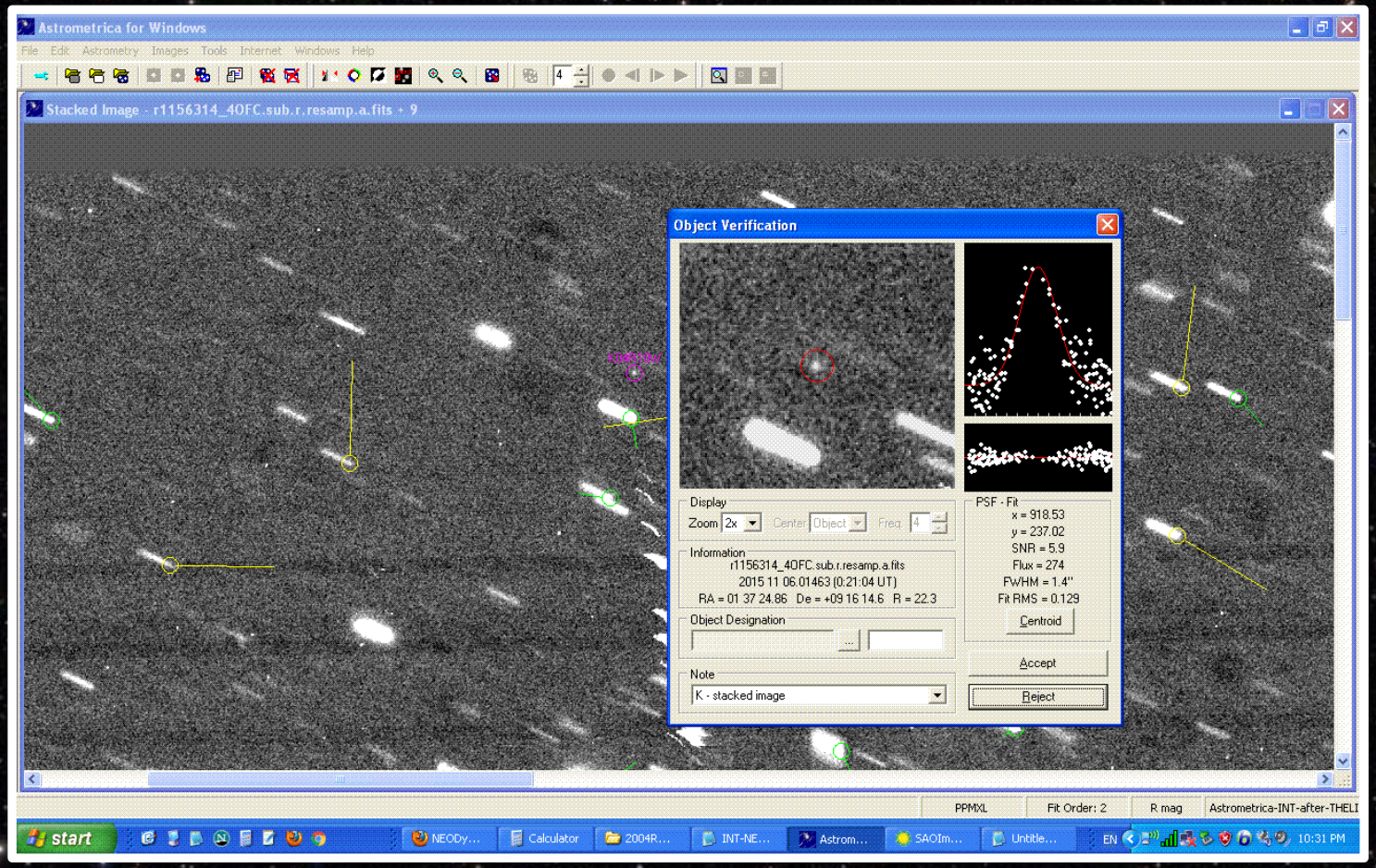
(Vaduvescu et al, 2011b)

Samples of one-opposition NEA recoveries



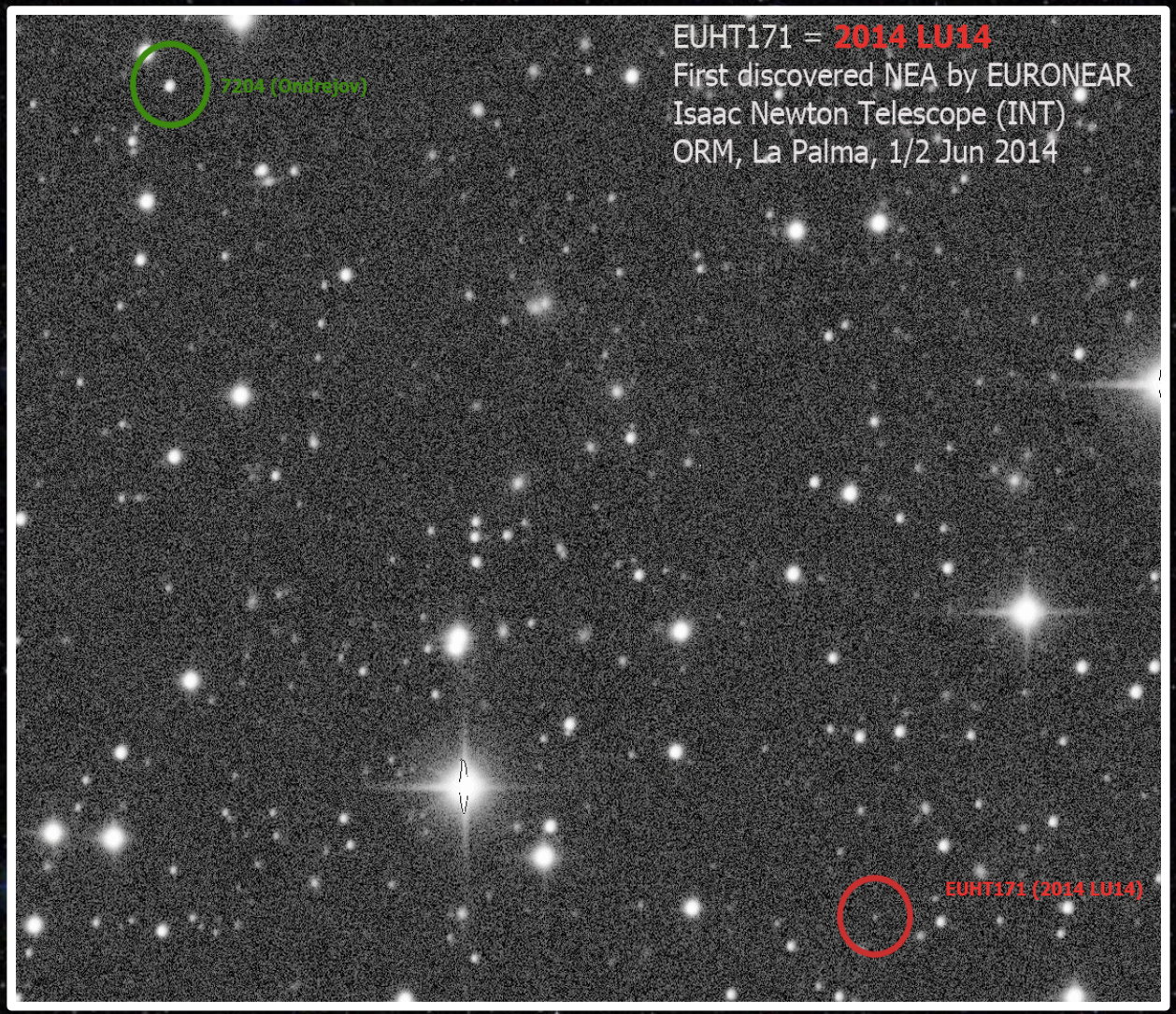
One-opposition NEA search along the NEODyS uncertainty ellipse 2012 SW20 using Astrometrica (with track and stack capability) and DS9 (to plot the region)

Samples of one-opposition NEA recoveries



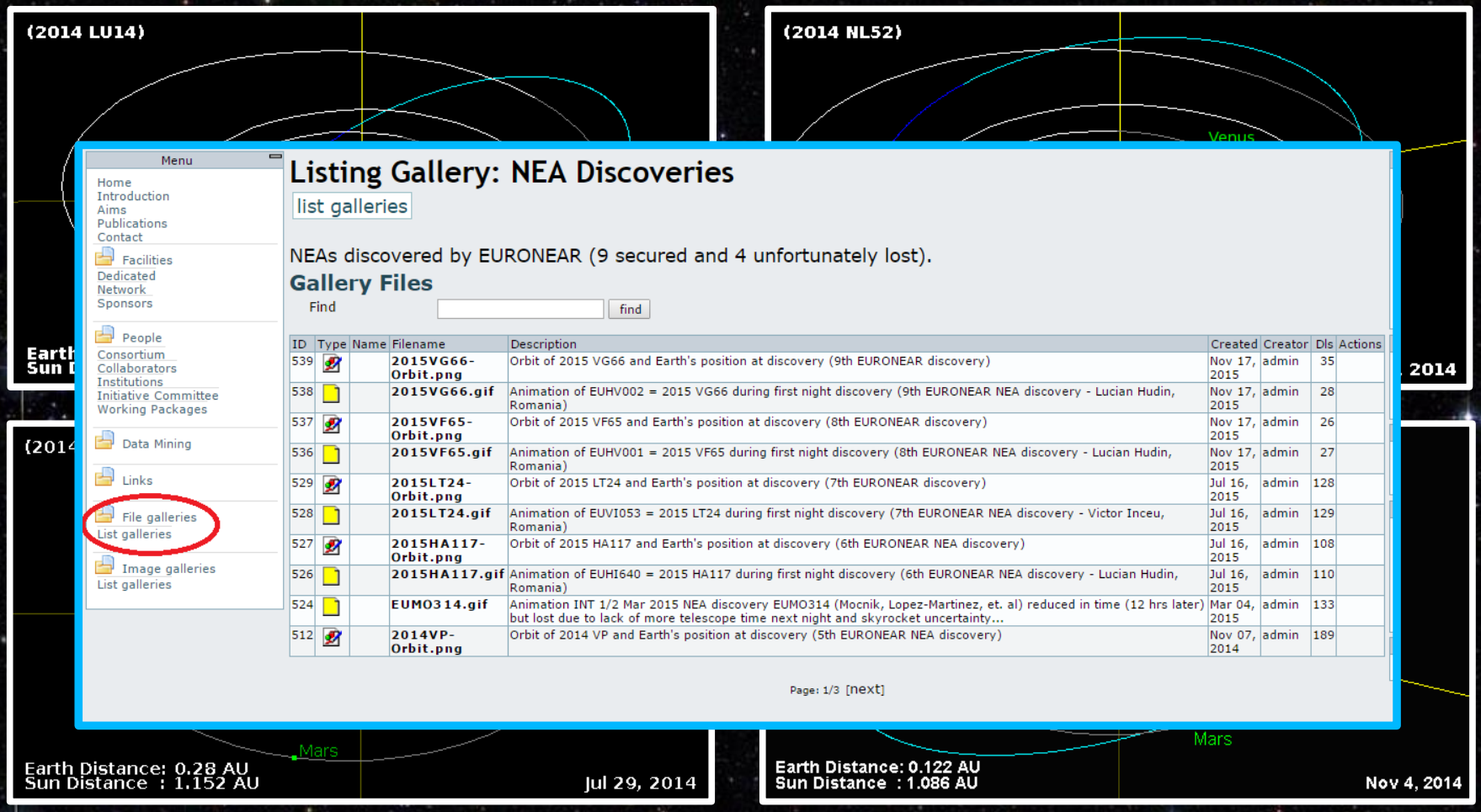
One-opposition NEA recovery along the NEODyS uncertainty ellipse of 2004 RW10 (12 year old!) using Astrometrica (with track and stack) and DS9

Samples of NEAs discovered by EURONEAR



First EURONEAR NEA discovery: 2014 LU14 (Lucian Hudin)

Samples of NEAs discovered by EURONEAR



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Listing Gallery: NEA Discoveries

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NEAs discovered by EURONEAR (9 secured and 4 unfortunately lost).

Gallery Files

Find find

ID	Type	Name	Filename	Description	Created	Creator	Dls	Actions
539			2015VG66-Orbit.png	Orbit of 2015 VG66 and Earth's position at discovery (9th EURONEAR discovery)	Nov 17, 2015	admin	35	
538			2015VG66.gif	Animation of EUHV002 = 2015 VG66 during first night discovery (9th EURONEAR NEA discovery - Lucian Hudin, Romania)	Nov 17, 2015	admin	28	
537			2015VF65-Orbit.png	Orbit of 2015 VF65 and Earth's position at discovery (8th EURONEAR discovery)	Nov 17, 2015	admin	26	
536			2015VF65.gif	Animation of EUHV001 = 2015 VF65 during first night discovery (8th EURONEAR NEA discovery - Lucian Hudin, Romania)	Nov 17, 2015	admin	27	
529			2015LT24-Orbit.png	Orbit of 2015 LT24 and Earth's position at discovery (7th EURONEAR discovery)	Jul 16, 2015	admin	128	
528			2015LT24.gif	Animation of EUVI053 = 2015 LT24 during first night discovery (7th EURONEAR NEA discovery - Victor Inceu, Romania)	Jul 16, 2015	admin	129	
527			2015HA117-Orbit.png	Orbit of 2015 HA117 and Earth's position at discovery (6th EURONEAR NEA discovery)	Jul 16, 2015	admin	108	
526			2015HA117.gif	Animation of EUHI640 = 2015 HA117 during first night discovery (6th EURONEAR NEA discovery - Lucian Hudin, Romania)	Jul 16, 2015	admin	110	
524			EUMO314.gif	Animation INT 1/2 Mar 2015 NEA discovery EUMO314 (Mocnik, Lopez-Martinez, et. al) reduced in time (12 hrs later) but lost due to lack of more telescope time next night and skyrocket uncertainty...	Mar 04, 2015	admin	133	
512			2014VP-Orbit.png	Orbit of 2014 VP and Earth's position at discovery (5th EURONEAR NEA discovery)	Nov 07, 2014	admin	189	

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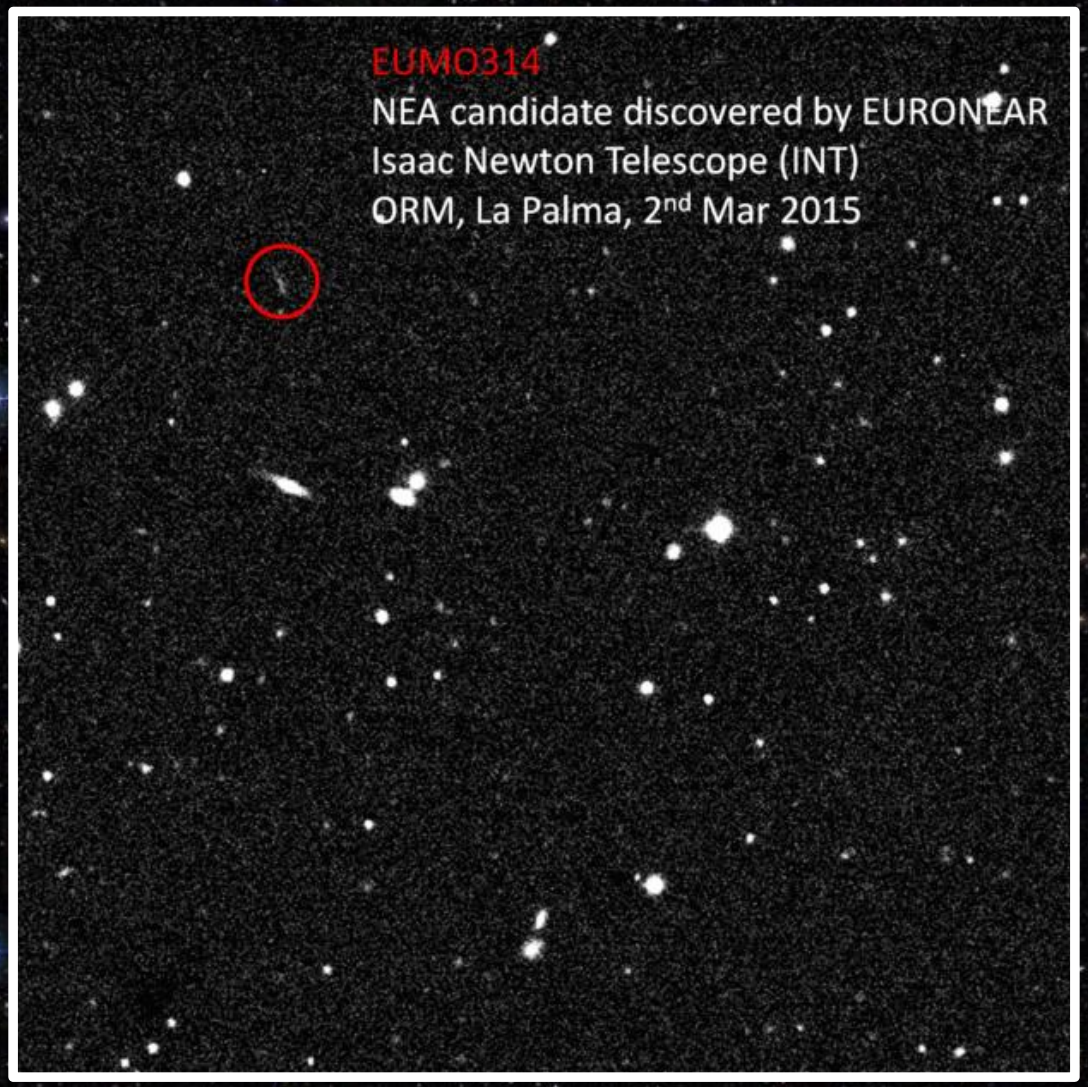
Orbits of the first EURONEAR NEAs discovered in 2014 (Vaduvescu et al, 2015)
(all 9 discoveries are accessible on the EURONEAR site from left-side menu)

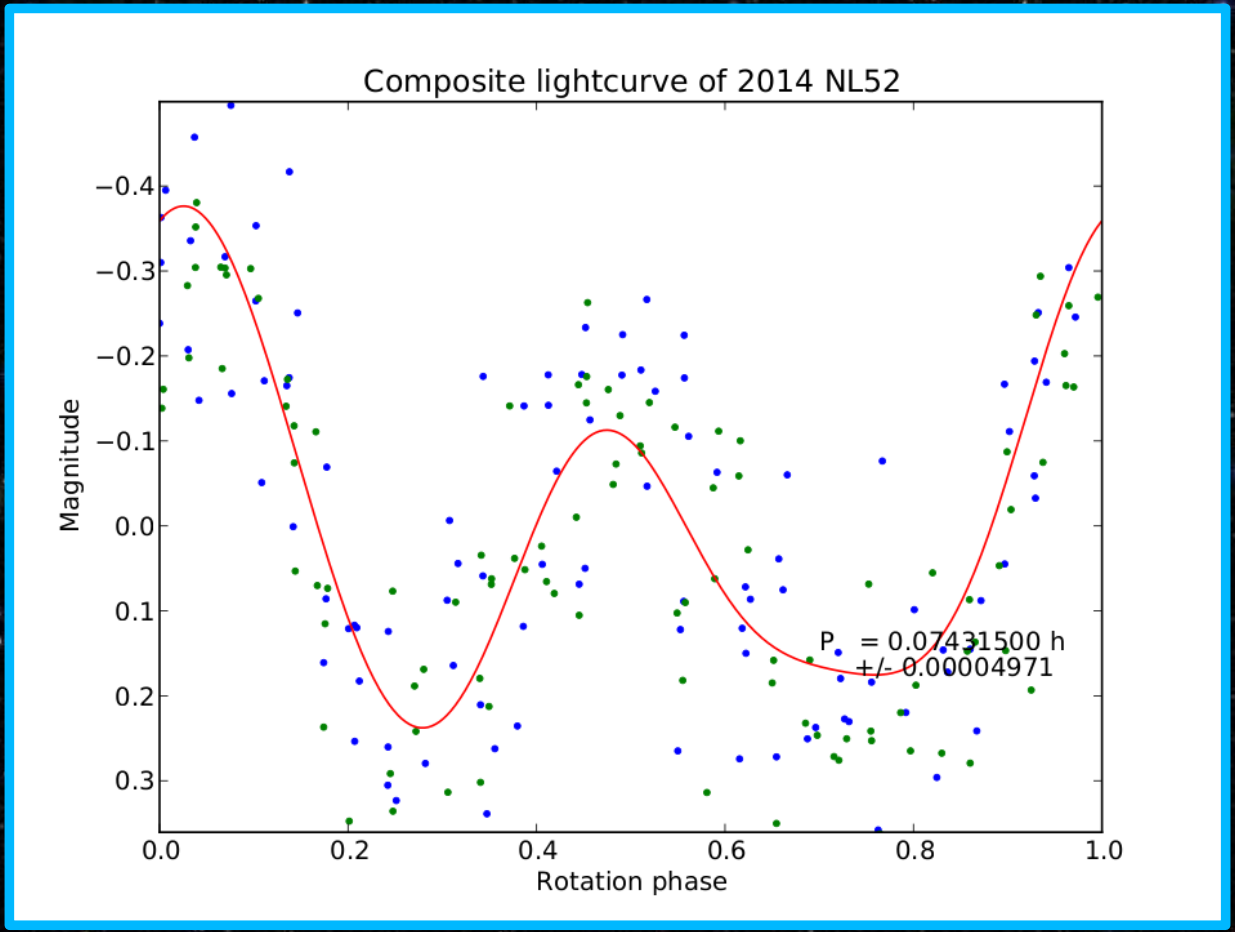
Samples of NEAs discovered by EURONEAR



EURONEAR NEA discovery by former ING and PhD student Teo Mocnik

This very fast NEA (15”/min) was lost due to lack of follow-up time on INT or other large field telescope ☹ while Europe does not have any such dedicated facility...

Samples of NEA light-curves observed by EURONEAR

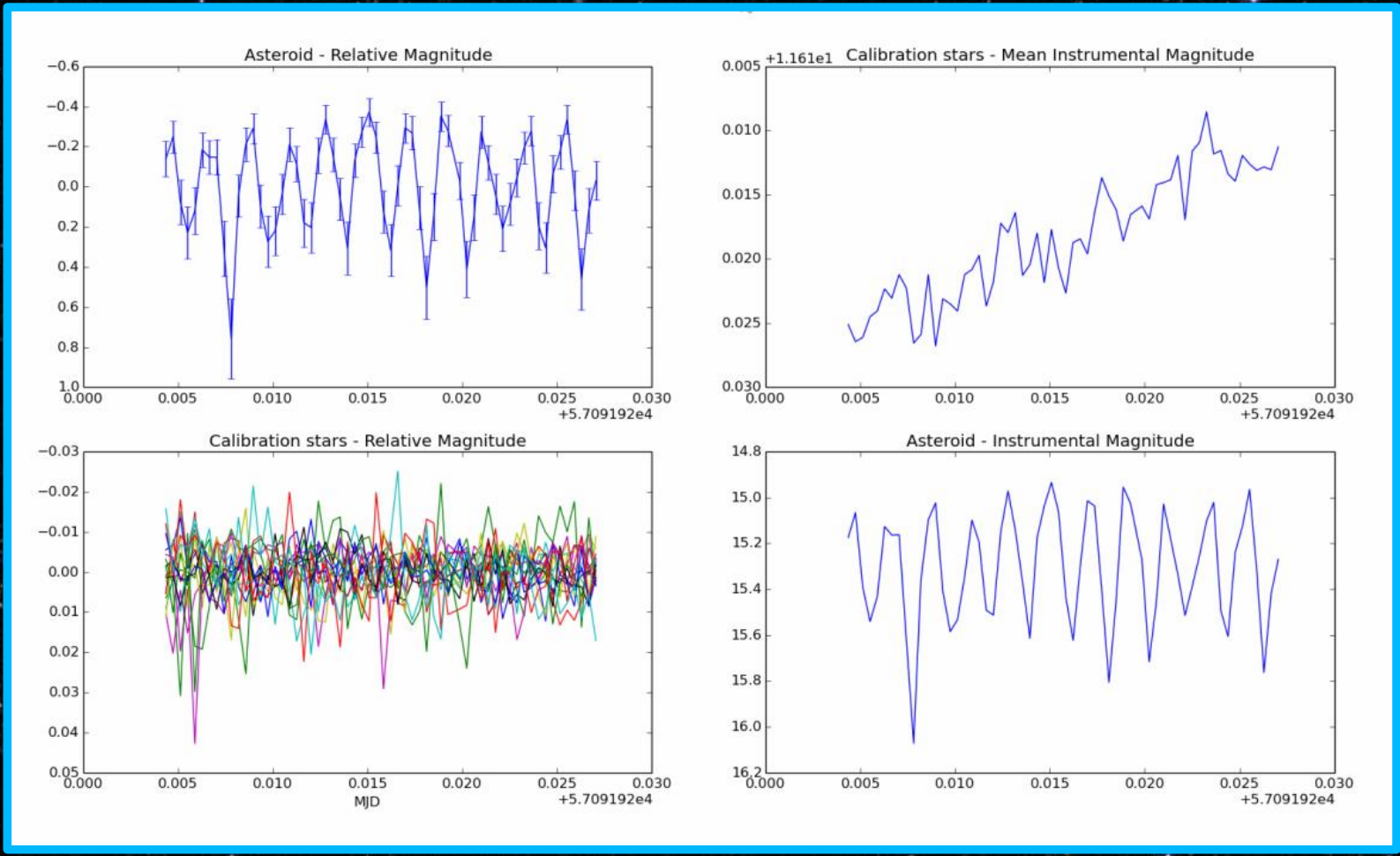


Very fast rotator P=4min 2014NL52 discovered by EURONEAR

(reducer Tomasz Kwiatkowski)

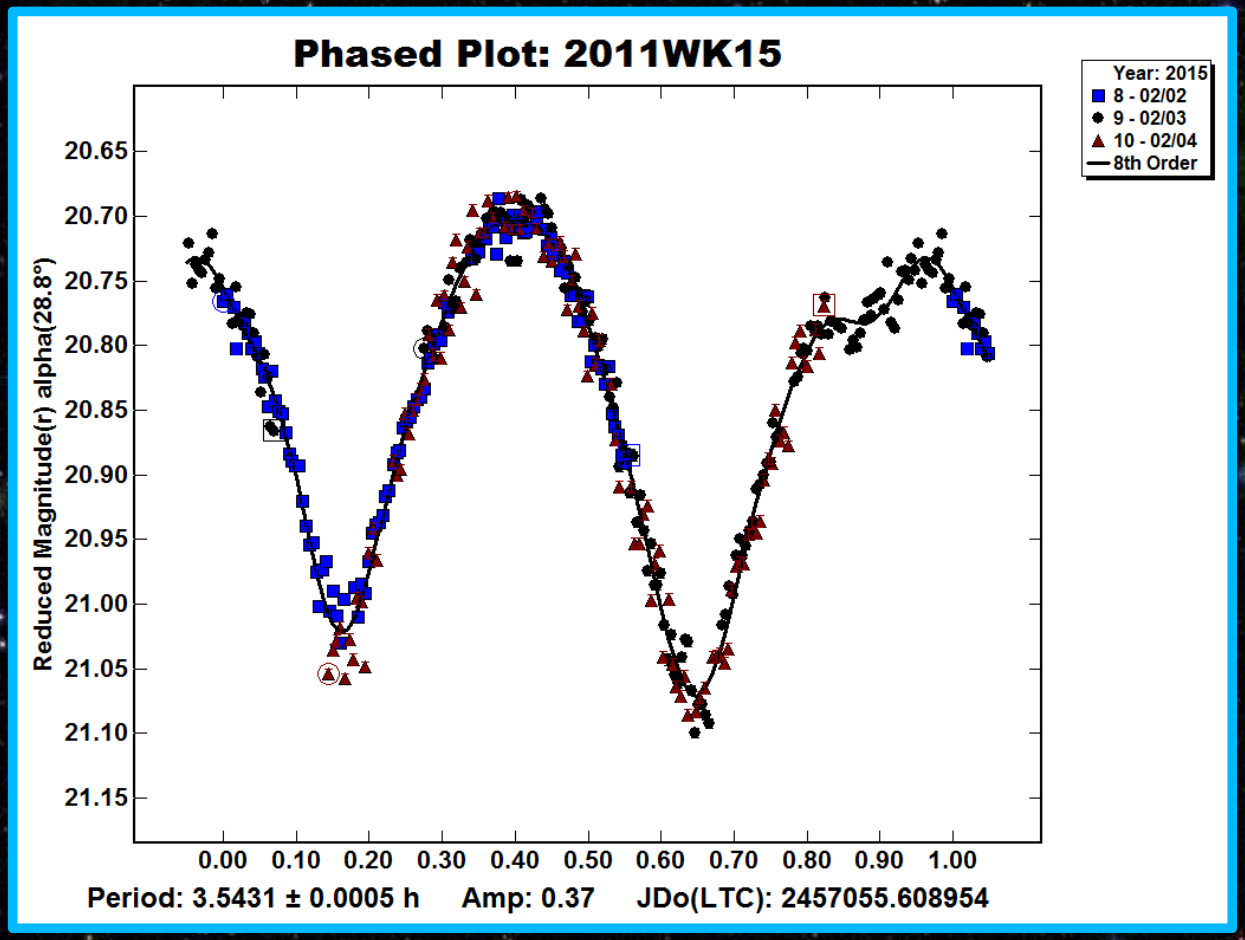
Samples of NEA light-curves observed by EURONEAR

LIDAS pipeline written in Python and IRAF by student Vlad Tudor



Very fast rotator P=6min 2014 EK24 (student observer and reducer Radu Cornea)

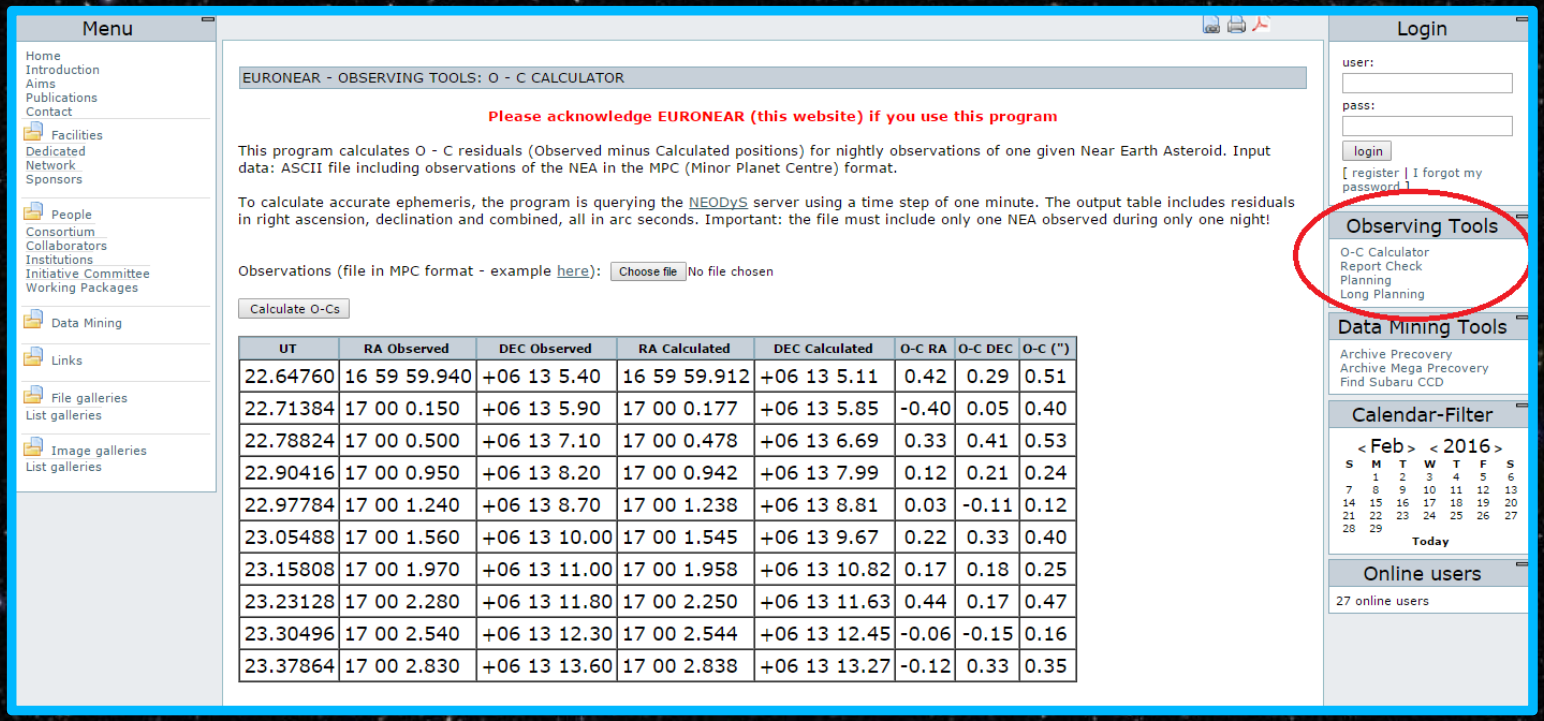
Samples of NEA light-curves observed by EURONEAR



NEA 2011 WK15 period reduced with MPO Canopus
(Radu Cornea and new students Marian Predatu and Amadeo Aznar)

EURONEAR – Online Observing Tools

O-C CALCULATOR

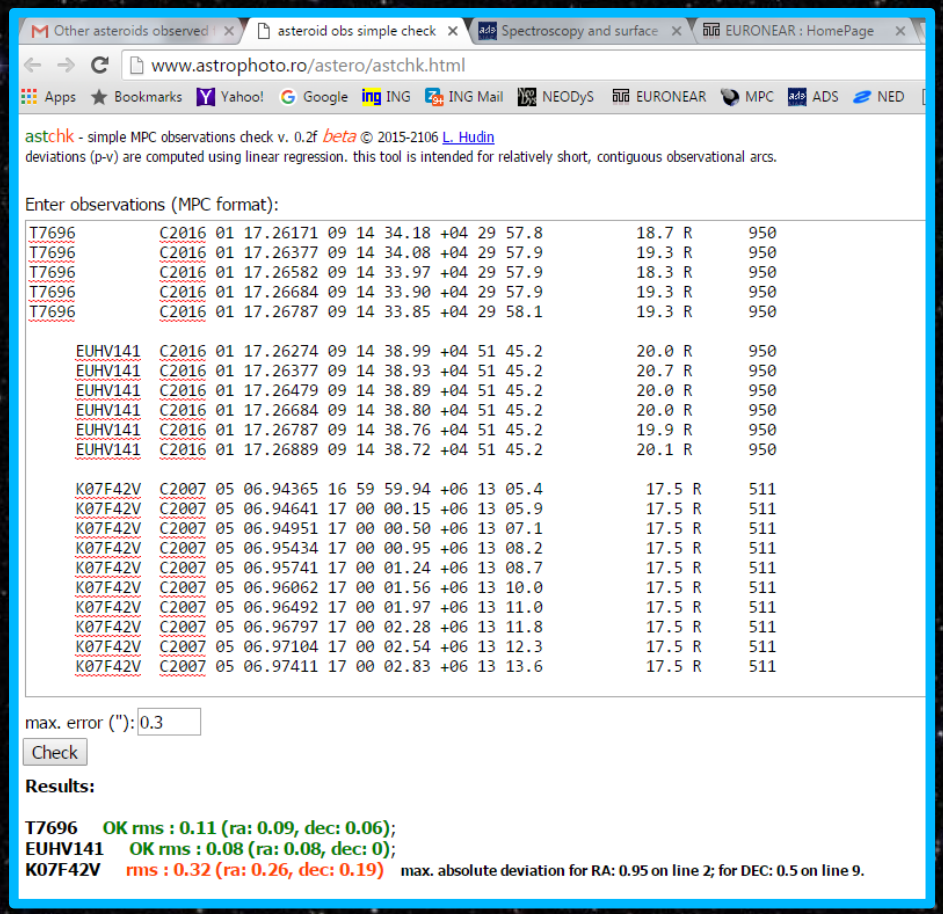


O-C Quality Control tool for checking the astrometry residuals
(O. Vaduvescu, 2007, to be improved soon)

(all tools are accessible on the EURONEAR site from right-side menus)

EURONEAR – Online Observing Tools

ASTCHK QC



ASTeroid CHecKer quality control tool for checking astrometric consistency

(amateur Lucian Hudin, 2014)

EURONEAR – Online Observing Tools

PLANNING astrometry runs

2016-01-31 20:00 Moon altitude: below the horizon

Asteroid Name	Priority	Altitude (deg)	Magnitude (V)	Proper Motion ("/min)	Sky Plane Error (")	Number of Stars / Field	Moon distance (deg)	OBSERVABILITY
2015KF19	NEA	61	23	3.43	15.43	122	172	1.06%
2005EQ70	NEA	78	22	0.15	853.62	255	148	0.86%
2015AW16	NEA	48	22.8	3.5	32.52	196	158	0.84%
2015BQ	NEA	85	23.1	3.02	525.18	233	160	0.73%
2014PA59	NEA	42	23	2.22	0.39	378	140	0.43%
2005YT55	NEA	76	22.9	0.81	814.74	264	168	0.4%
2011EK	NEA	53	22.9	3.17	654.42	233	165	0.33%
2015AY245	PHA	44	23.4	2.08	0.79	153	157	0.21%
2014VK2	NEA	32	23.1	0.79	27.61	436	99	0.06%

2016-01-31 21:00 Moon altitude: below the horizon

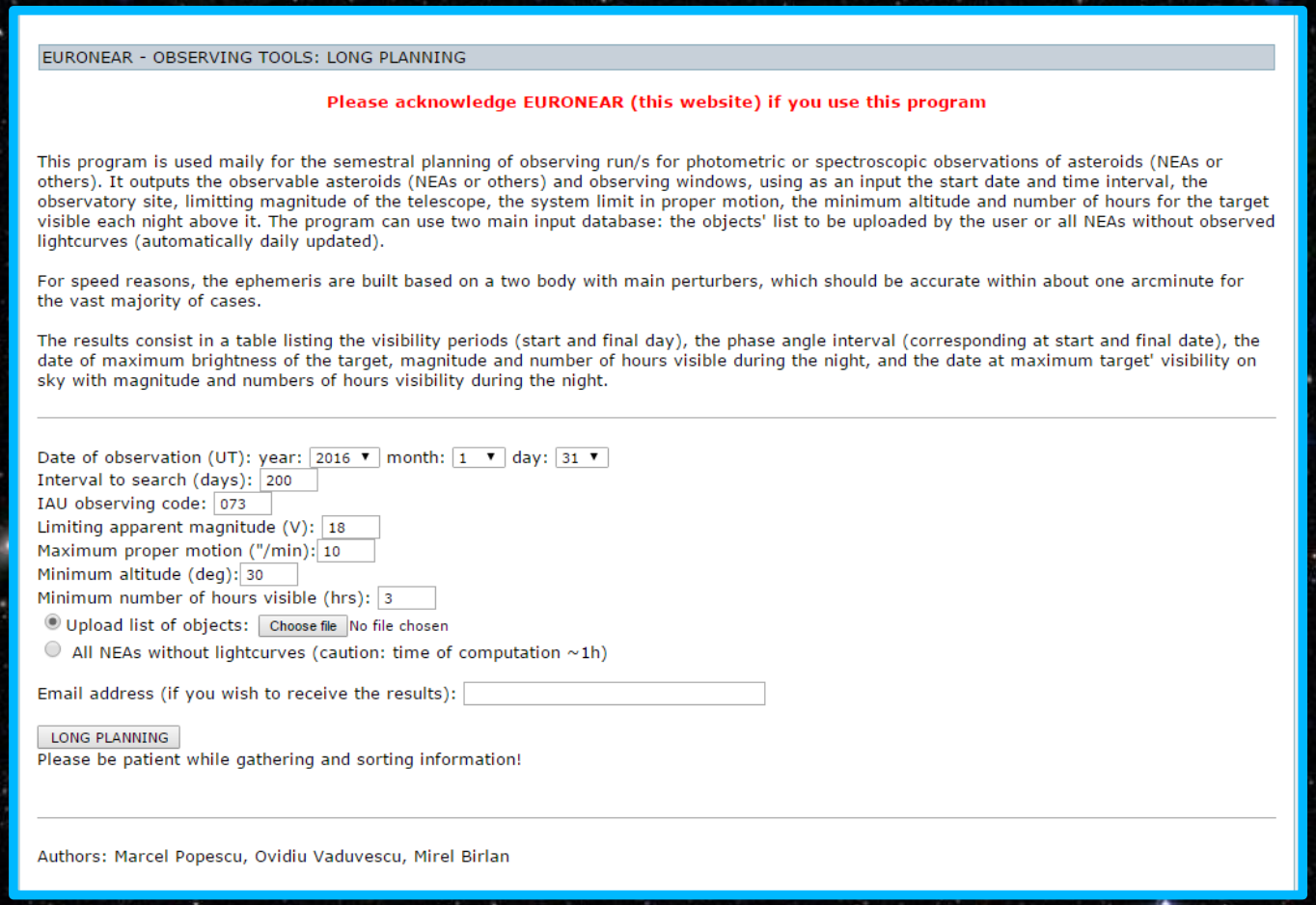
Asteroid Name	Priority	Altitude (deg)	Magnitude (V)	Proper Motion ("/min)	Sky Plane Error (")	Number of Stars / Field	Moon distance (deg)	OBSERVABILITY
2005EQ70	NEA	88	22	0.15	853.38	258	149	1.04%
2015KF19	NEA	49	23	3.43	15.42	121	172	0.65%
2015BQ	NEA	75	23.1	3.03	525.36	232	161	0.6%
2015AW16	NEA	42	22.8	3.5	32.52	197	158	0.56%
2010CB55	NEA	34	21.9	3.37	9.14	239	110	0.44%
2014VK2	NEA	43	23.1	0.79	27.6	453	99	0.39%
2005YT55	NEA	68	22.9	0.81	814.56	301	168	0.33%
2011EK	NEA	45	22.9	3.18	654.18	227	165	0.22%
2005QN11	NEA	33	23.1	0.77	116.1	168	94	0.08%

Starting date: Year: 2016 Month: 01 Day: 31 Hour (UT): 08

PLANNING server for your follow-up/recovery astrometric observations using Spaceguard list (new objects) or MPC recovery opportunities (one-opposition objects)
(amateur Iulia Comsa, M. Popescu, O. Vaduvescu, 2008)

EURONEAR – Online Observing Tools

LONG-PLANNING photometry or spectroscopy runs



EURONEAR - OBSERVING TOOLS: LONG PLANNING

Please acknowledge EURONEAR (this website) if you use this program

This program is used maily for the semestral planning of observing run/s for photometric or spectroscopic observations of asteroids (NEAs or others). It outputs the observable asteroids (NEAs or others) and observing windows, using as an input the start date and time interval, the observatory site, limitting magnitude of the telescope, the system limit in proper motion, the minimum altitude and number of hours for the target visible each night above it. The program can use two main input database: the objects' list to be uploaded by the user or all NEAs without observed lightcurves (automatically daily updated).

For speed reasons, the ephemeris are built based on a two body with main perturbers, which should be accurate within about one arcminute for the vast majority of cases.

The results consist in a table listing the visibility periods (start and final day), the phase angle interval (corresponding at start and final date), the date of maximum brightness of the target, magnitude and number of hours visible during the night, and the date at maximum target' visibility on sky with magnitude and numbers of hours visibility during the night.

Date of observation (UT): year: 2016 ▾ month: 1 ▾ day: 31 ▾
Interval to search (days): 200
IAU observing code: 073
Limiting apparent magnitude (V): 18
Maximum proper motion ("/min): 10
Minimum altitude (deg): 30
Minimum number of hours visible (hrs): 3
◉ Upload list of objects: Choose file No file chosen
○ All NEAs without lightcurves (caution: time of computation ~1h)

Email address (if you wish to receive the results):

LONG PLANNING
Please be patient while gathering and sorting information!

Authors: Marcel Popescu, Ovidiu Vaduvescu, Mirel Birlan

LONG-PLANNING for few nights NEA photometry or spectroscopy runs

(M. Popescu, et al., 2014, to be upgraded soon)

EURONEAR – Online Observing Tools

PRECOVERY NEAs

1. **Observing logs from CFHTLS** (Canada-France-Hawaii Legacy Survey):

Observing log (file in CFHLS format - example here): Choose file No file chosen

Precover asteroids

Please be patient, the whole run could take a few minutes...

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2. **Observing logs in a standard format** including the following fields: image id, Julian Date (obs start), exp time (sec), RA image center (hrs with decimals), DEC image center (degrees with decimals), image field in RA (deg), image field in DEC (deg), comment - all fields separated by the pipeline "|" character:

Observing log (file in standard format - example here): Choose file No file chosen

Observatory (3-digit MPC code):

Precover asteroids

Please be patient, the whole run could take a few minutes...

---

3. **Observing logs from INT WFC** (Isaac Newton Telescope, ING) in a standard format (same as above):

Observing log (file in standard format - example here): Choose file No file chosen

Email address (if you wish to receive mail at the end):

Precover asteroids

Please be patient, the whole run could take a few minutes...

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4. **Observing logs from ESO/MPG WFI** (ESO/MPG) in a standard format (same as above):

Observing log (file in standard format - example here): Choose file No file chosen

Email address (if you wish to receive mail at the end):

Recover/precover all known NEAs in one given archive of images (CFHTLS, ESO/MPG, INT/WFC, SUBARU/SuprimeCam, other free format)

(O. Vaduvescu, et al., 2008)

EURONEAR – Online Observing Tools

MEGA-PRECOVERY NEAs

MEGAPRECOVERY

Objects:

Up to five objects (asteroids or comets) seprated by comma. SsODNet is used to check designations.
The designations for the asteroids must respect one of the following formats: 1, Vesta, 1996 FG3
The designations for the comets must respect one of the following formats: c:19P,c:P/2004 T1,c:C/2005 A1-B,c:73P-B

Email address (if you wish to receive mail at the end):

Select an archive for data mining:

☑ ALL (66 instrument archives including about 7660738pointings)

or several archives:

Instrument	AΩA	FOV(sq.')	Images	Start Date	End Date
AAT-WFI	14830.8	1089	4453	2000-8-21	2006-2-5
ING/INT2.5m-WFC	563652.7	1169.64	393390	1998-6-20	2013-2-28
SDSSIII	131305.8	140.76	938046	1998-9-19	2009-11-18
CADC/CFHT3.6m-Megacam	1154045.9	3600	143896	2003-2-22	2013-5-9
CADC/CFHT3.6m-MOCAM	331.8	225	662	1995-5-28	1995-11-29
CADC/DAO-E2VCCD	2539.4	253.6056	14477	2008-2-11	2015-11-16
CADC/GeminiN-MOS	17512.8	60.84	20423	2001-10-21	2011-10-3
CADC/GeminiS-MOS	21381.9	60.84	24935	2003-2-27	2011-10-11
CADC/HST-ACS	1224.9	11.6964	84722	2002-4-2	2015-10-11
CADC/HST-NICMOS	1.5	0.81	1529	1997-7-23	2007-8-22
CADC/HST-WFC3/NIR	353.5	9.3636	30543	2009-7-5	2012-11-15
CADC/HST-WFC3/Vis	376	14.7456	20626	2009-7-13	2012-11-15
CADC/HST-WFPC/OPT	41.1	9	3691	1989-11-30	1993-12-3
CADC/HST-WFPC2/NIR	24.1	14.2884	1366	1994-3-5	2008-4-6
CADC/HST-WFPC2/OPT	2862.5	14.2884	162072	1993-12-20	2009-5-12
CADC/Mt.Stromlo-MACHO	114404.5	1794.3696	197868	1992-7-21	2002-11-19
CADC/CFHT-Wide-fieldIR	195843.1	466.56	179897	2006-1-14	2013-5-1
ESO/VLT-EFOSC2	20998.8	16.6464	87131	2004-7-3	2015-11-22
ESO/NTT-EMMI	3833.8	83.1744	17541	2004-3-17	2008-4-1
ESO/VLT-FORS1	23860.2	45.9684	35852	1999-1-23	2009-3-26

Mega-Precovery searching the Mega-Archive (now 7 million images and growing daily) for one or a few known or new NEAs or other Solar System objects

(Marcel Popescu, Lucian Curelaru, et al., 2014, upgrading right now)

EURONEAR – Online Observing Tools

FINDSUBARUCCD

Find Suprime Cam (SUBARU) CCD

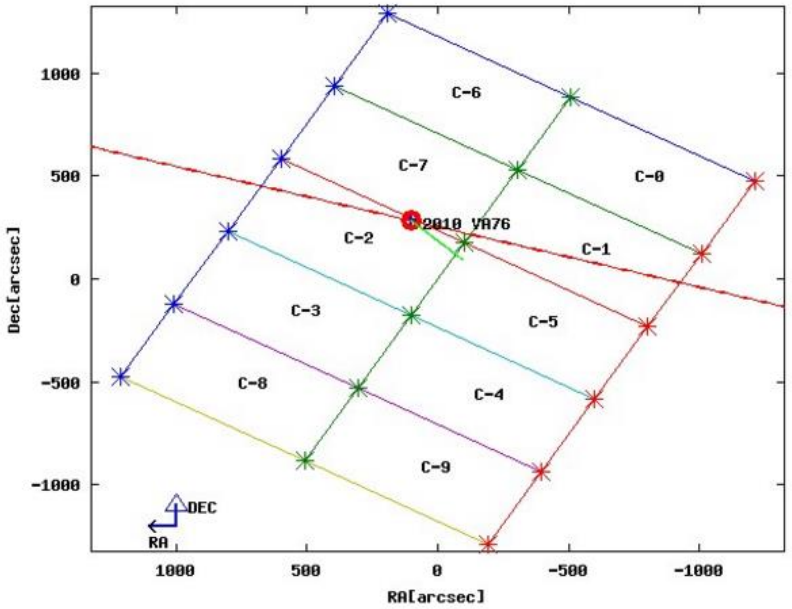
Image ID: (Ex: SUPA0057368)

Position Angle °: ° (Ex: 120)

Get Geometry

Please be patient, the run could take ~20 seconds...

The geometry for the image SUPA0057368 considering P.A = 120° is:



Graphic tool to search the SuprimeCam mosaic camera for known NEAs along uncertainty

(M. Popescu, et al., 2014, to be extended soon to other major cameras)

Conclusions and future work

> The EURONEAR results and publications were achieved with extremely small funding from a few institutions, involving many volunteer students and amateurs (most Romanians), regular observing time applications and data mining of few public imaging archives;

> Publications and counting:
- 11 published papers;
- 150+ MPC/MPEC circulars;
- 15 international conferences;
- other 6 published papers related (EURONEAR collaborators);
- 1300+ NEAs plus 10000+ MBAs observed (astrometry);
- 500+ NEAs data mined (astrometry);
- 100+ NEA light-curves observed since 2014;
- 60+ NEA spectra observed since 2014;
- 5 papers in work plus 2 new projects;
- involving 10+ PhD projects (Birlan, Kwiatkovski, Vaduvescu, etc).

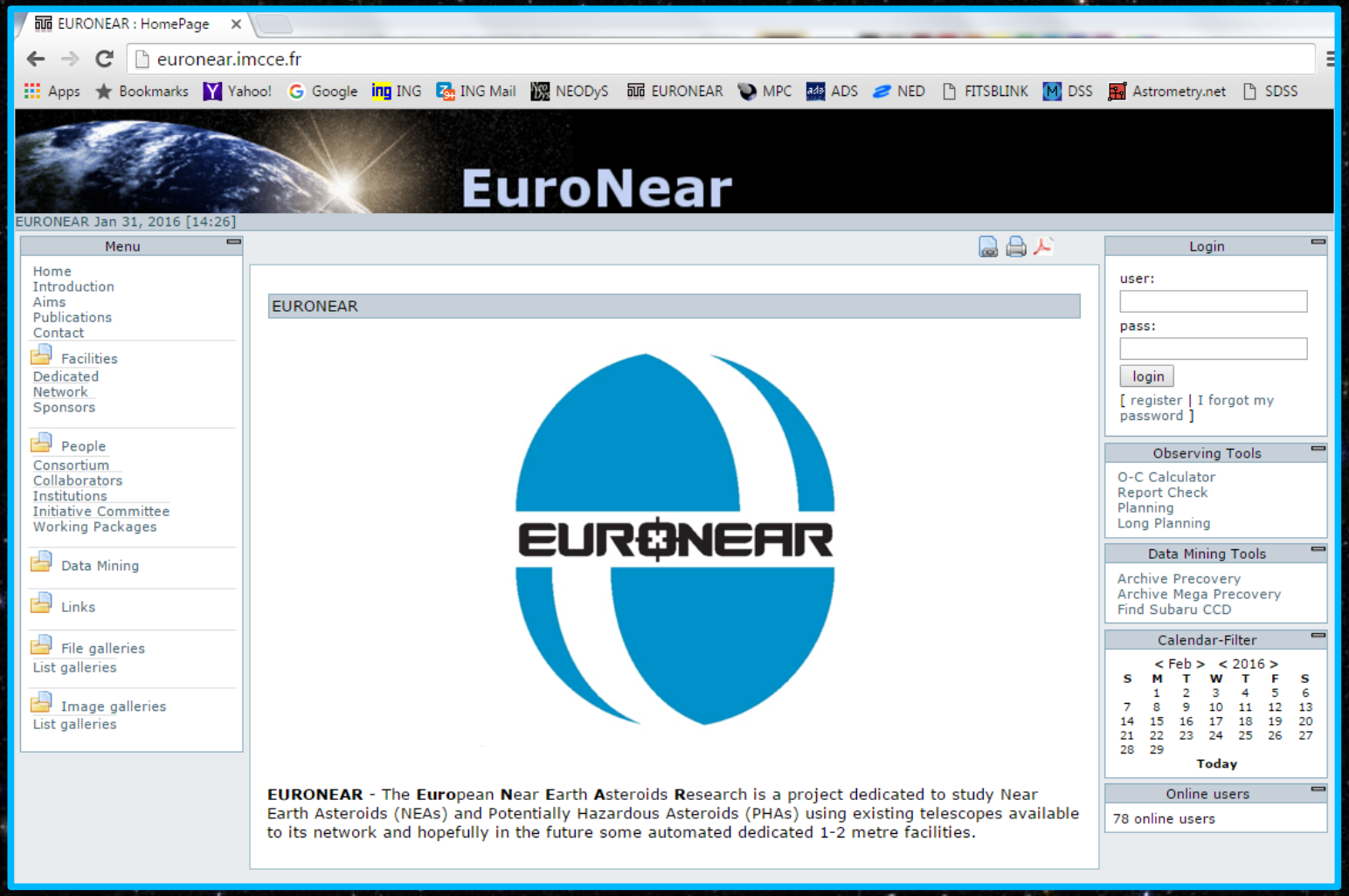
Conclusions and future work

> We need to increase the human resources:
- New remote volunteers to join our projects (data reduction, data mining, software development, etc);
- New MSc/PhD theses co-supervised in EURONEAR projects supported by universities, H2020 schemes, industry, sponsorship;
- Increase the mobility in the EU + Chile (ex. to send COST proposal);

> We need to improve the infrastructure:
- There are available 1-2m telescopes suitable for photometry;
- Larger 2-4m telescopes are required for spectroscopy;
- Existing larger field 2m telescopes are very good for NEO recovery, follow-up and survey work; but 1m in my opinion are small today;
- At least one (preferably two in the North and South), larger field (>0.5 deg), and preferably 2m-class (new or refurbished) are needed in Europe for 100% dedicated NEA research!

> EURONEAR remains interested in collaboration with ESA.

References



http://euronear.imcce.fr


Thank you!