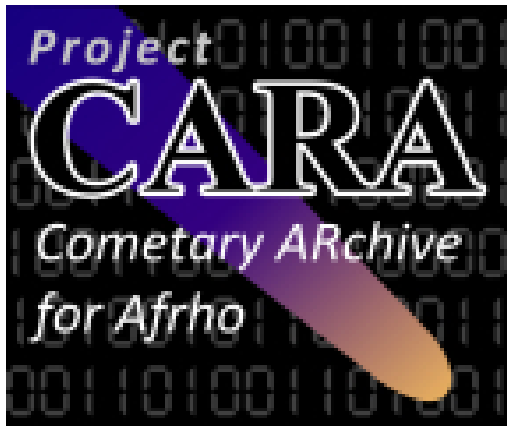


Corso Comete

7 e 8 settembre Parco astronomico “Livio
Gratton” di Rocca di Papa

ASTRO – metria



Relatore Paolo Bacci – Responsabile Sezione Asteroidi UAI

E pur si muove



Memorizzate questa immagine !!

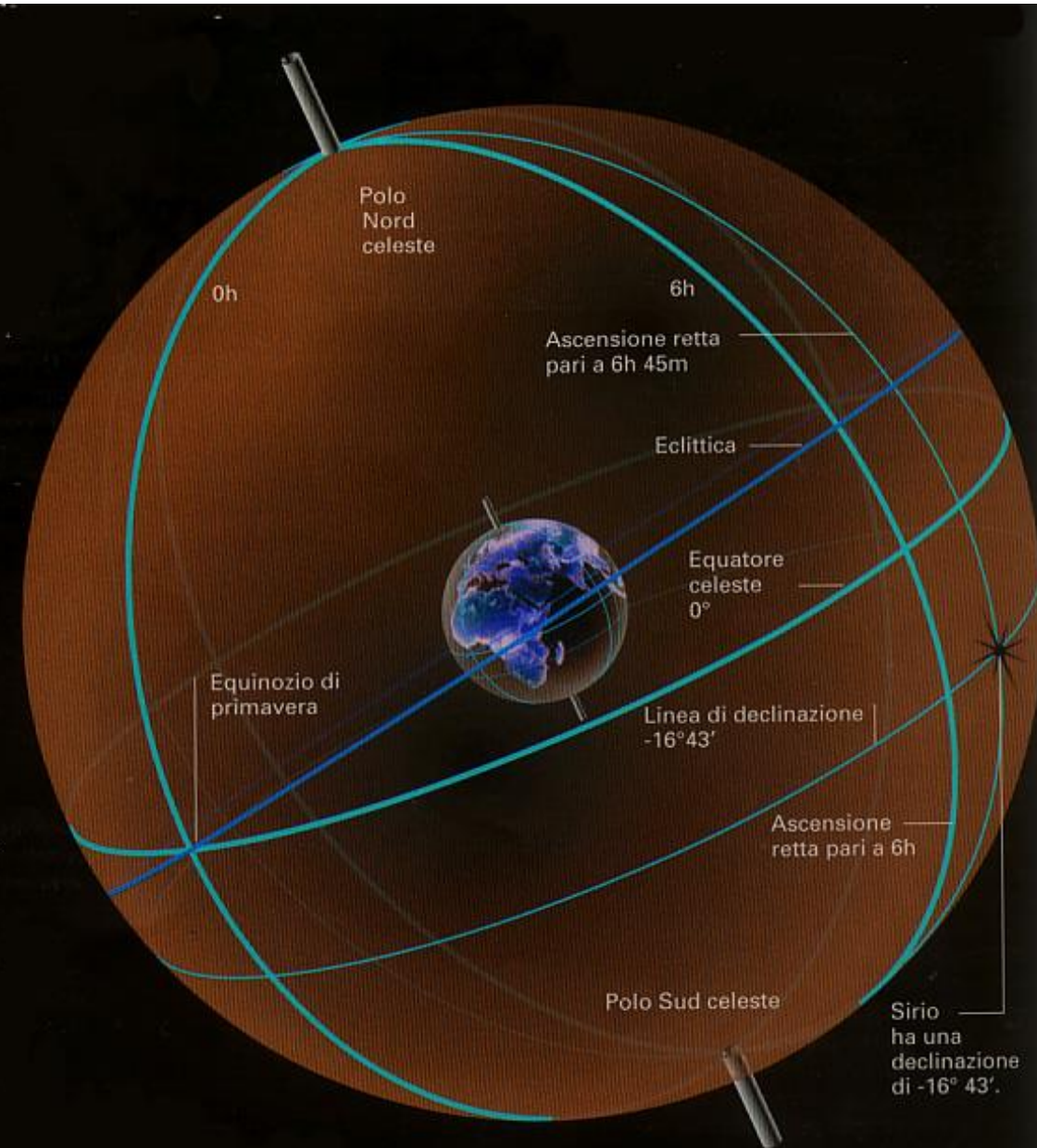
Uscimmo a riverder le stelle

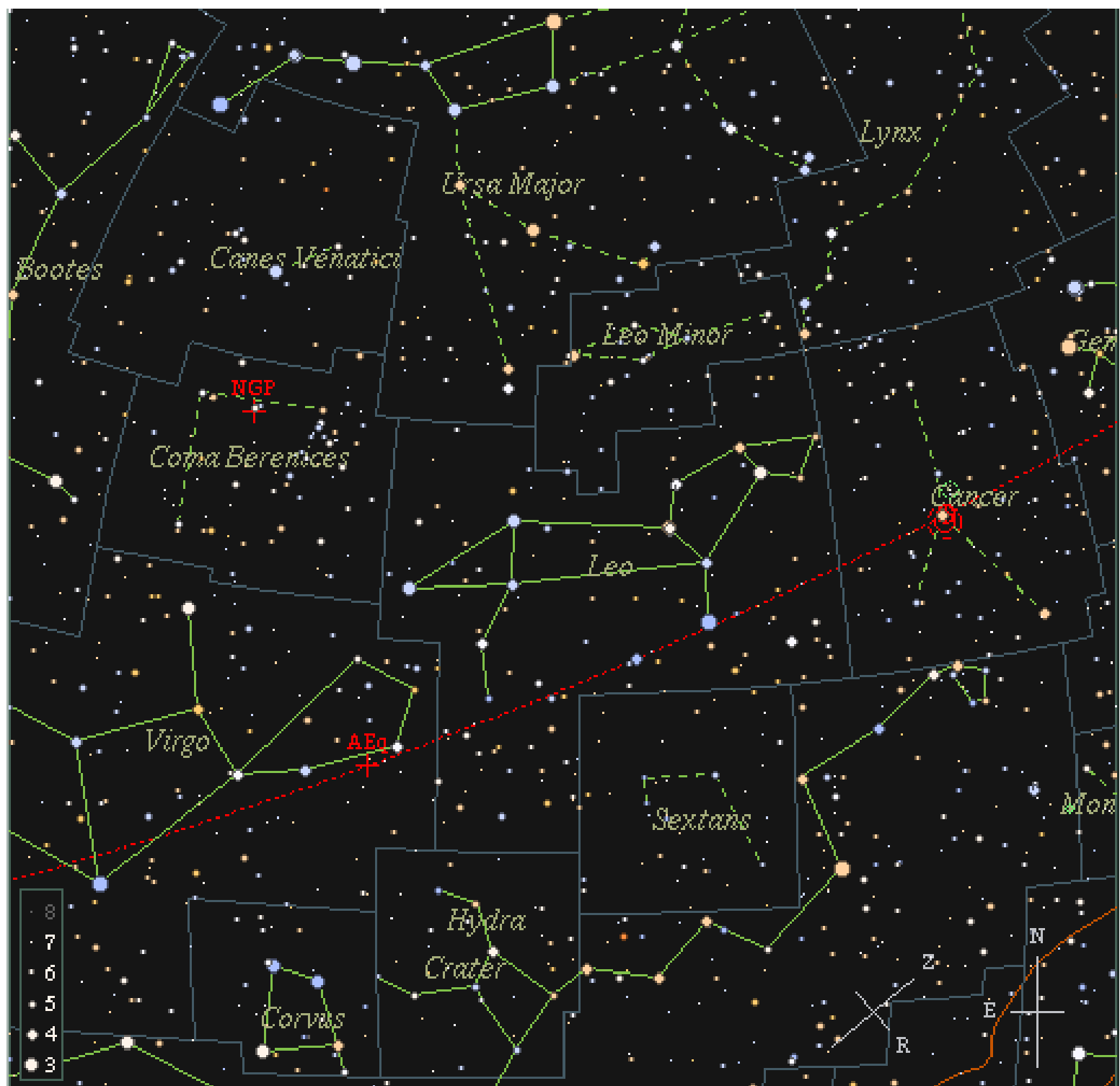


*Colui che ha visto il leone ruggire non corre allo stesso
modo di chi lo ha soltanto sentito.
(Proverbio africano)*



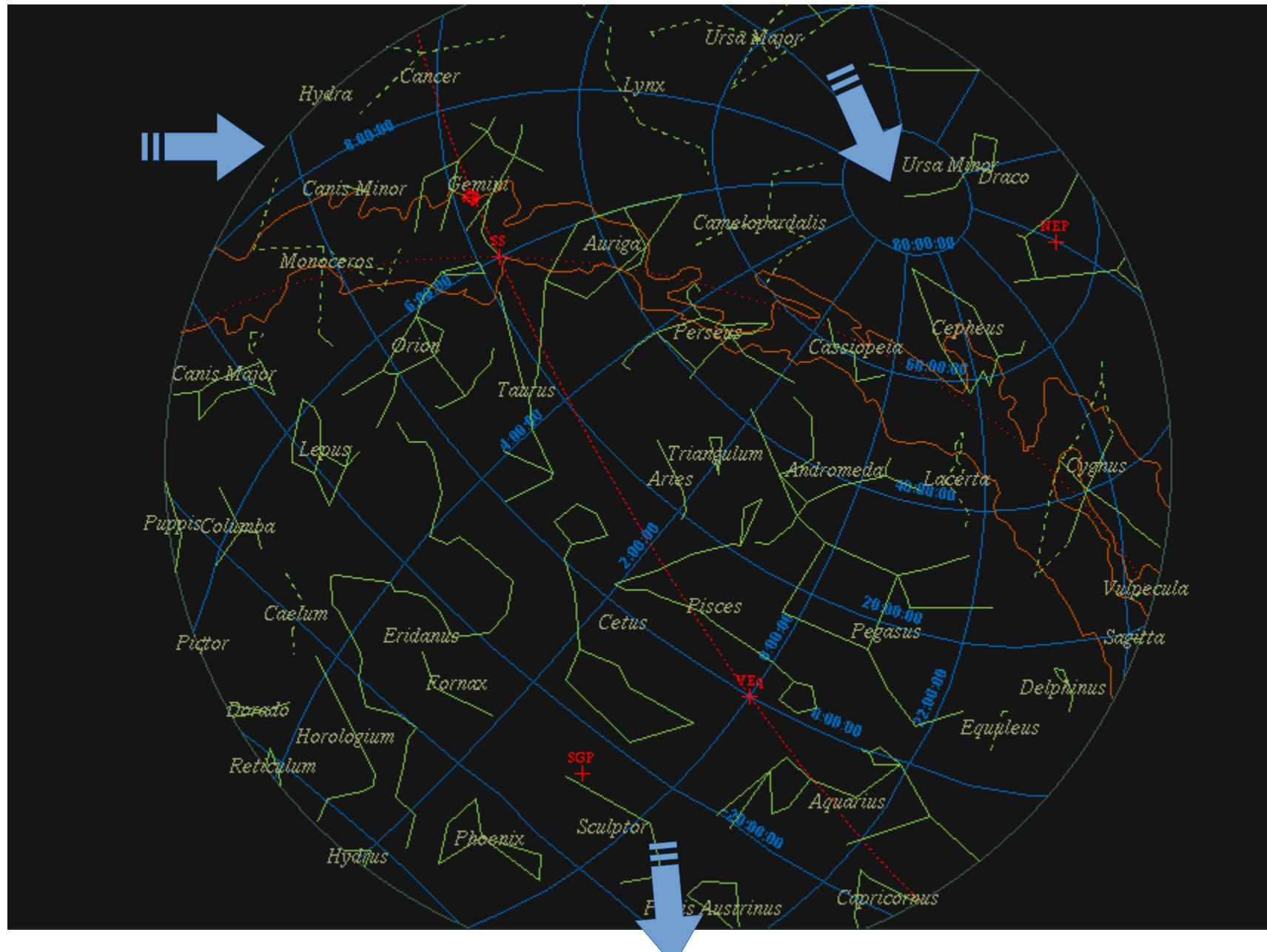
La sfera celeste



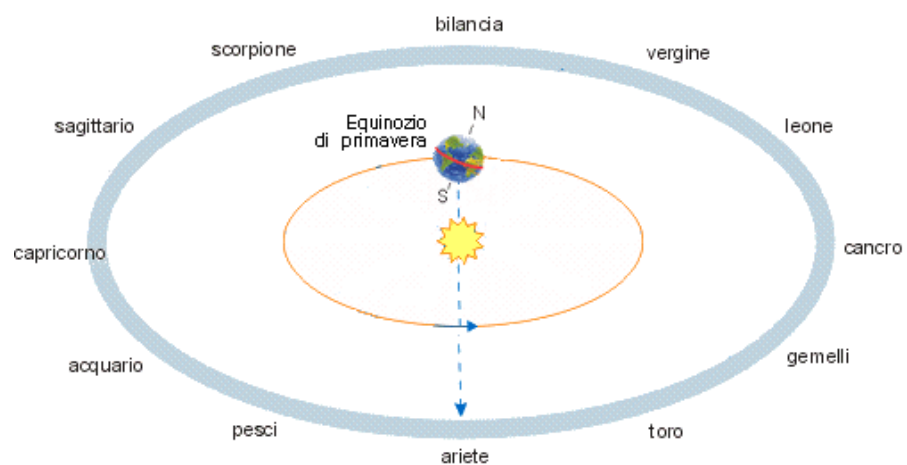


A.R. Ascensione Retta

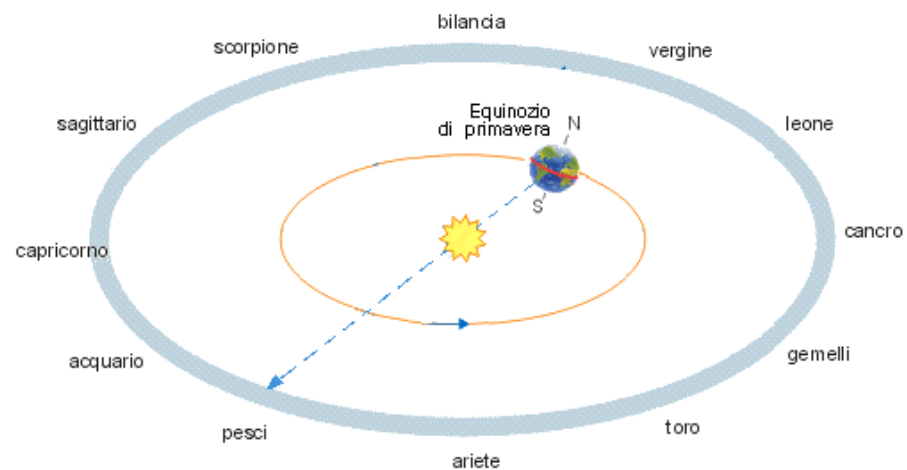
Dec Declinazione



Il punto Vernale, punto dell'Ariete o punto gamma



2100 ANNI FA



OGGI

Cataloghi stellari

- **Prodromus Astronomiae** - 1553 stelle elencate e pubblicate nel 1690 da J. **Hevelius**.
- **Historia Coelestis Britannica** - 3310 stelle catalogate da J. **Flamsteed**, e successivamente numerate progressivamente per costellazione dall'astronomo J. **Lalande**, nel 18° secolo, che avrebbe così introdotto il sistema di nomenclatura stellare basato sui numeri.
- **Bonner Durchmusterung** - pubblicato nel 19° secolo da F. **Argelander**, riporta oltre 450000 stelle, comprese fra il polo Nord celeste ed i -23° di declinazione, che vengono indicate con la sigla BD, seguita dal grado di declinazione corrispondente e dal nr. d'ordine (BD $+40^\circ 1000$).
- **Henry Draper Catalogue** - compilato dall'osservatorio di Harvard ai primi del '900, riporta oltre 225000 stelle classificate secondo il tipo spettrale di appartenenza (HD più nr. d'ordine);
- **General Catalogue** - redatto nel 1936 da L. **Boss**, riporta 33000 stelle fino alla settima magnitudine (GC più nr d'ordine);
- **Catalogue of Bright Stars** - pubblicato nel 1964 dallo Yale Observatory, elenca tutte le stelle più brillanti fino alla sesta magnitudine.
- **SAO Catalogue** - pubblicato nel 1966 dallo Smithsonian Astrophysical Observatory, contiene 259000 stelle fino alla nona magnitudine (SAO più nr. d'ordine).
- **Hipparcos** - stilato sulla base dei risultati ottenuti dalla missione dell'omonimo satellite dell'ESA, contiene dati di posizione di 120000 stelle e di 40000 fra variabili e doppie.
- **Tycho** - dati derivanti dalla missione Hipparcos dell'ESA sulla posizione, magnitudine ed indice di colore di oltre 1000000 di stelle.

I principali cataloghi stellari

.Tycho

.PPMXL

.USNO

.NOMAD

.CMC15

.URAT

.UCAC

.GAIA → indubbiamente il più consigliato

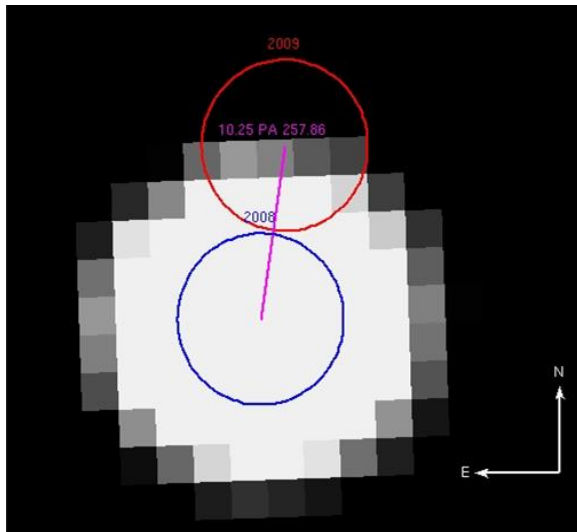
La stella di Barnard



Sono trascorsi 370 giorni tra le due riprese.

Utilizzando un software per il calcolo del centroide stellare, ho misurato in modo approssimativo la distanza percorsa dalla stella in secondi d'arco, che risulta approssimativamente di **10.253**, **PA 285.8** ovvero circa 0.027" al giorno, 10.11"+/-0.15" in un anno, conforme a quanto conosciuto.

Dista da noi a soli **5,9 anni luce**. Il suo elevato moto proprio fu scoperto nel 1916 dall'astronomo **Edward Emerson Barnard**, (1857-1923) attento osservatore e scopritore di ben 16 comete, e di altre importanti oggetti sulla volta celeste.



18.54 UA --2.773.795.738 km – 304.441 Km/h

Ogni 50 anni

- A causa dei movimenti di precessione della Terra ogni **50 anni** viene aggiornato il sistema di riferimento delle coordinate astronomiche A.R e Dec.
- Oggi utilizziamo **J2000** ovvero la posizione delle stelle sulla volta celeste alla data del 1 gennaio 2000.

Ricordiamoci J2000

Strumenti per astrofili



B09 Capannoli – 0.25-m F/6.3
B33 Libbiano – 0.50-m F/8
104 San Marcello – 0.60-m F/4

Osservare i corpi minori

(che sono gli oggetti più belli nel cielo)



- In generale l'astrofilo per questo tipo di attività deve avere:

- Postazione fissa

- Adeguata strumentazione

- (Tel. 0.20-m, ccd → risoluzione pixel $\sim 2''/\text{arc}$
Filtri fotometrici)

- Software per la riduzione dati (astrometria e fotometria)

- Codice del MPC

- (*Orologio di sistema perfettamente sincronizzato*)

Scala Immagine

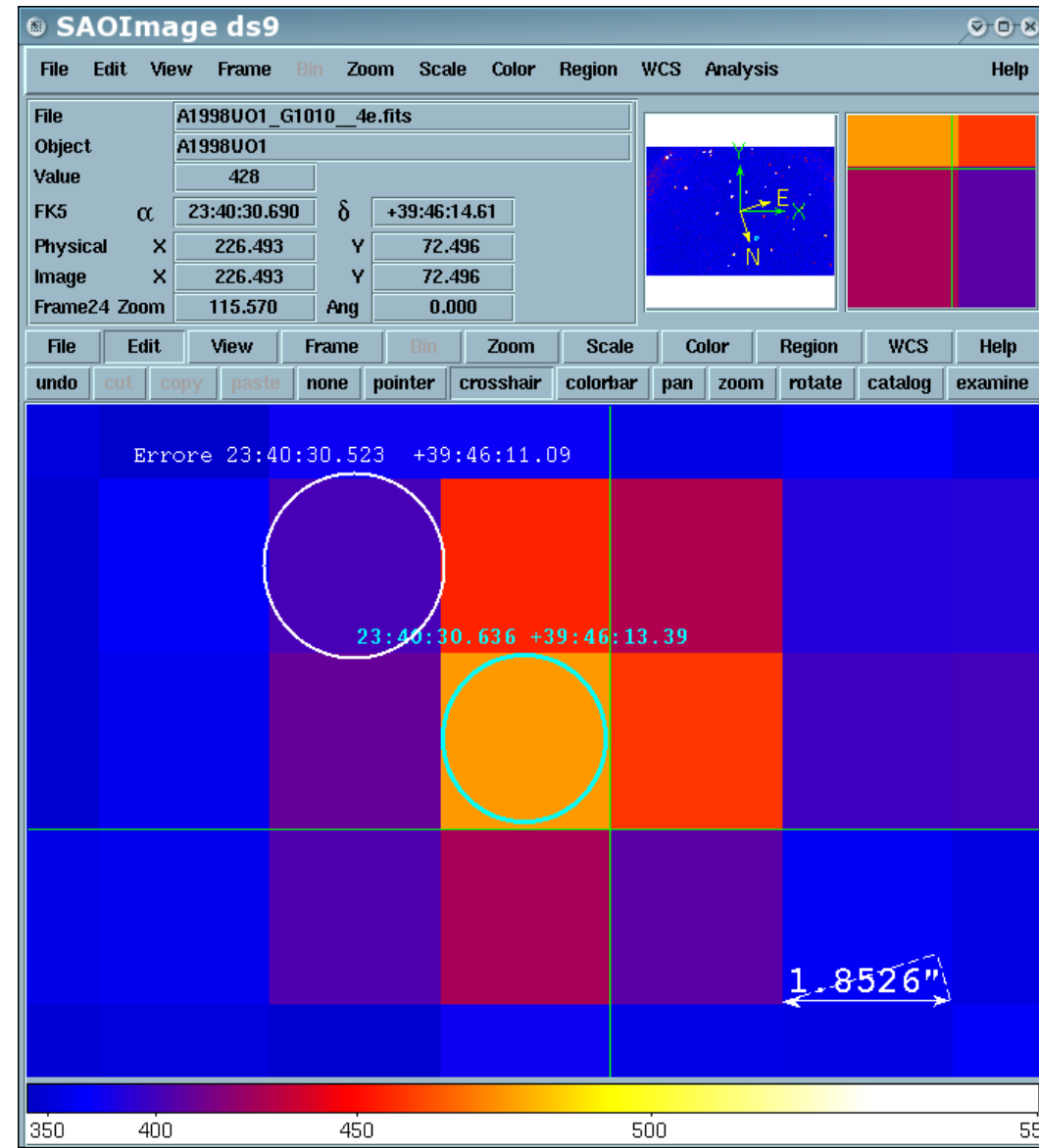
2"/pixel

$$\Phi = 206265 * \frac{L}{F}$$

$$scala = \frac{\Phi}{p}$$

$$scala = 206265 / F * \mu$$

Dove μ dimensione in mm del “pixel” del sensore



$$206265 / 2500 * 0,024 = 1,98 \text{ sec/arc}$$

Codice osservatorio

Le osservazione degli asteroidi e Comete vengono gestite dal **Minor Planet Center (MPC)**, istituzione a livello mondiale che ne cura l'archiviazione; provvede all'aggiornamento delle effemeridi; alla

Osservare almeno due asteroidi con numerazione superiore a 400

Effettuare osservazione per due notti consecutive

Per ogni notte almeno due misure dello stesso oggetto con unintervallo di almeno 20 minuti

Effettuare misurazioni precise di ~ 1"

obs@cfa.harvard.edu

COD XXX
CON BACCI Paolo, Via Niccxxx 007, Comune (Prov), Italy
CON backman@backman.homelinux.org
OBS P. BACCI
MEA P. BACCI
TEL 0-25-m 1/6.3 Schmidt-Cassegrain
COM Long. 349 19 45 E, Lat 43 35 11 N, Alt 50m
NET USNO-A2.0
ACK 2006-08-27
00707 C2006 08 21.90346 21 48 42.85 -06 39 12.7
XXX

00707 C2006 08 22.92171 21 47 40.88 -06 42 19.5
XXX

Obiettivi

•Lo studio sulla natura, distribuzione, formazione e evoluzione sono fondamentali per comprendere come si sono formati i pianeti, e ultimamente perché la vita esiste sulla terra ?

•Qual'è la popolazione e composizione strutturale della MBA

•Come la dinamica e le collisioni modificano questa struttura

•Quale sono le proprietà

•Ricerca

•NEOCP

•Follow-up

•Recovery

•Fotometria

•Occultazioni

Astrofiti



Il nostro primo asteroide

• Osserviamo l'asteroide (7481) San Marcello

1) Collegamento al sito del [Minor Planet Center](http://www.minorplanetcenter.net)

(<http://www.minorplanetcenter.net>)

2) selezioniamo il servizio [Minor Planet & Comet Ephemeris Service](#) (MPES)

3) inseriamo nell'apposito form il numero (o nome) del nostro Asteroide.

4) selezioniamo la data delle effemeridi, l'intervallo tra esse, il sito osservativo

Get ephemerides/HTML page Reset form

☒ Return ephemerides ☐ Return summary ☐ Return HTML page

1 by designation or by name. Enter a list of designations or names below (one entry per line, excess

7481

46P
C/2017 U1

Ephemeris Options (applicable only if selecting ephemeris return):

By default, ephemerides are geocentric, begin now and are for 20 days at 1 day intervals.

Ephemeris start date: Number of dates to output:

Ephemeris interval: Ephemeris units: ☒ days ☐ hours ☐ minutes ☐ seconds

For daily ephemerides, enter desired offset from 0h UT: hours

You may enter an observatory code (ground-based only) or your observing site's coordinates:

 Observatory code:

Format for elements output:

☐ none	☐ MPC 1-line	☒ MPC 8-line
☐ SkyMap (SkyMap Software)	☐ Guide (Project Pluto)	☐ xephem (E. Downey)
☐ Home Planet (J. Walker)	☐ MyStars! (Relative Data Products)	☐ TheSky (Software Bisque)
☐ Starry Night (Sienna Software)	☐ Deep Space (D. S. Chandler)	☐ PC-TCS (D. Harvey)
☐ Earth Centered Universe (Nova Astronomics)	☐ Dance of the Planets (ARC)	☐ MegaStar V4.x (E.L.B. Software)
☐ SkyChart 2000.0 (Southern Stars Software)	☐ Voyager II (Carina Software)	☐ SkyTools (CapellaSoft)
☐ Autostar (Meade Instruments)		

Effemeridi ed elementi orbitali

• Possiamo ottenere gli elementi orbitali del nostro asteroide

• Effemeridi

• Inoltre se l'asteroide è Numerato e nominato è possibile visualizzare le designazioni e la

(7481) San Marcello

[Display all designations for this object](#) / [Show naming citation](#) / # of variant orbits available = 3

Epoch 2016 July 31.0 TT = JDT 2457600.5 MPC
M 328.64753 (2000.0) P Q
n 0.19744242 Peri. 330.36798 -0.81469600 -0.57943644 T = 2457759.29296 JDT
a 2.9208488 Node 174.06425 +0.56600626 -0.80315766 q = 2.8021230
e 0.0406477 Incl. 12.78667 +0.12612433 -0.13853228
P 4.99 H 12.5 G 0.15 U 0
From 1530 observations at 20 oppositions, 1954-2016, mean residual 0".48.

Last observed on 2016 Mar. 13. Perturbed ephemeris below based on elements from MPO 374935.

Discovery date : 1994 08 11

Discovery site : San Marcello

Discoverer(s) : Boattini, A., Tombelli, M.

Nome decodificato dell'asteroide !!!

[Further observations?](#) Not necessary for orbit improvement.

07481 Date	[H=12.5]		UT h m s	R. A. (J2000)	Decl.	Delta	r	El.	Ph.	V	Sky Motion		Object		Sun Alt.	Moon Phase Dist.	Alt.	Uncertainty info	
											"/min	P. A.	Azi.	Alt.				3-sig/"	P. A.
2016 06 18	000000	06 32 12.6	+14 10 41	3.806	2.832	14.1	5.0	18.1	1.02	090.8	179	-32	-22	0.94	141	+21	N/A	N/A	Map / Offsets
2016 06 19	000000	06 33 53.0	+14 10 16	3.808	2.831	13.7	4.9	18.1	1.02	091.0	180	-32	-22	0.98	153	+24	N/A	N/A	Map / Offsets
2016 06 20	000000	06 35 33.5	+14 09 47	3.810	2.831	13.3	4.7	18.1	1.02	091.2	181	-32	-22	1.00	164	+26	N/A	N/A	Map / Offsets
2016 06 21	000000	06 37 14.0	+14 09 13	3.812	2.831	12.9	4.6	18.1	1.02	091.4	181	-32	-22	1.00	175	+27	N/A	N/A	Map / Offsets
2016 06 22	000000	06 38 54.5	+14 08 34	3.814	2.831	12.5	4.5	18.1	1.02	091.6	182	-32	-22	0.98	170	+28	N/A	N/A	Map / Offsets

```

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n 0.19744242 Peri. 330.36798 -0.81469600 -0.57943644 T = 2457759.29296 JDT
a 2.9208488 Node 174.06425 +0.56600626 -0.80315766 q = 2.8021230
e 0.0406477 Incl 12.78667 +0.12612433 -0.13853228
P 4.99 H 12.5 G 0.15 U 0
From 1530 observations at 20 oppositions, 1954-2016, mean residual 0".48.

```

Last observed on 2016 Mar. 13. Perturbed ephemeris below based on elements from *MPO 374935*.

Epoch The epoch of osculation of the orbital elements.

M Mean anomaly at the epoch.

T Date of perihelion passage.

n Mean daily motion (in degrees/day).

A Semimajor axis (in AU).

Z Reciprocal semimajor axis (in 1/AU).

q Perihelion distance (in AU).

e Orbital eccentricity.

P Orbital period (in years).

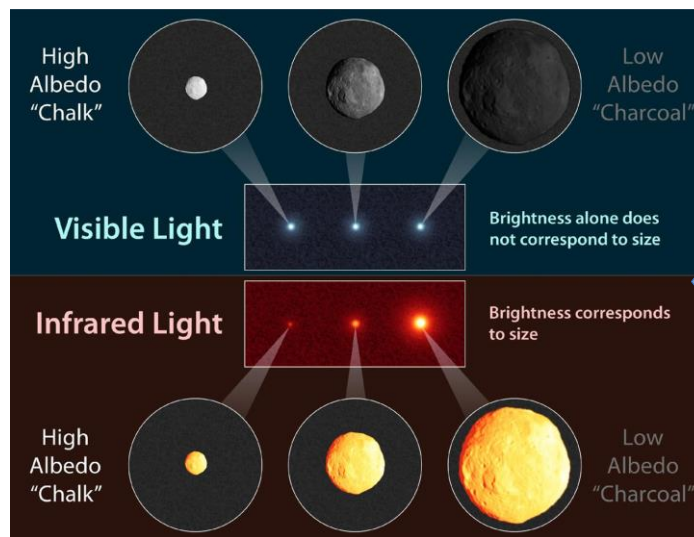
P and **Q** vectors The vectors P and Q are an alternate form of representing the angular elements **Peri.**, **Node** and **Incl.** .

U Uncertainty parameter.

H Absolute visual magnitude. A table converting H to a diameter is available.

G Slope parameter. For an explanation of the H,G magnitude system refer to Application of Photometric Models to Asteroids, Bowell et al., in Asteroids II, 524-556

U & H



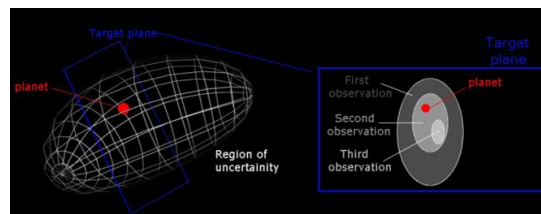
•Uncertainty Parameter U and Orbit Quality Codes

<http://www.minorplanetcenter.net/iau/info/UValue.html>

U	RUNOFF	U	RUNOFF
0	< 1.0	5	< 1692
1	< 4.4	6	< 7488
2	< 19.6	7	< 33121
3	< 86.5	8	< 146502
4	< 382	9	> 146502

Q	Quality code
9,8	1A
7	1B
6	2A
5	2B
4	3A
3	3B
2,1,0	4

RUNOFF
in seconds of arc per decade



H	Albedo			H	H
	0.50	0.25	0.05		
-2.0	4700	6700	14900	13.0	28.0
-1.5	3700	5300	11800	13.5	28.5
-1.0	3000	4200	9400	14.0	29.0
-0.5	2400	3300	7500	14.5	29.5
0.0	1900	2600	5900	15.0	30.0
0.5	1500	2100	4700	15.5	30.5
1.0	1200	1700	3700	16.0	31.0
1.5	940	1300	3000	16.5	31.5
2.0	750	1050	2400	17.0	32.0
2.5	590	840	1900	17.5	32.5
3.0	470	670	1500	18.0	33.0
3.5	370	530	1200	18.5	33.5
4.0	300	420	940	19.0	34.0
4.5	240	330	740	19.5	34.5
5.0	190	260	590	20.0	35.0
5.5	150	210	470	20.5	35.5
6.0	120	170	370	21.0	36.0
6.5	95	130	300	21.5	36.5
7.0	75	110	240	22.0	37.0
7.5	60	85	190	22.5	37.5
8.0	45	65	150	23.0	38.0
8.5	40	50	120	23.5	38.5
9.0	30	40	95	24.0	39.0
9.5	25	35	75	24.5	39.5
10.0	19	25	60	25.0	40.0
10.5	15	20	50	25.5	40.5
11.0	12	17	37	26.0	41.0
11.5	9	13	30	26.5	41.5
12.0	7	11	24	27.0	42.0
12.5	6	8	19	27.5	42.5
13.0	5	7	15	28.0	43.0
13.5	4	5	12	28.5	43.5
14.0	3	4	9	29.0	44.0
14.5	2	3	7	29.5	44.5
15.0	2	3	6	30.0	45.0
15.5	1	2	5	30.5	45.5
16.0	1	2	4	31.0	46.0
16.5	1	1	3	31.5	46.5
17.0	1	1	2	32.0	47.0
17.5	1	1	2	32.5	47.5

07481

Date

[H=12.5]

Date	UT			R. A. (J2000)	Decl.	Delta	r	El.	Ph.	V	Sky Motion		Object		Sun	Moon			Uncertainty info	
	h	m	s								"/min	P. A.	Azi.	Alt.		Alt.	Phase	Dist.	Alt.	3-sig/"
2016 06 18	00	00	00	06 32 12.6	+14 10 41	3.806	2.832	14.1	5.0	18.1	1.02	090.8	179	-32	-22	0.94	141	+21	N/A	N/A / Map / Offsets
2016 06 19	00	00	00	06 33 53.0	+14 10 16	3.808	2.831	13.7	4.9	18.1	1.02	091.0	180	-32	-22	0.98	153	+24	N/A	N/A / Map / Offsets
2016 06 20	00	00	00	06 35 33.5	+14 09 47	3.810	2.831	13.3	4.7	18.1	1.02	091.2	181	-32	-22	1.00	164	+26	N/A	N/A / Map / Offsets
2016 06 21	00	00	00	06 37 14.0	+14 09 13	3.812	2.831	12.9	4.6	18.1	1.02	091.4	181	-32	-22	1.00	175	+27	N/A	N/A / Map / Offsets
2016 06 22	00	00	00	06 38 54.5	+14 08 34	3.814	2.831	12.5	4.5	18.1	1.02	091.6	182	-32	-22	0.98	170	+28	N/A	N/A / Map / Offsets

Data delle effemeridi

UT delle effemeridi i UT

RA ascensione retta dell'asteroide
(J2000)

Dec declinazione dell'asteroide
(J2000)

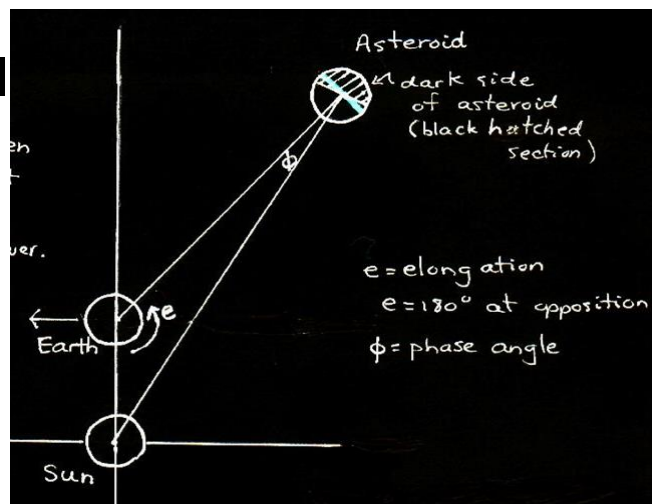
Delta Distanza Asteroide-Sole in UA

R distanza Asteroide Terra in UA

El Elongazione Sole

Ph Angolo di Fase

V magnitudine



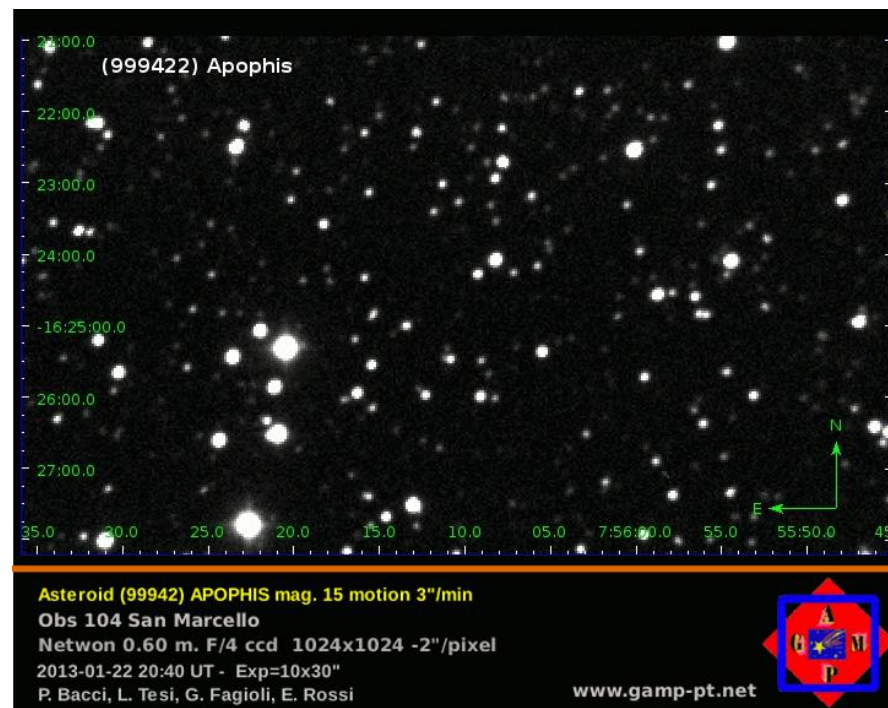
Sky Motion velocità apparente dell'asteroide

PA angolo di movimento

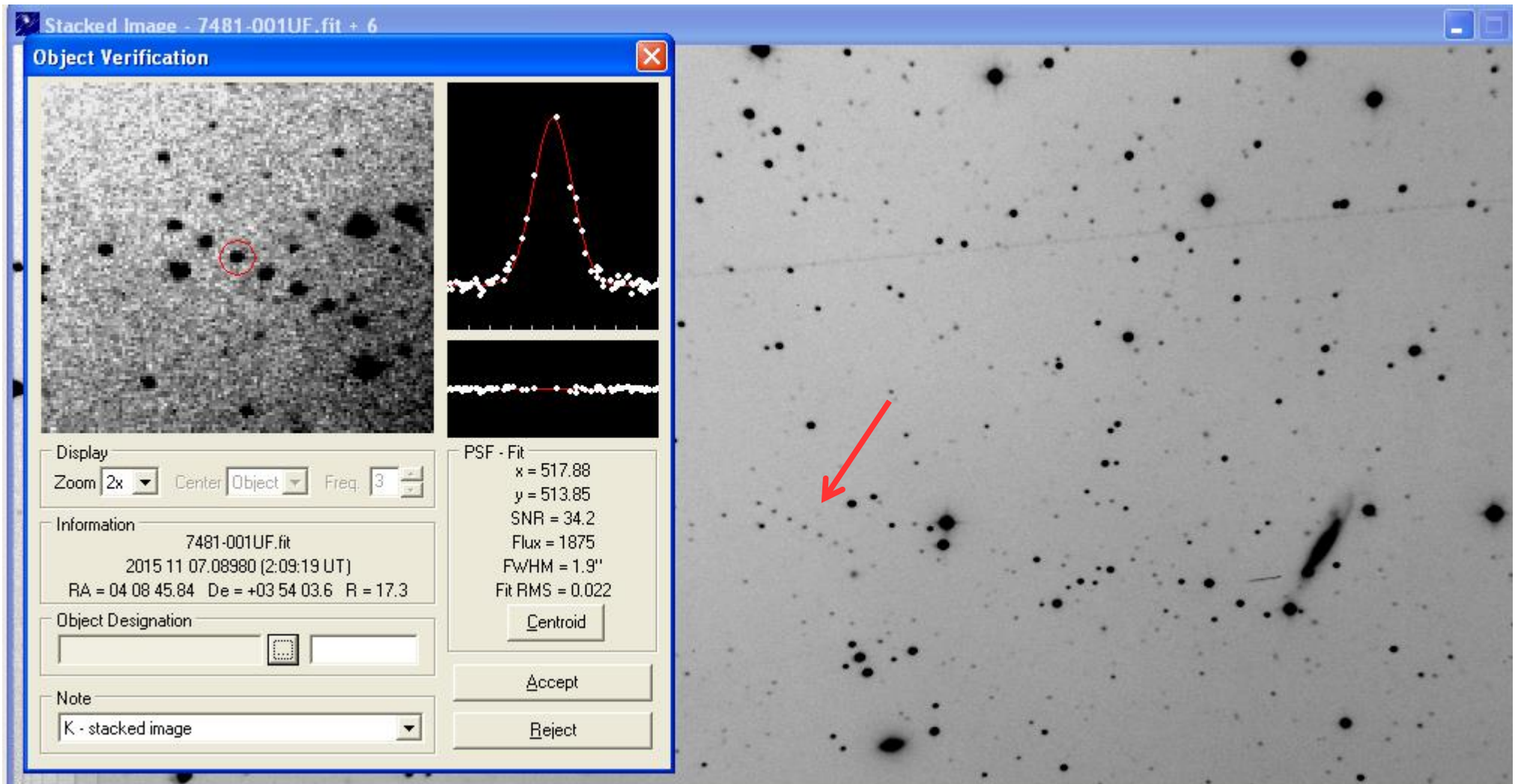
Object coordinate azimutali

Sun altezza del sole sull'orizzonte

Moon Fase lunare, distanza dall'asteroide e altezza sull'orizzonte



Misuriamo l'asteroide

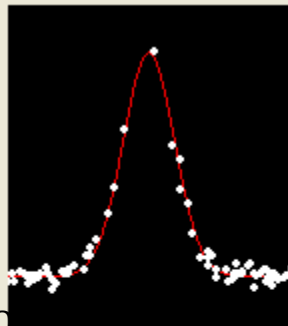
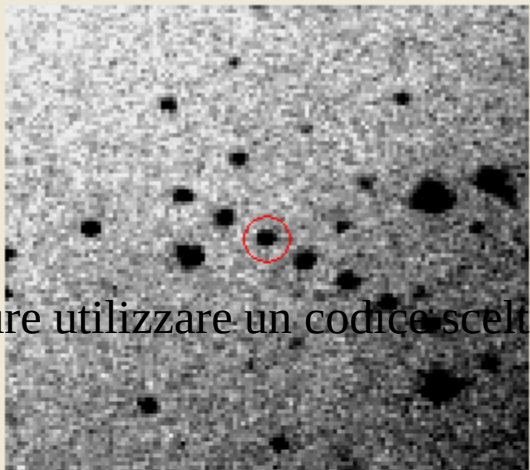


Misure Astrometriche

SIGLA ASTEROIDE:

Possiamo inserire la designazione decodificata del MPC, oppure utilizzare un codice scelto

Object Verification



Display
Zoom **2x** Center **Object** Freq. **3**

Information
7481-001UF.fit
2015 11 07.08980 (2:09:19 UT)
RA = 04 08 45.84 De = +03 54 03.6 R = 17.3

Object Designation
LBPNO01

Note
K - stacked image

PSF - Fit
x = 517.88
y = 513.85
SNR = 34.2
Flux = 1875
FWHM = 1.9"
Fit RMS = 0.022

Centroid

Accept

Reject

Astrometrica - Send Mail

To: **obs@cfa.harvard.edu**

CC:

Subject: **Observations**

COD 104
OBS P. Bacci
MEA P. Bacci, L. Tesi, G. Fagioli
TEL 0.60-m F4 Reflector + CCD
ACK MPCReport file updated 2016.07.03 14.58.33
AC2 xxxxxx@gmail.com
NET UCAC-3

LBPNO01	C2015	11	06.99428	04 08	44.76	+03 53	51.2	15.2	R
LBPNO01	C2015	11	07.05796	04 08	45.84	+03 54	03.7	15.2	R
LBPNO01	C2015	11	07.12132	04 08	46.92	+03 54	15.9	15.3	R

----- end -----

Send **Cancel**

Data Reduction Results

Image	Stars	Ref. Stars	Ref./Ast.	Fit Order	dRA	dDe	Ref./Phot.	dmag	Zero Pt.
7481-001UF.fit	789	8	6	1	0.47"	0.52"	5	0.45mag	25.46mag
7481-031UF.fit	806	8	6	1	0.46"	0.52"	5	0.44mag	25.48mag
7481-061UF.fit	715	8	6	1	0.45"	0.51"	5	0.44mag	25.44mag

(7481) San Marcello

[Display all designations for this object](#) / [Show naming citation](#) /

Perturbed ephemeris below is based on 20-opp elements from

Discovery date : 1994 08 11
Discovery site : San Marcello
Discoverer(s) : Boattini, A., Tombelli, M.

[Further observations?](#) Not necessary for orbit improvement.

07481	[H=12.5]									
Date	UT	R.A. (J2000)	Decl.	Delta	r	El.	Ph.	V		
	h m s									
2016 07 03 000000	06 57 22.3	+13 55 55	3.827	2.828	9.2	3.3	18.			

(331011) Peccioli

[Display all designations for this object](#) / [Show naming citation](#) /

Perturbed ephemeris below is based on 8-opp elements from /

Discovery date : 2009 10 26
Discovery site : Libbiano
Discoverer(s) : Bacci, P., Biasci, F.

[Further observations?](#) Not necessary for orbit improvement.

331011	[H=16.4]									
Date	UT	R.A. (J2000)		Decl.	Delta	r	El.	Ph.	V	
	h m s									
2016 07 03 000000	13 46 31.7	-04 39 49	2.008	2.475	105.0	23.4	21.			

2016 LA

[Display all designations for this object](#)

Ephemeris below based on 1-day-arc elements from *MPO* 3828

[Further observations?](#) Useful for numbering.

K16L00A		[H=16.2]							
Date	UT	R.A. (J2000)		Decl.	Delta	r	El.	Ph.	V
	h m s								
2016 07 03	000000	13 09	37.3	-25 04 37	1.889	2.350	103.9	24.8	20.

Nome Asteroide

- Numerati
- Non Numerati

- Numerati con Nome
- Numerati
- Designazione

Letter	Dates	Letter	Dates
A	Jan. 1-15	B	Jan. 16-31
C	Feb. 1-15	D	Feb. 16-29
E	Mar. 1-15	F	Mar. 16-31
G	Apr. 1-15	H	Apr. 16-30
J	May 1-15	K	May 16-31
L	June 1-15	M	June 16-30
N	July 1-15	O	July 16-31
P	Aug. 1-15	Q	Aug. 16-31
R	Sept. 1-15	S	Sept. 16-30
T	Oct. 1-15	U	Oct. 16-31
V	Nov. 1-15	W	Nov. 16-30
X	Dec. 1-15	Y	Dec. 16-31

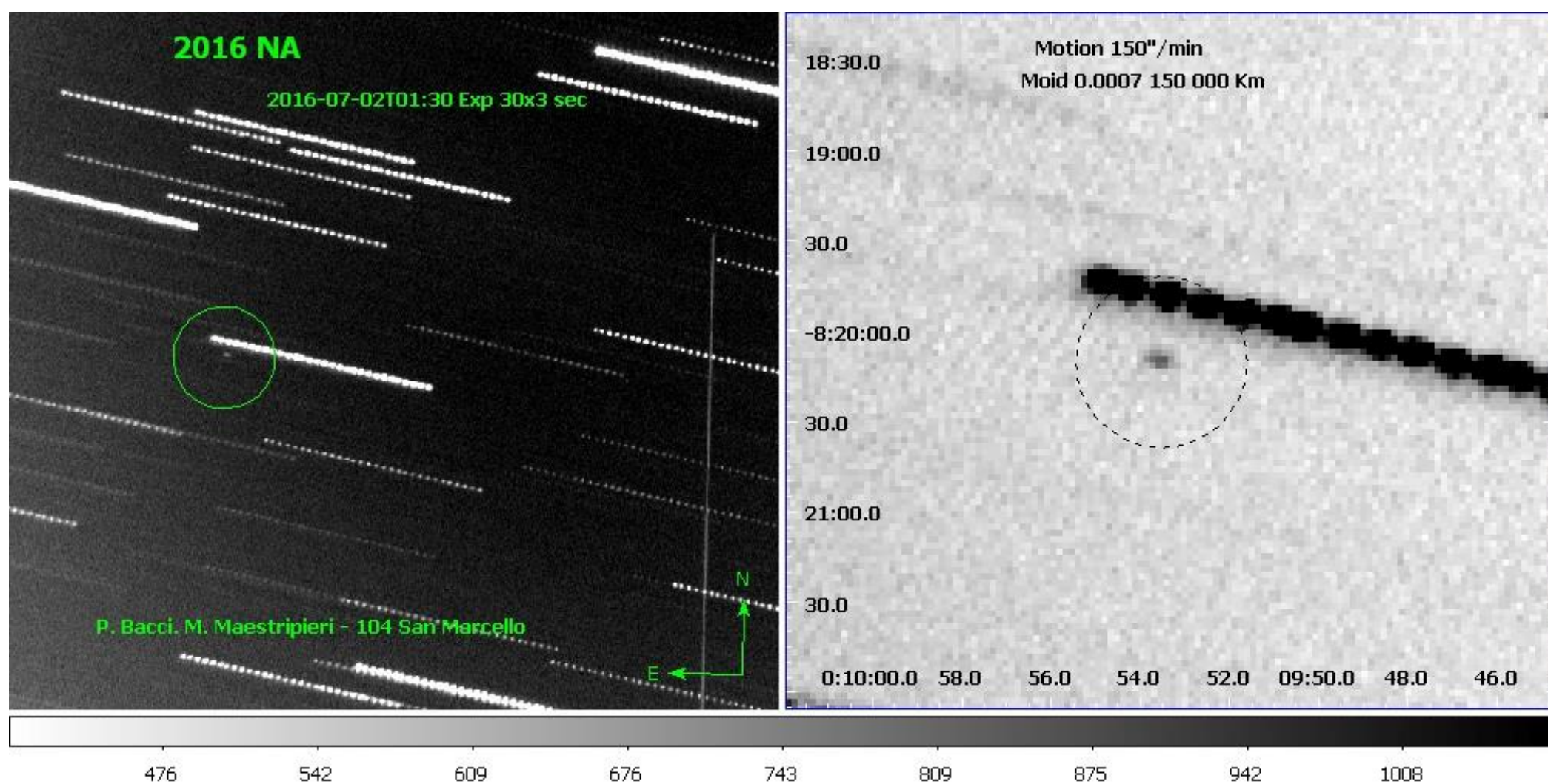
I is omitted and Z is unused

The order within the month is indicated using letters as follows:

A = 1st	B = 2nd	C = 3rd	D = 4th	E = 5th
F = 6th	G = 7th	H = 8th	J = 9th	K = 10th
L = 11th	M = 12th	N = 13th	O = 14th	P = 15th
Q = 16th	R = 17th	S = 18th	T = 19th	U = 20th
V = 21st	W = 22nd	X = 23rd	Y = 24th	Z = 25th

I is omitted

Tecniche di ripresa



(Mo)

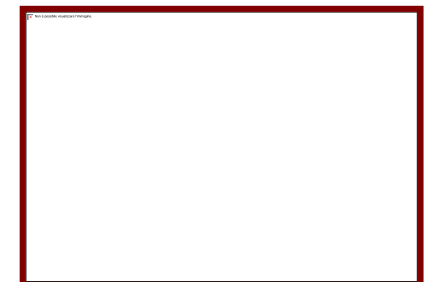
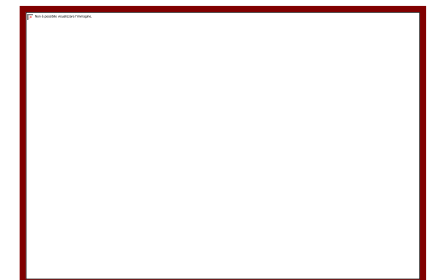
(Sc)

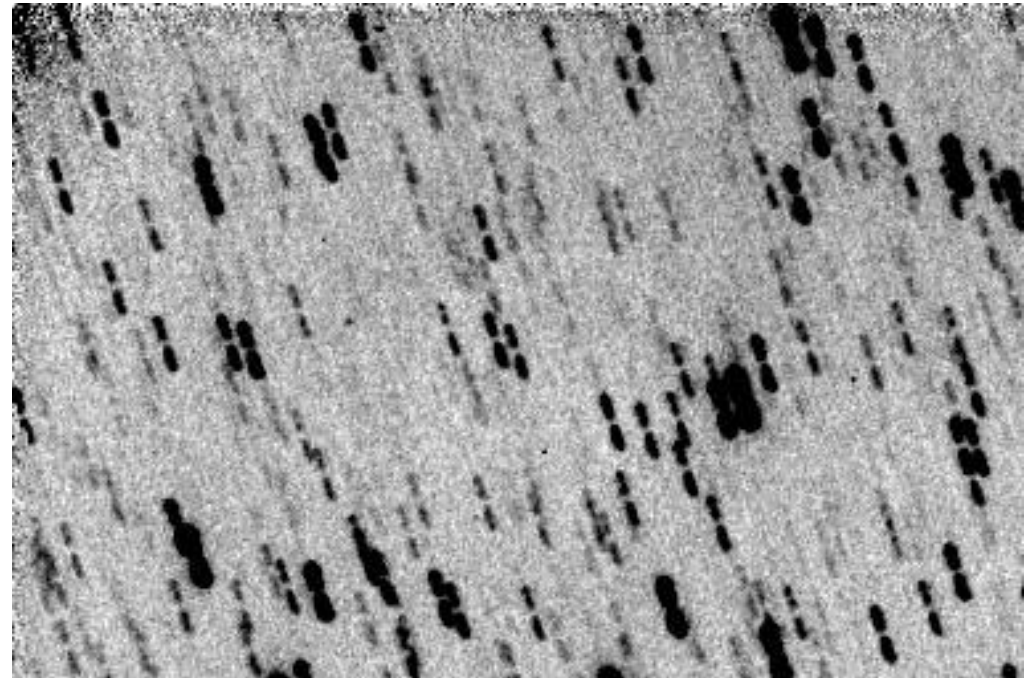
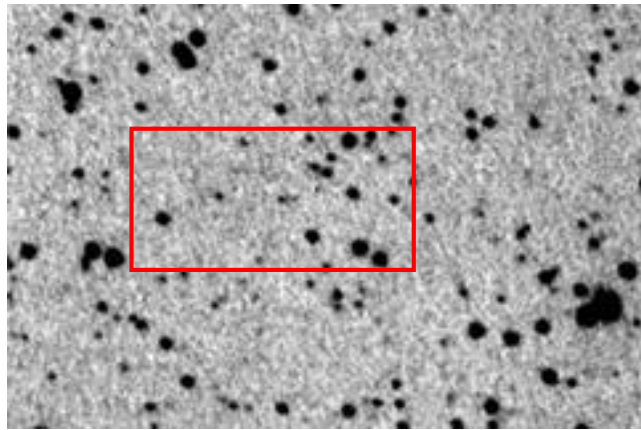
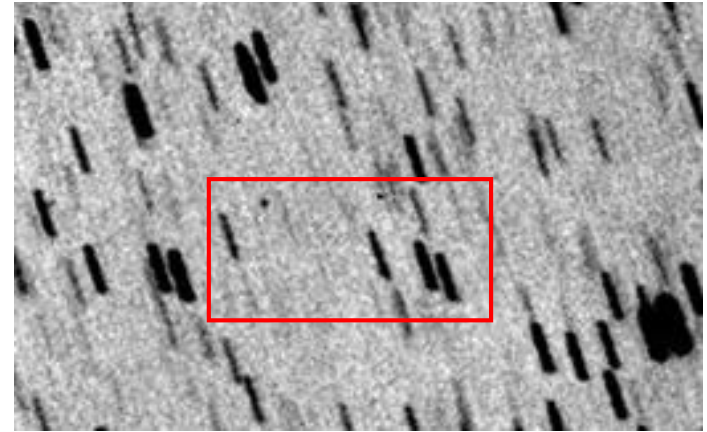
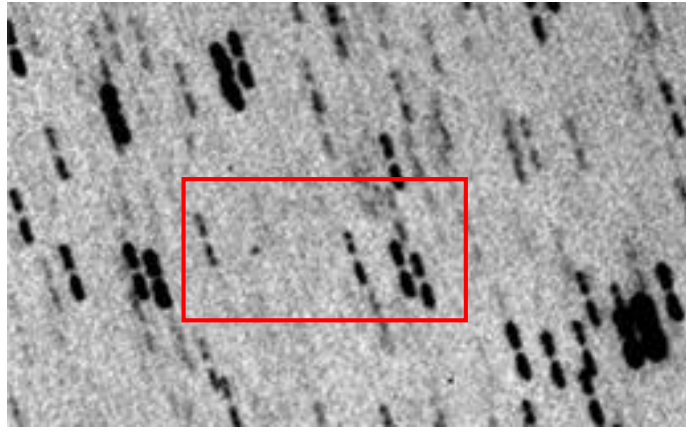
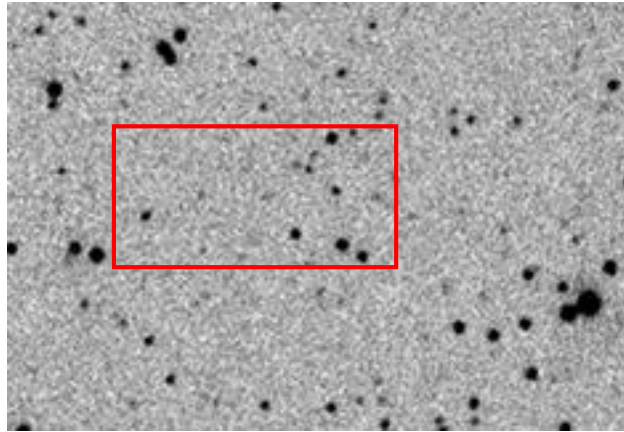
(T)

Oppure $\rightarrow Sc \sim FWHM = \text{seeing} !!!!$

T	Sc	Mo
----------	-----------	-----------

				1,89
		7,21		
T	1,89	7,21	0,262 Min	16
T	2.5	7,21	0,262 Min	21
		16		





Ogni asteroide ha il suo tempo...

(7481) San Marcello

[Display all designations for this object](#) / [Show naming citation](#) / # of variant orbits available = 3

Perturbed ephemeris below is based on 20-opp elements from *MPO* 374935. Last observed on 2016 Mar. 13.

Discovery date : 1994 08 11

Discovery site : San Marcello

Discoverer(s) : Boattini, A., Tombelli, M.

[Further observations?](#) Not necessary for orbit improvement.

07481 Date	UT h m s	[H=12.5]		Delta	r	El.	Ph.	V	Sky Motion		Object Azi. Alt.	Sun Alt.	Moon Phase Dist. Alt.	Uncertainty info	
		R.A. (J2000)	Decl.						"/min	P.A.				3-sig/"	P.A.
2016 07 04	000000	06 59 03.0	+13 54 16	3.827	2.827	9.1	3.3	18.0	1.03	093.9	190 -32	-23	0.00 009 -26	N/A	N/A / Map / Offsets
2016 07 05	000000	07 00 43.8	+13 52 33	3.827	2.827	8.9	3.2	18.0	1.03	094.1	190 -32	-23	0.00 007 -28	N/A	N/A / Map / Offsets

(331011) Peccioli

[Display all designations for this object](#) / [Show naming citation](#) / # of variant orbits available = 1

Perturbed ephemeris below is based on 8-opp elements from *MPO* 380050. Last observed on 2016 Mar. 13.

Discovery date : 2009 10 26

Discovery site : Libbiano

Discoverer(s) : Bacci, P., Biasci, F.

[Further observations?](#) Not necessary for orbit improvement.

X1011 Date	UT h m s	[H=16.4]		Delta	r	El.	Ph.	V	Sky Motion	
		R.A. (J2000)	Decl.						"/min	P.A.
2016 07 04	000000	13 47 06.0	-04 42 51	2.019	2.474	104.2	23.5	21.0	0.38	109.6
2016 07 05	000000	13 47 41.5	-04 46 02	2.030	2.473	103.5	23.6	21.0	0.40	109.7

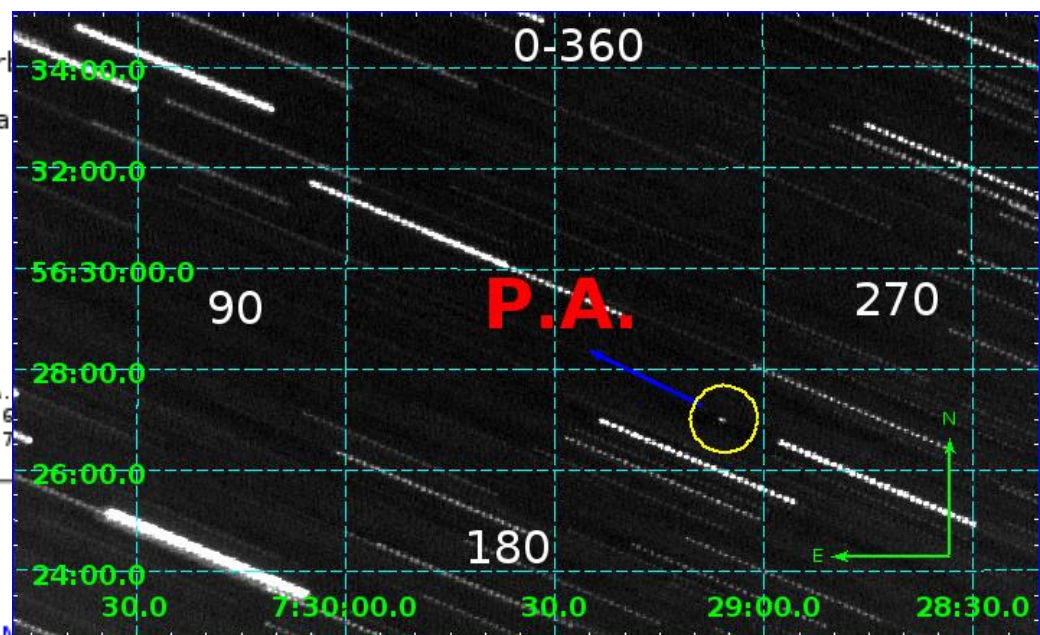
2016 NA

[Display all designations for this object](#) / # of variant orbits available = 11

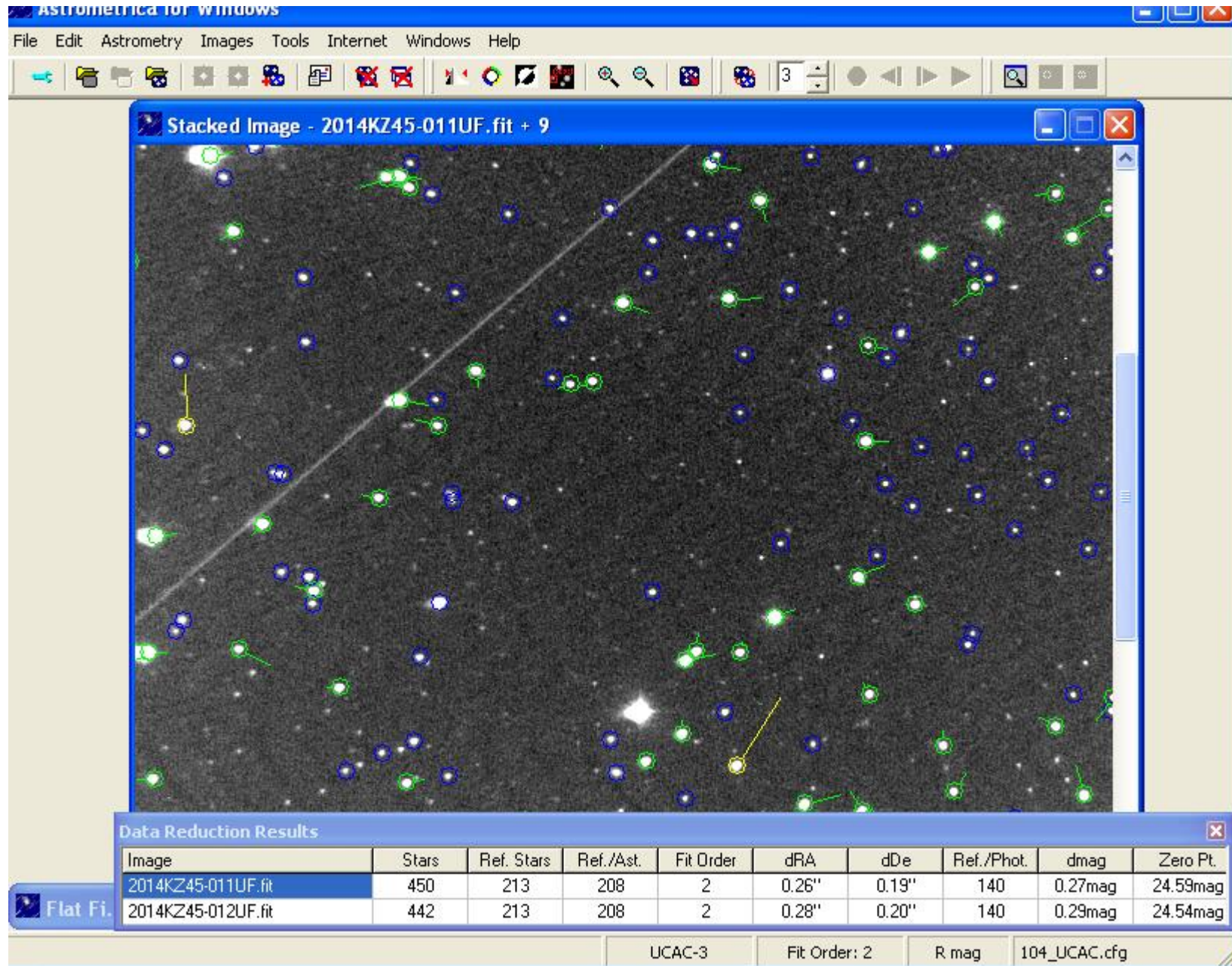
Perturbed ephemeris below is based on 1-day-arc elements from *MPEC* 2016-N-001.

[Further observations?](#) Useful for orbit improvement (based on orbit uncertainty). Not necessary this month for numbering.

K16N00A Date	UT h m s	[H=26.9]		Delta	r	El.	Ph.	V	Sky Motion		Object Azi. Alt.	Sun Alt.	Moon Phase Dist. Alt.	Uncertainty info	
		R.A. (J2000)	Decl.						"/min	P.A.				3-sig/"	P.A.
2016 07 04	000000	03 10 49.9	+03 31 22	0.010	1.011	57.1	122.4	22.0	19.71	075.5	250 -15	-23	0.00 050 -26	3 074.5 /	Map / Offsets
2016 07 05	000000	03 31 31.2	+04 53 02	0.014	1.008	52.7	126.6	23.1	10.48	075.9	246 -17	-23	0.00 058 -28	3 073.3 /	Map / Offsets

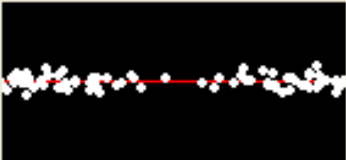
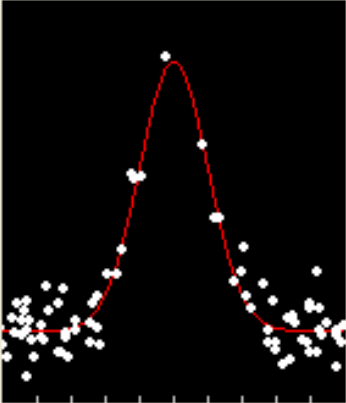
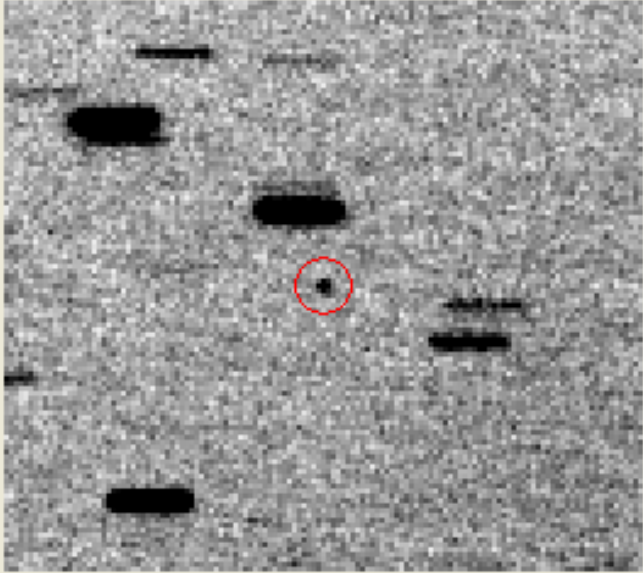


Misuriamo un asteroide con Astrometrica



Il centroide

Object Verification



Display
Zoom **2x** Center **Object** Freq. **3**

Information
2014KZ45-001UF.fit
2016 07 02.01703 (0:24:31 UT)
RA = 23 31 15.32 De = +12 29 43.4 R = 18.7

Object Designation
MBPG001

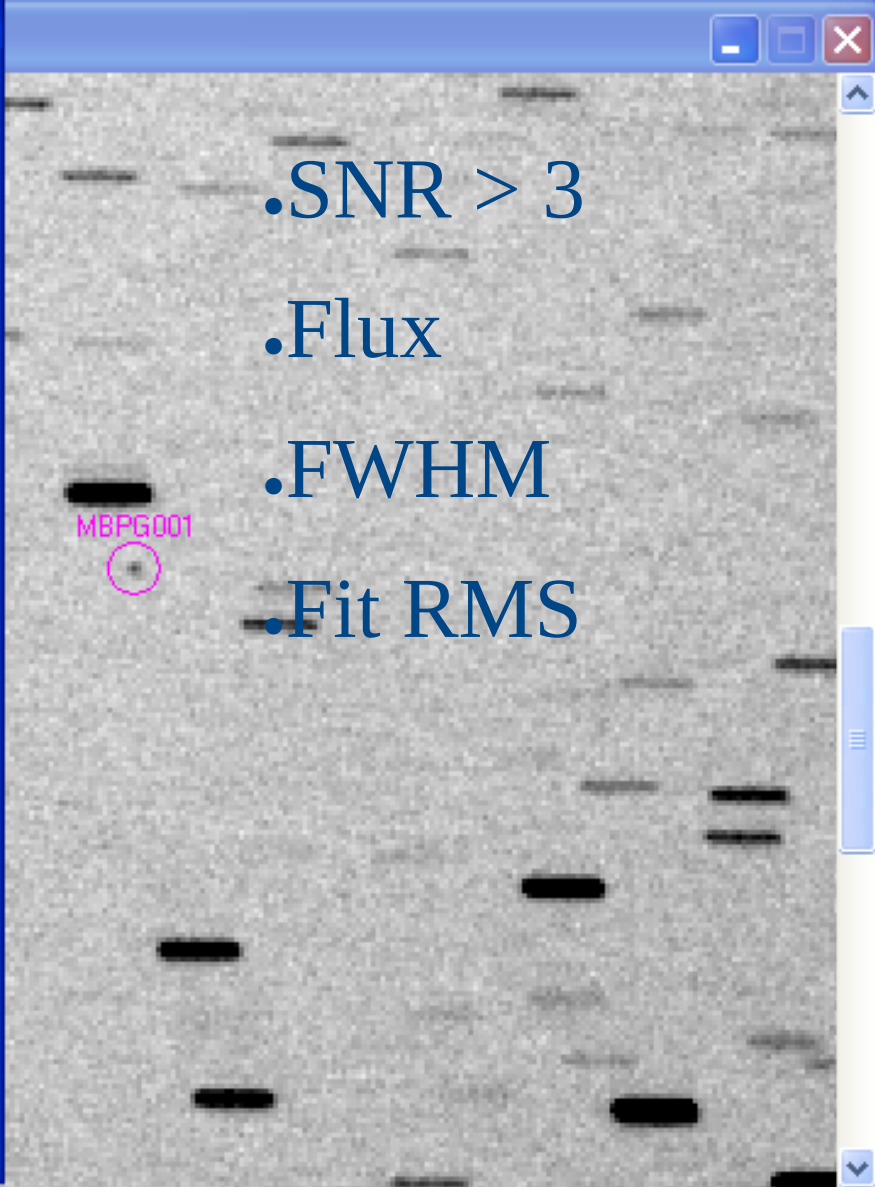
Note
K - stacked image

PSF - Fit
x = 701.19
y = 607.11
SNR = 9.4
Flux = 214
FWHM = 4.8"
Fit RMS = 0.063

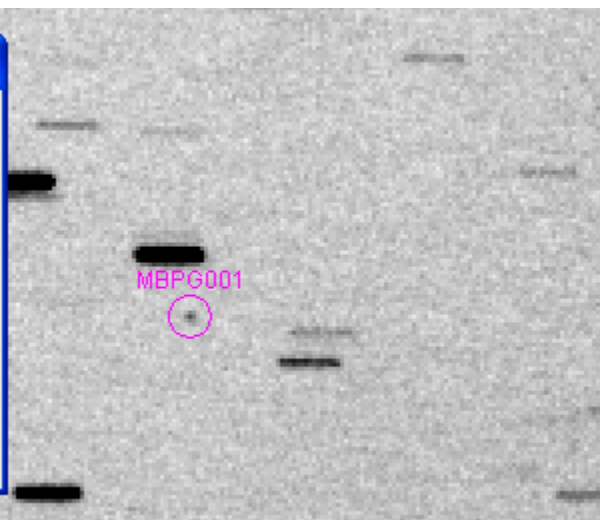
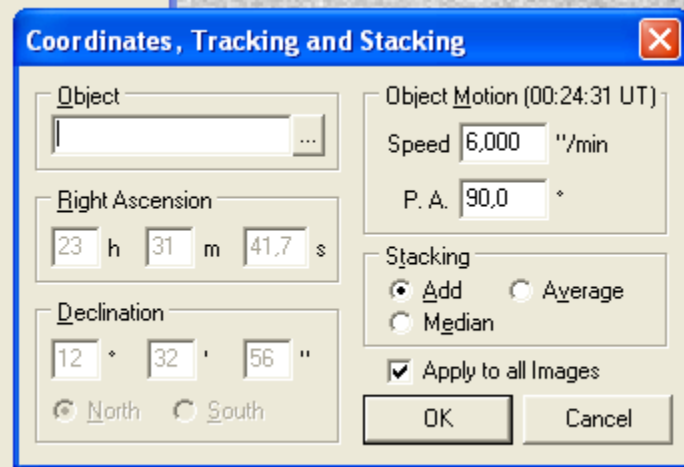
Centroid

Accept

Reject

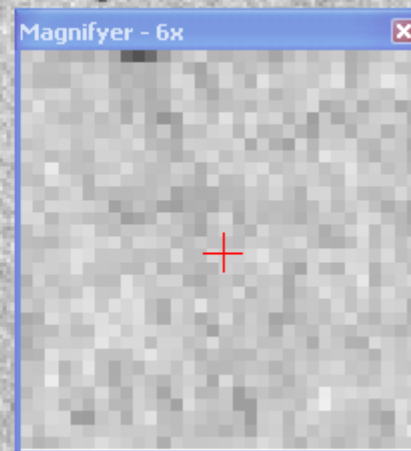
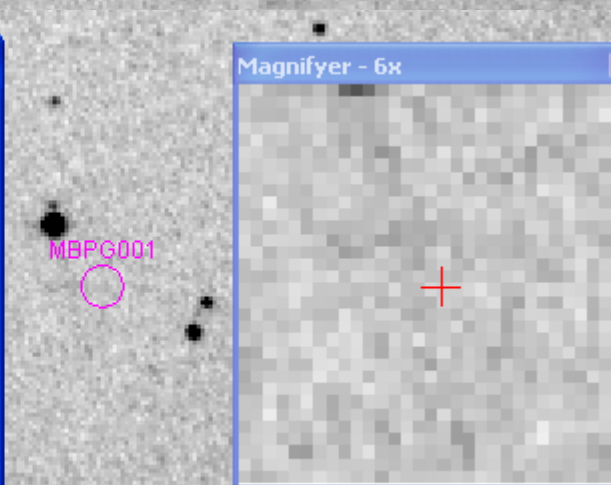
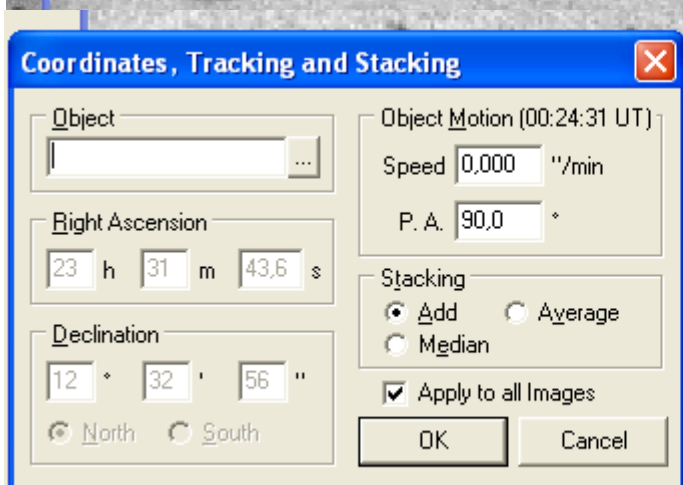
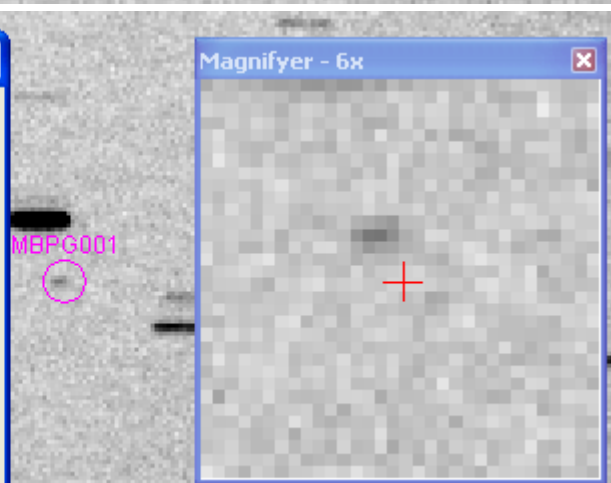
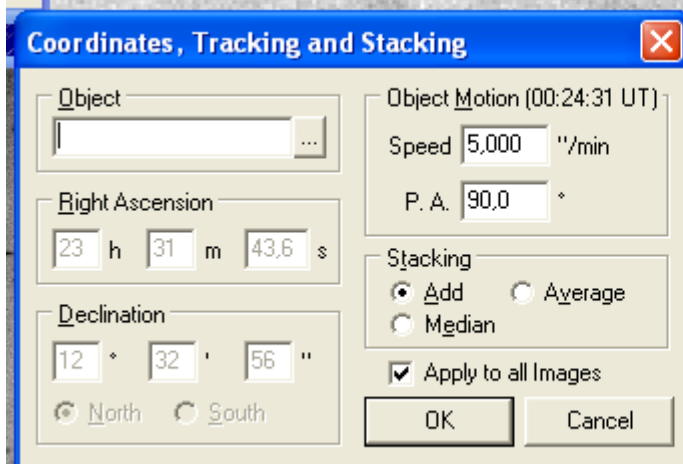


- SNR > 3
- Flux
- FWHM
- Fit RMS



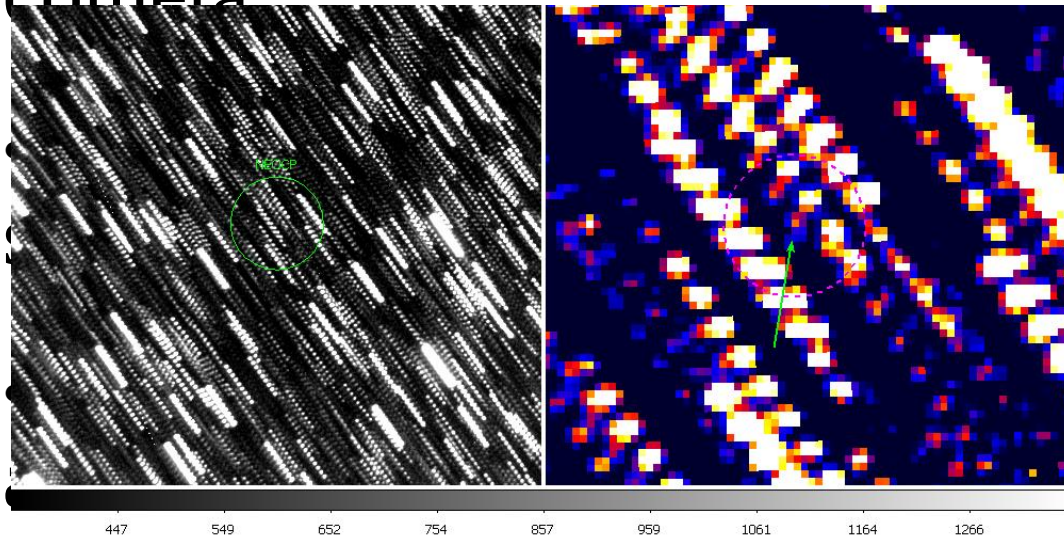
•La somma di immagini è un efficace metodo per migliorare le nostre performance :

•STACK and TRACK



Alcune delle criticità dell'astrometria

- $\text{SRN} > 3$
- Moto apparente troppo veloce
- Campo stellare affollato
- Stelle luminose in prossimità dell'asteroide o cometa



Report delle misure

Astrometrica - Send Mail

To:

CC:

Subject:

COD 104
OBS P. Bacci
MEA P. Bacci, L. Tesi, G. Fagioli
TEL 0.60-m F4 Reflector + CCD
ACK MPCReport file updated 2016.07.05 00.21.31
AC2
NET UCAC-3

LBPNO01	C2015	11	06.99428	04	08	44.76	+03	53	51.2	15.2	R	104
LBPNO01	C2015	11	07.05796	04	08	45.84	+03	54	03.7	15.2	R	104
LBPNO01	C2015	11	07.12132	04	08	46.92	+03	54	15.9	15.3	R	104

----- end -----

Inviare mail : **obs@cfa.harvard.edu**

Inviare le misure al MPC

COD XXX
CON BACCI Paolo, Via Nicxxxx 007, Comune (Prov), Italy
CON [backman@backman.homelinux.org]
OBS P. BACCI
MEA P. BACCI
TEL 0.25-m f/6.3 Schmidt-Cassegrain
COM Long. 349 19 45 E, Lat 43 35 11 N, Alt 50m
NET USNO-A2.0
ACK 2006-08-27

COD three-character observatory code.

OBS (followed by the list of observers, no programs)

MEA (followed by the list of measurers, no programs)

TEL (followed by details of the telescope)

NET (followed by the abbreviated name(s))

```
COD 104
OBS P. Bacci,
MEA P.Bacci, L. Tesi, G. Fagioli
TEL 0.60-m F/4 Reflector + CCD
ACK MPCReport file updated 2014.01.28 21.57.09
AC2 B09.backman@gmail.com
NET UCAC-4
    K06DF6C KC2014 01 28.83964 08 29 34.25 +11 07 33.3      19.1 R      104
    K06DF6C KC2014 01 28.85287 08 29 33.52 +11 07 39.8      19.8 R      104
    K06DF6C KC2014 01 28.85801 08 29 33.21 +11 07 41.8      19.6 R      104
91029      KC2014 01 28.83964 08 28 23.37 +11 03 45.1      18.3 R      104
91029      KC2014 01 28.84846 08 28 22.85 +11 03 48.1      18.1 R      104
91029      KC2014 01 28.85801 08 28 22.34 +11 03 51.2      18.0 R      104
I2253      KC2014 01 28.84846 08 29 42.57 +11 05 42.5      17.9 R      104
I2253      KC2014 01 28.85801 08 29 41.93 +11 05 46.5      18.6 R      104
I9712      KC2014 01 28.83964 08 29 23.28 +11 05 39.7      19.6 R      104
I9712      KC2014 01 28.84846 08 29 22.77 +11 05 40.9      19.7 R      104
I9712      KC2014 01 28.85801 08 29 22.14 +11 05 42.6      19.3 R      104
----- end -----
```

```
COD J95
OBS P. Birtwhistle
TEL 0.40-m f/6.0 Schmidt-Cassegrain + CCD
ACK MPCReport P. Bacci file updated 2011.09.03 02:44:34 F
AC2 peter@
COM Paolo Bacci requested follow-up of this recently designated object.
COM On the basis of his positions for Aug 28.1, 30.0, Sep 1.9 and my
COM positions below for Sep 3.1 it looks like it may be a NEO?
NET UCAC-3
    K11Q39Y KC2011 09 03.09328 23 17 43.91 -05 48 10.1      J95
    K11Q39Y KC2011 09 03.10090 23 17 43.32 -05 48 12.8      J95
    K11Q39Y KC2011 09 03.10687 23 17 42.85 -05 48 15.1      18.4 R      J95
```



Verifica dei nostre misure: residual

•MPC: effemeridi selezioniamo show residual inserendo il codice del nostro osservatorio

☐ none	☐ MPC 1-line	☒ MPC 8-line
☐ SkyMap (SkyMap Software)	☐ Guide (Project Pluto)	☐ xephem (E. Downey)
☐ Home Planet (J. Walker)	☐ MyStars! (Relative Data Products)	☐ TheSky (Software Bisque)
☐ Starry Night (Sienna Software)	☐ Deep Space (D. S. Chandler)	☐ PC-TCS (D. Harvey)
☐ Earth Centered Universe (Nova Astronomics)	☐ Dance of the Planets (ARC)	☐ MegaStar V4.x (E.L.B. Software)
☐ SkyChart 2000.0 (Southern Stars Software)	☐ Voyager II (Carina Software)	☐ SkyTools (CapellaSoft)
☐ Autostar (Meade Instruments)		

If you select 8-line MPC format, you may display the residual block for the objects selected:

 ☐ Show residuals blocks. Show only residual lines containing observations from code 

```
Epoch 2016 July 31.0 TT = JDT 2457600.5
M 358.47701 (2000.0) P MPC
n 0.53229570 Peri. 217.86533 +0.74124817 +0.66935620 T = 2457603.36118 JDT
a 1.5078822 Node 100.03948 -0.60274362 +0.69662563 q = 0.9619869
e 0.3620278 Incl. 2.91840 -0.29538327 +0.25821504 Earth MOID = 0.00070 AU
P 1.85 H 26.9 G 0.15 U 5
From 60 observations 2016 July 1-2, mean residual 0".82.
```

Residuals

20160701	Y00	(2.1-	0.6-)	20160701	Y00	0.3-	0.9+	20160702	104	1.2+	0.3+
20160701	Y00	(2.8-	0.5+)	20160701	Y00	1.1-	0.8-	20160702	104	0.1+	1.2-
20160701	Y00	1.7-	0.5+	20160701	Y00	1.0-	0.8-	20160702	104	1.3+	0.1+
20160701	Y00	0.9+	1.2-	20160701	474	1.7-	0.1+	20160702	104	1.5+	0.1-

Last observed on 2016 July 2. Perturbed ephemeris below based on elements from [MPEC 2016-N10](#).

[Further observations?](#) Useful for orbit improvement (based on orbit uncertainty). Not necessary this mor

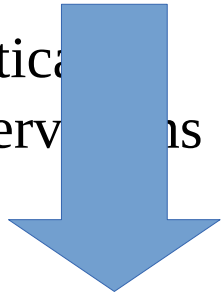
Residui

•Dal sito **NEODYS**
(solo per NEA)

AstDys (solo per
non NEA)

•OBSERVATIONAL
INFORMATION

•Optical
observations



•MPC → Documentation

•Statistics on residuals from observations of minor planets, by
observatory code

•Statistics on residuals from observations of numbered minor planets,
by observatory code

```
backman@R2D2:~> cat residuals.txt | grep ^104
```

```
104 2016 348 294 44 7 3 0 +0.03 +/- 0.56 -0.03 +/- 0.56
104 2015 841 715 92 28 6 0 +0.09 +/- 0.60 -0.05 +/- 0.56
104 2014 696 580 91 17 8 0 +0.05 +/- 0.63 -0.08 +/- 0.58
104 2013 1905 1641 230 28 6 0 +0.09 +/- 0.54 -0.01 +/- 0.51
104 2012 1334 1211 99 20 4 0 +0.00 +/- 0.46 -0.05 +/- 0.48
104 2011 1933 1622 253 44 14 0 +0.00 +/- 0.58 -0.02 +/- 0.58
104 2010 358 309 40 7 2 0 +0.10 +/- 0.56 +0.15 +/- 0.50
104 2009 1535 1149 307 65 14 0 +0.08 +/- 0.69 +0.21 +/- 0.67
104 2008 4791 3789 835 120 47 0 +0.10 +/- 0.60 +0.30 +/- 0.61
104 2007 4823 3932 743 120 28 0 +0.09 +/- 0.59 +0.27 +/- 0.57
104 2006 6122 4858 1000 200 64 0 +0.00 +/- 0.64 +0.22 +/- 0.63
104 2005 1156 914 181 46 15 0 +0.03 +/- 0.66 +0.27 +/- 0.61
104 2004 957 816 103 30 8 0 -0.04 +/- 0.61 +0.23 +/- 0.52
104 2003 311 252 46 13 0 0 -0.09 +/- 0.63 +0.23 +/- 0.54
104 2002 802 579 172 39 12 0 +0.01 +/- 0.79 +0.25 +/- 0.67
104 2001 2159 1412 559 130 58 0 +0.03 +/- 0.88 +0.31 +/- 0.73
104 2000 1429 856 436 113 24 0 +0.10 +/- 0.93 -0.02 +/- 0.75
104 1999 1571 963 502 77 29 0 +0.21 +/- 0.89 +0.07 +/- 0.73
104 1998 2073 1344 617 91 21 0 +0.17 +/- 0.80 +0.09 +/- 0.71
104 1997 1341 861 403 65 12 0 +0.05 +/- 0.76 +0.10 +/- 0.77
```

2016NA	474	2016-07-01.62501	1.118	F	0.000	-0.557	1.118	F	0.000	0.197	0.57	Yes	0.70	-0.84	Yes
2016NA	474	2016-07-01.62536	1.118	F	0.000	0.214	1.118	F	0.000	0.157	0.22	Yes	0.70	-0.34	Yes
2016NA	104	2016-07-02.06261	0.660	F	0.083	1.722	0.600	F	-0.076	0.503	2.90	Yes	0.70	-0.40	Yes
2016NA	104	2016-07-02.06513	0.660	F	0.083	0.633	0.600	F	-0.076	-0.903	1.93	Yes	0.70	-0.70	Yes
2016NA	104	2016-07-02.08361	0.660	F	-0.036	1.906	0.600	F	-0.032	0.333	3.12	Yes	0.70	0.04	Yes
2016NA	104	2016-07-02.08614	0.660	F	-0.146	2.242	0.600	F	0.003	0.094	3.16	No	0.70	-0.67	Yes
2016NA	J04	2016-07-02.15247	0.572	F	-0.030	-0.801	0.520	F	-0.020	-0.174	1.68	Yes	0.70	-0.39	Yes
2016NA	J04	2016-07-02.15317	0.572	F	-0.030	-0.974	0.520	F	-0.020	-0.123	2.00	Yes	0.70	-0.49	Yes
2016NA	J04	2016-07-02.15382	0.572	F	-0.030	-0.840	0.520	F	-0.020	-0.118	1.74	Yes	0.70	-0.20	Yes

```
-0.03 +/- 0.79 +0.27 +/- 0.78
-0.02 +/- 0.77 -0.03 +/- 0.75
-0.22 +/- 0.86 +0.00 +/- 0.86
-0.11 +/- 1.08 -0.01 +/- 0.83
+0.30 +/- 1.44 +0.11 +/- 0.92
+0.28 +/- 1.45 +0.02 +/- 1.18
```

Verifica delle nostre misure (indicativo)

- Find_orb
- Si crea un file txt con tutte le misure
- Si verificano i residui

16 07 01.625359	474	22 01 43.50	-12 52 22.9	2.1-	.72-
16 07 02.06261	104	00 09 47.57	-08 20 29.7	.32-	.35+
16 07 02.06513	104	00 10 23.54	-08 18 26.9	1.4-	1.1-
16 07 02.08361	104	00 14 44.38	-08 03 16.8	.17-	.22+
16 07 02.08614	104	00 15 19.61	-08 01 12.9	.06+	.01+

4 observations selected of 66
Mean RA residual -0.46 +/- 0.56; dec -0.12 +/- 0.55
2016 July 2 (33.9 min)
Version Jul 27 2014
No JPL DE ephemeris file loaded; using (slower) PS1996 series
See http://www.projectpluto.com/find_orb.htm#de_eph for info on how/why to use JPL DE ephemerides

FIND_ORB Orbit Determination Software

Open... 2016 NA

Perturbers:
☒ Merc ☒ Mars ☒ Uran
☒ Venu ☒ Jupi ☒ Nept
☒ Eart ☒ Satu ☒ Plut
☒ Moor ☐ Asteroids
All Perturbors Off

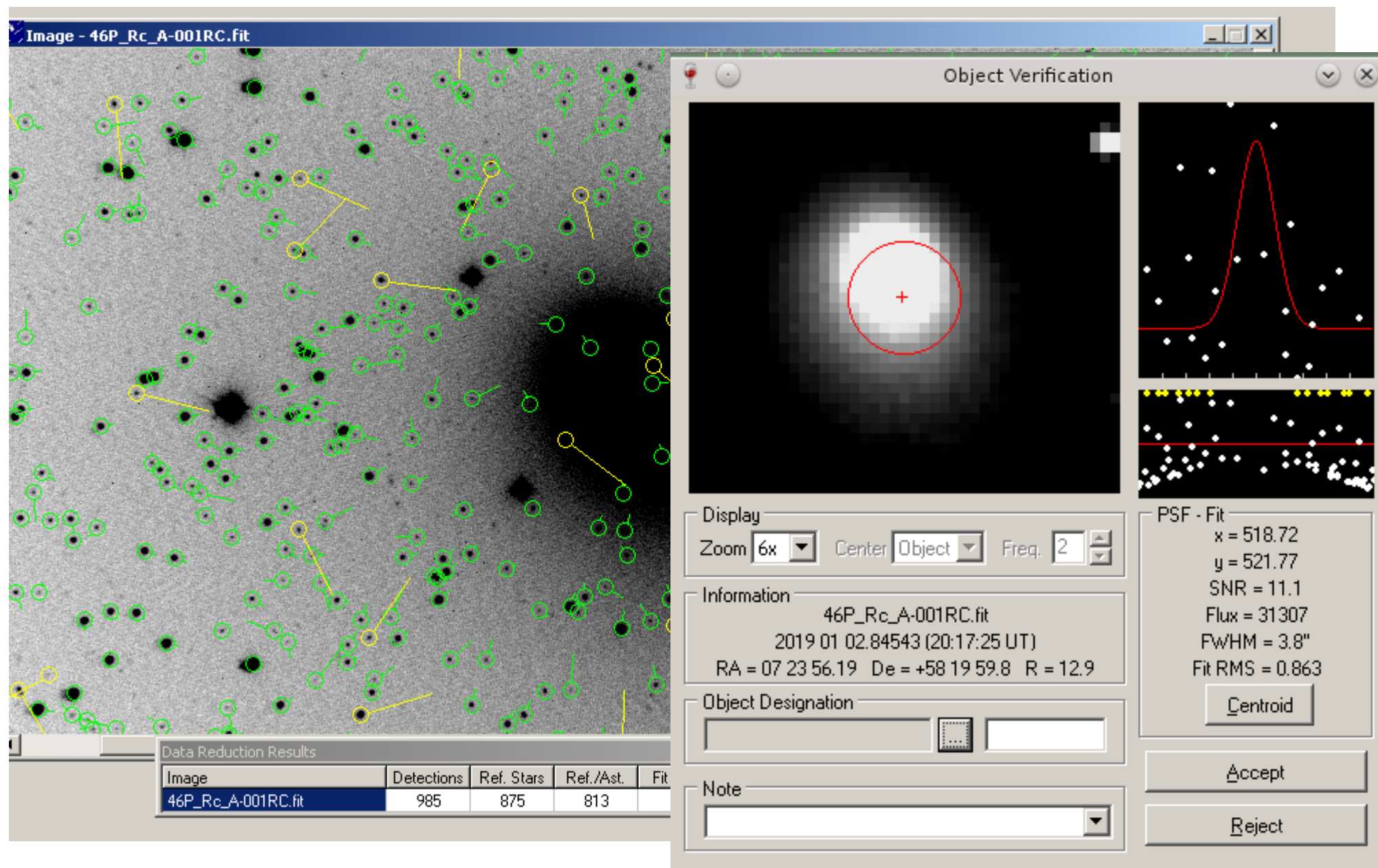
Epoch 2016 Jul 1
R1: 0.0041 AU
R2: 0.0036 AU

Orbital elements: 2016 NA
Perigee 2016 Jul 1.705043 TT = 16:55:15 (JD 2457571.205043)
Epoch 2016 Jul 1.0 TT = JD 2457570.5 Find_Orb
q482961.257km
H 26.9 G 0.15 Peri. 302.17613
Node 33.38901
e 66.9568320 Incl. 14.80193
53 of 66 observations 2016 July 1-2 (23.9 hr); mean residual 1".632.

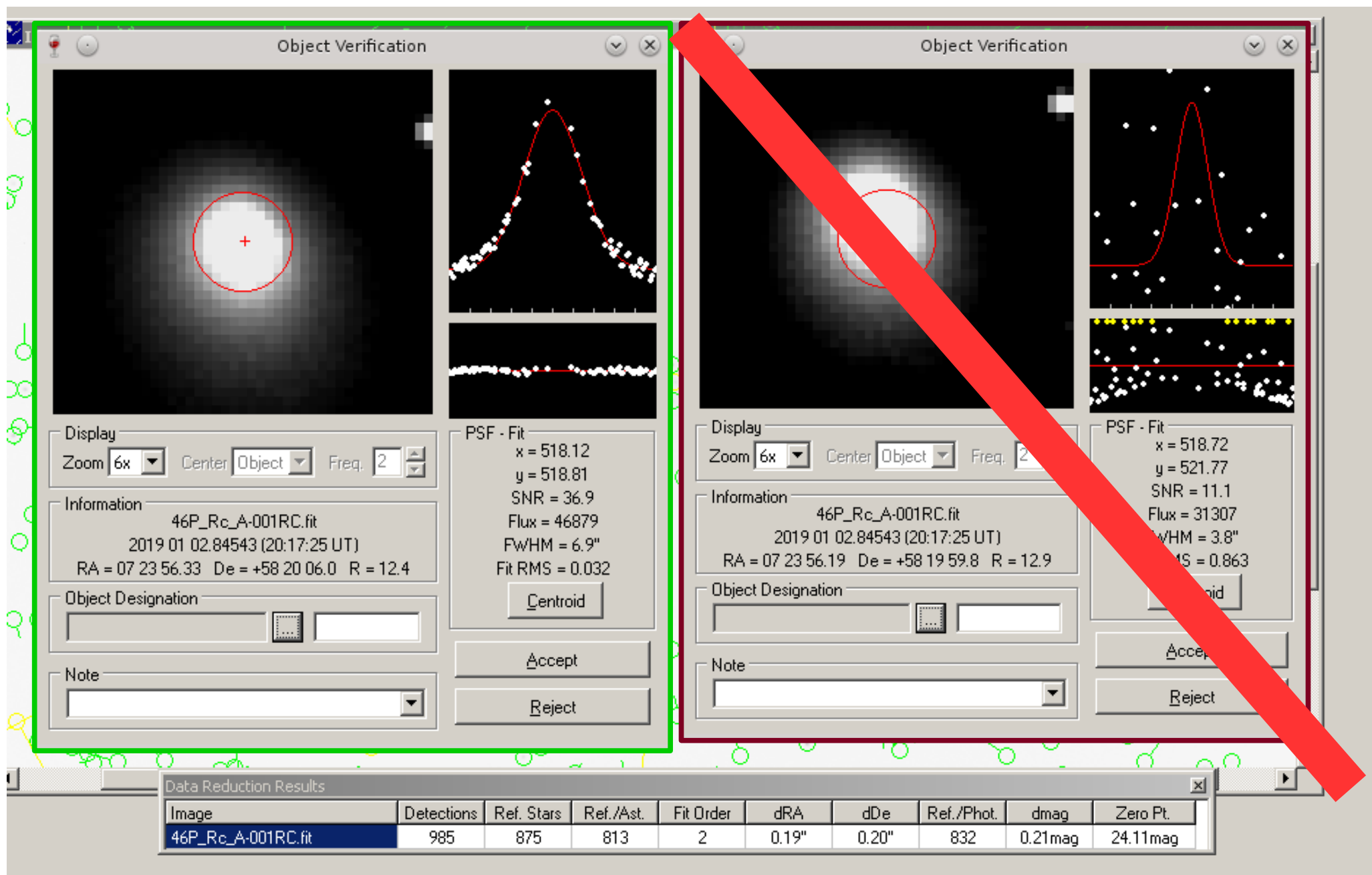
16 07 01.508345	474	21 27 14.43	-13 42 00.4	2.3-	.69-
16 07 01.568414	474	21 44 47.38	-13 19 30.8	2.9-	.71-
16 07 01.568762	474	21 44 53.57	-13 19 21.7	2.5-	.53-
16 07 01.569109	474	21 44 59.73	-13 19 12.9	2.4-	.63-
16 07 01.569456	474	21 45 05.85	-13 19 03.9	2.8-	.55-
16 07 01.569803	474	21 45 12.01	-13 18 55.0	2.6-	.57-
16 07 01.570150	474	21 45 18.13	-13 18 45.9	3.1-	.41-
16 07 01.570498	474	21 45 24.35	-13 18 37.0	2.3-	.49-
16 07 01.623623	474	22 01 12.26	-12 53 17.7	3.4-	.91-
16 07 01.623970	474	22 01 18.59	-12 53 06.6	1.8-	.70-
16 07 01.624317	474	22 01 24.77	-12 52 55.6	2.5-	.61-
16 07 01.624780	474	22 01 33.11	-12 52 41.1	2.1-	.67-
16 07 01.625012	474	22 01 37.22	-12 52 33.8	2.8-	.68-
16 07 01.625359	474	22 01 43.50	-12 52 22.9	2.1-	.72-
16 07 02.06261	104	00 09 47.57	-08 20 29.7	.32-	.35+
16 07 02.06513	104	00 10 23.54	-08 18 26.9	1.4-	1.1-
16 07 02.08361	104	00 14 44.38	-08 03 16.8	.17-	.22+
16 07 02.08614	104	00 15 19.61	-08 01 12.9	.06+	.01+

Elong 188.1 Phase 79.7 RA vel 143.8'/hr decvel 34.08'/hr dT=-.048 sec
ang vel 147.8'/hr at RA 76.7 radial vel 3.141 km/s cross -0.25 3.5 days ago
Delta 537901 +/- 1.0174 mag=17.10 mag (computed)=17.02 2016 Jul 2 2:00:23.90
Sigma 0.50" MPEC 2016-N6 Obj alt 25.4 az 132.3 Sun alt -13.6 az 37.4 UCAC-3
Mag sigma 0.5; time sigma 1
San Marcello Pistoiese (N44.0631 E10.8042) Italy
K16N00A KC2016 07 02.08361 00 14 44.38 -08 03 16.8 17.1 RuEN006104

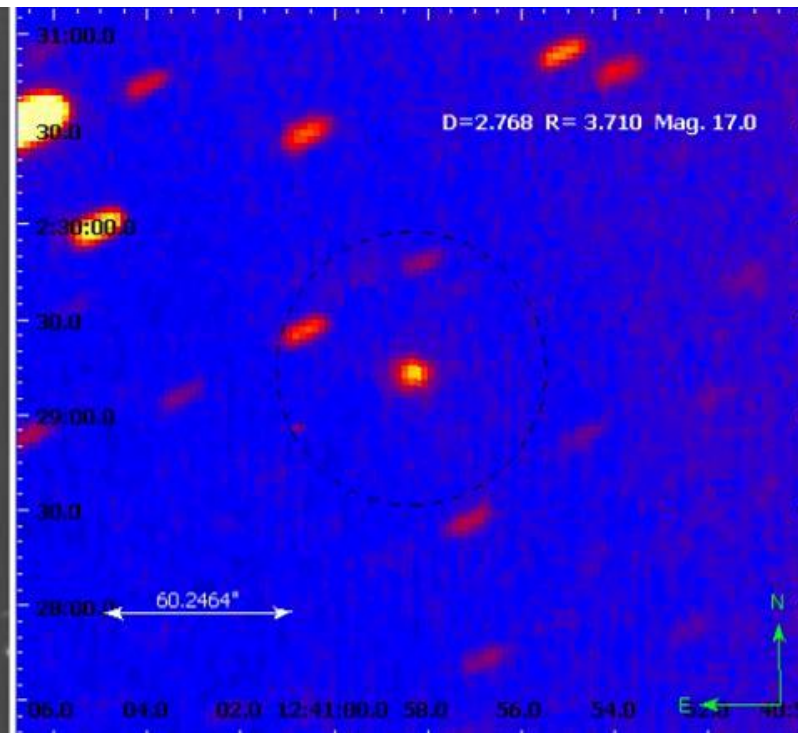
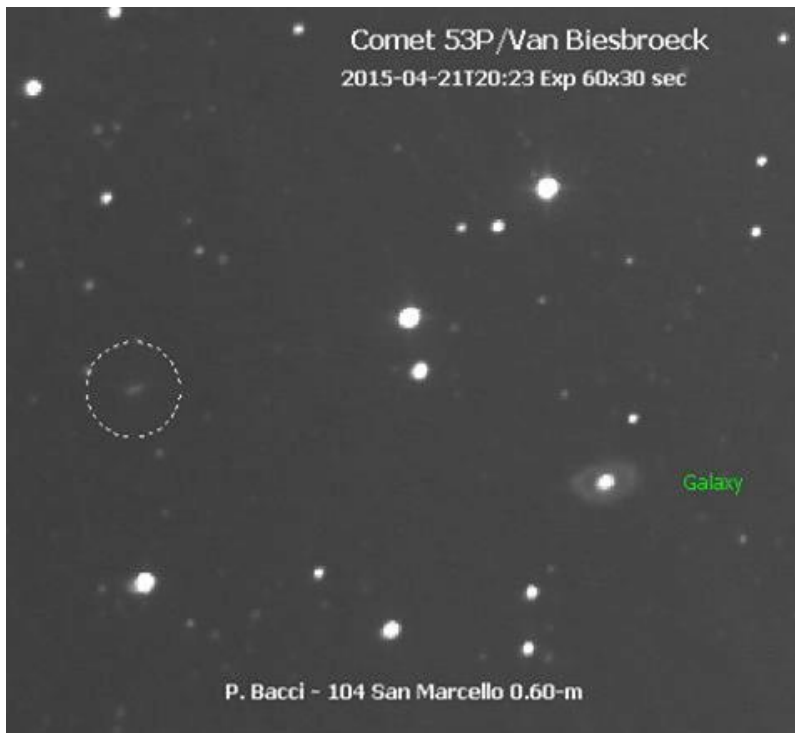
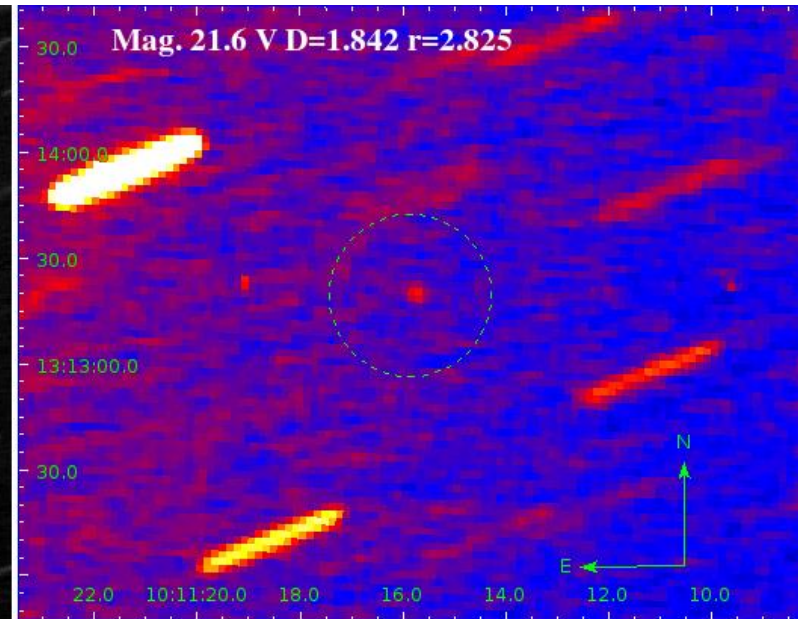
Misuriamo le comete



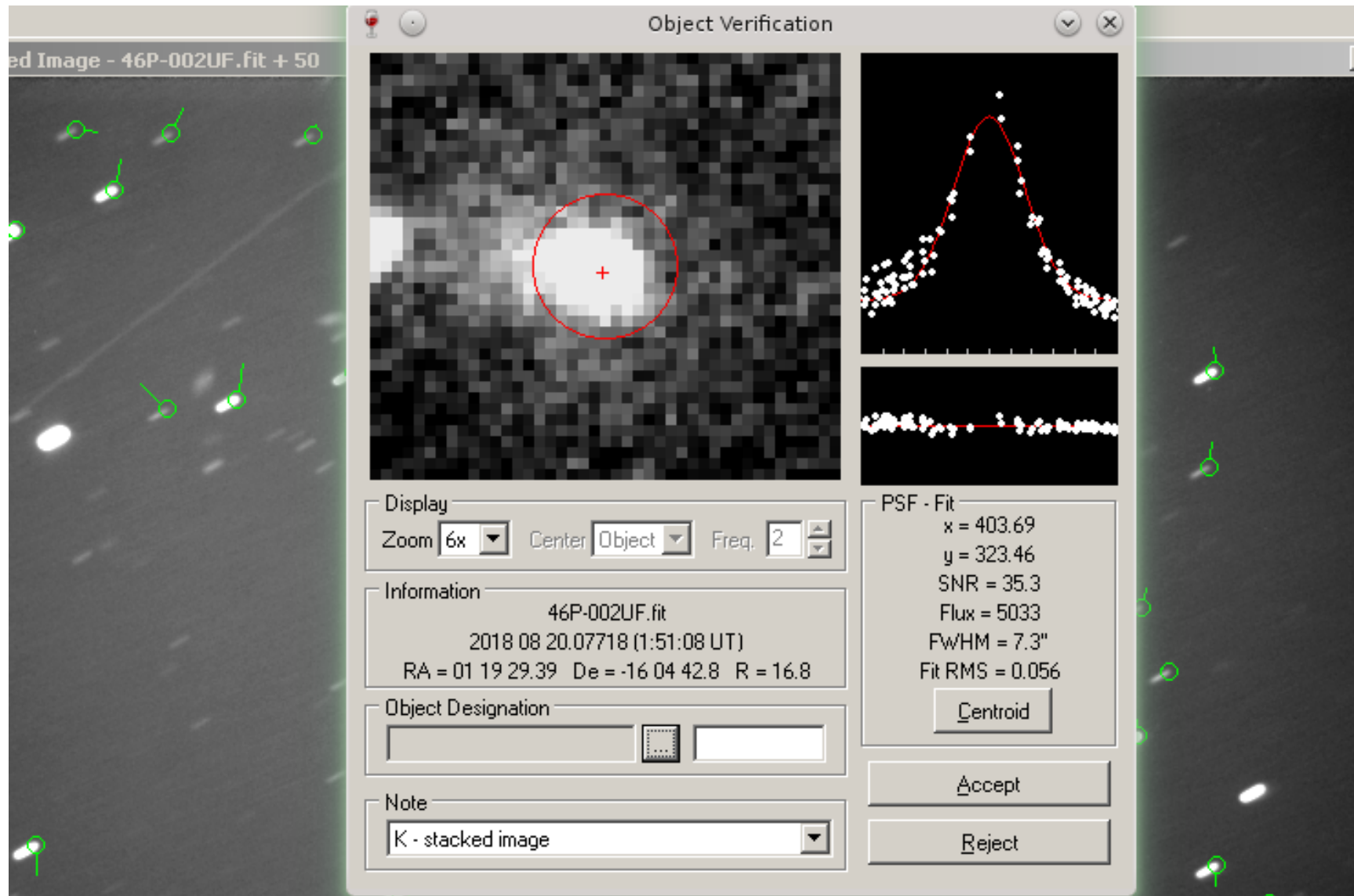
Misuriamo il centroide



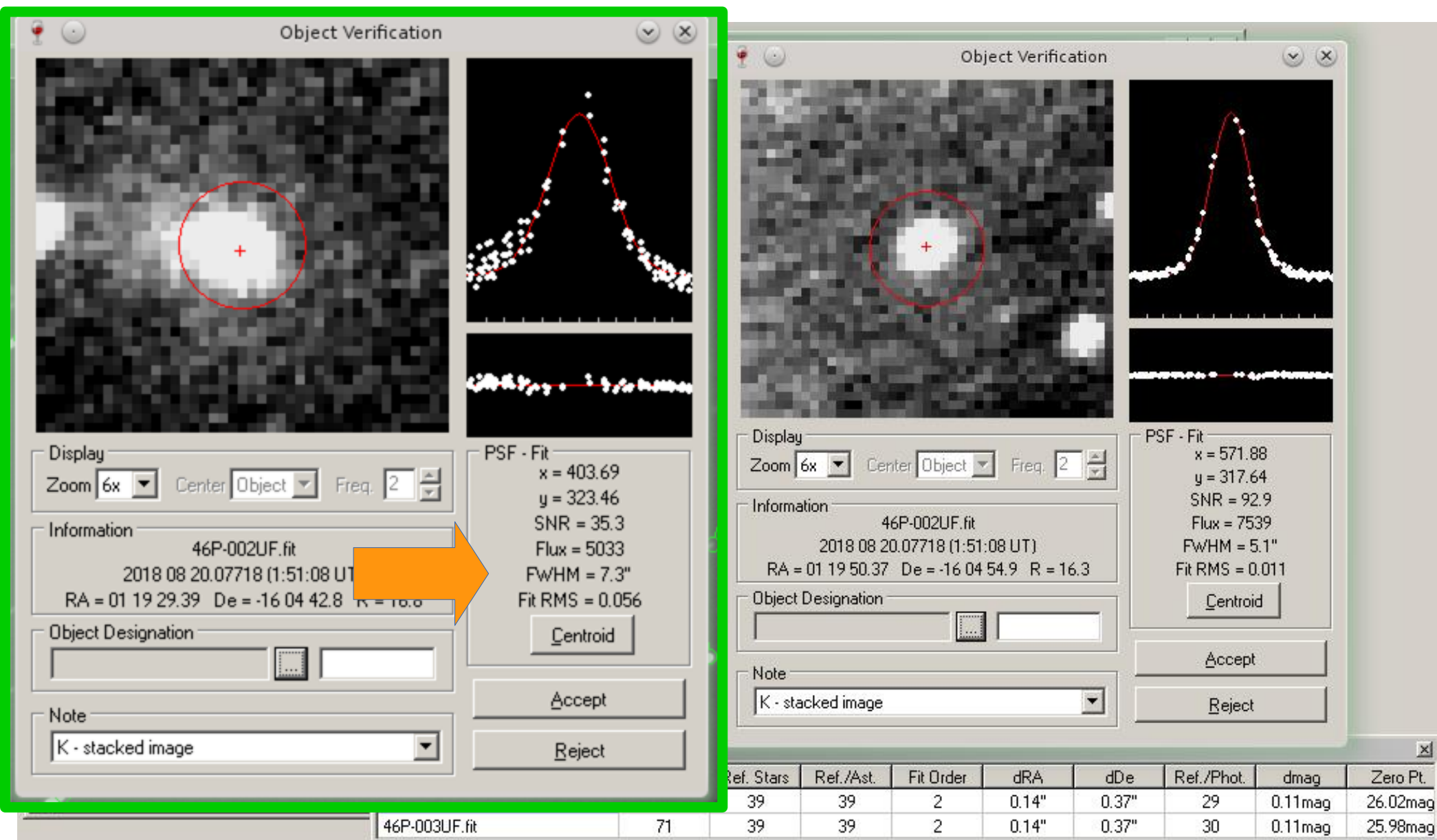
Asteroidi & Comete



FWHM indicator (?)



FWHM Stelle

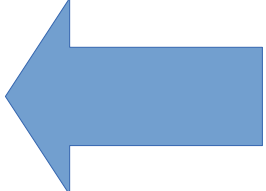


Comunichiamo che l'oggetto osservato è una cometa !!
:-)

• CBAT@IAU.ORG

• OBS@CFA.HARVARD.EDU

```
COD 104
OBS P. Bacci, M. Maestripieri
MEA P. Bacci, L. Tesi, G. Fagioli
TEL 0.60-m F4 Reflector + CCD
ACK MPCReport file updated 2019.06.24 22:56:24
AC2 B09.backman@gmail.com
ACK NEOCP A10eeCI
COM Object present cometary feature FWHM is about 30% bigger then star
COM with the same magnitude.
NET UCAC-4
      A10eeCI KC2019 06 24.92962 22 50 25.65 +43 23 25.6      18.1 R      104
      A10eeCI KC2019 06 24.93800 22 50 25.64 +43 23 28.3      18.1 R      104
      A10eeCI KC2019 06 24.94079 22 50 25.65 +43 23 29.2      18.2 R      104
----- end -----
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Strumenti utili del MPC

•Minor Planet & Comet **Ephemeris Service** (MPES) Generate current ephemerides for an arbitrary list of minor planets and comets.

•**NEA Observations Planning Aid**.

•MPC Database Search

•Get **NEO ratings** for your observations.

•**MPChecker** checks possible new minor planet suspects against known objects.

•**New Object Ephemeris Generator**

•Statistics on **residuals** from observations of minor planets, by observatory code

•Statistics on **residuals** from observations of numbered minor planets, by observatory code

• Sky coverage

•Date of Last Observation of NEOs not seen in a while, with easy access to ephemerides.

•Orbital Elements for Software Packages

Siti di riferimento

- Neodys

- Astdys

- HORIZONS Web-Interface - JPL Solar System Dynamics

- NASA Orbit

- Lowell Asteroid Services
- ESA NEO Coordination Centre
- Display statistics for the year
- Minor Planet Bulletin

- Goldstone Asteroid Schedule

- Sormano Astronomical Observatory: Minor Body Priority List

- MPML maillist

- NEA Up coming Close Approaches

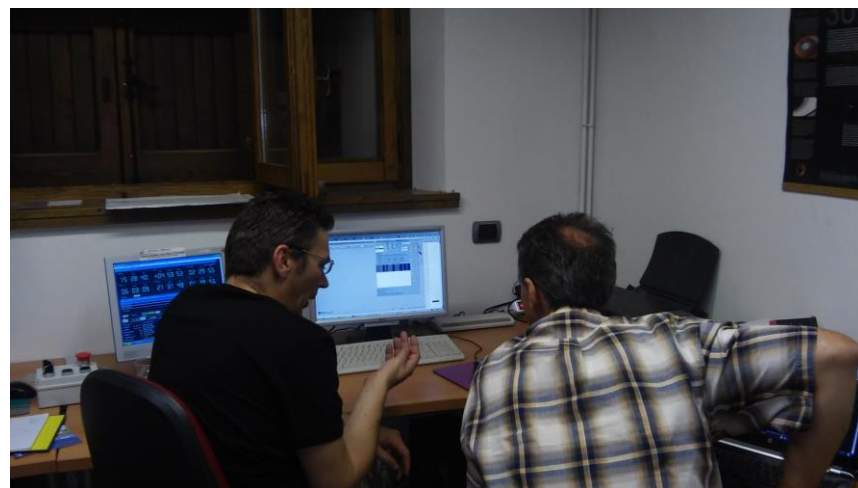
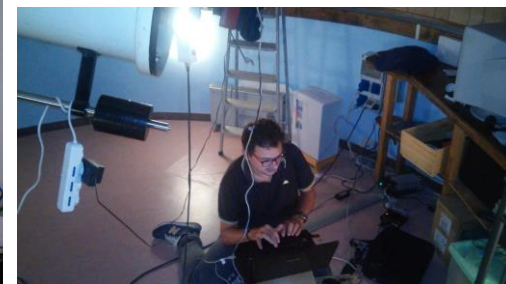


Software di riferimento

- Astrometrica
- AstroArt
- Iris
- AstroJimage
- Canopus

- Xephem
- Thesky6
- Guide
- Cartes du Ciel

- Find_orb
- MPCOrb
- SOLEX10



...Grazie per la stoica vostra pazienza...

