



Astrometry of Three NEAs with Li-jiang 2.4m Telescope

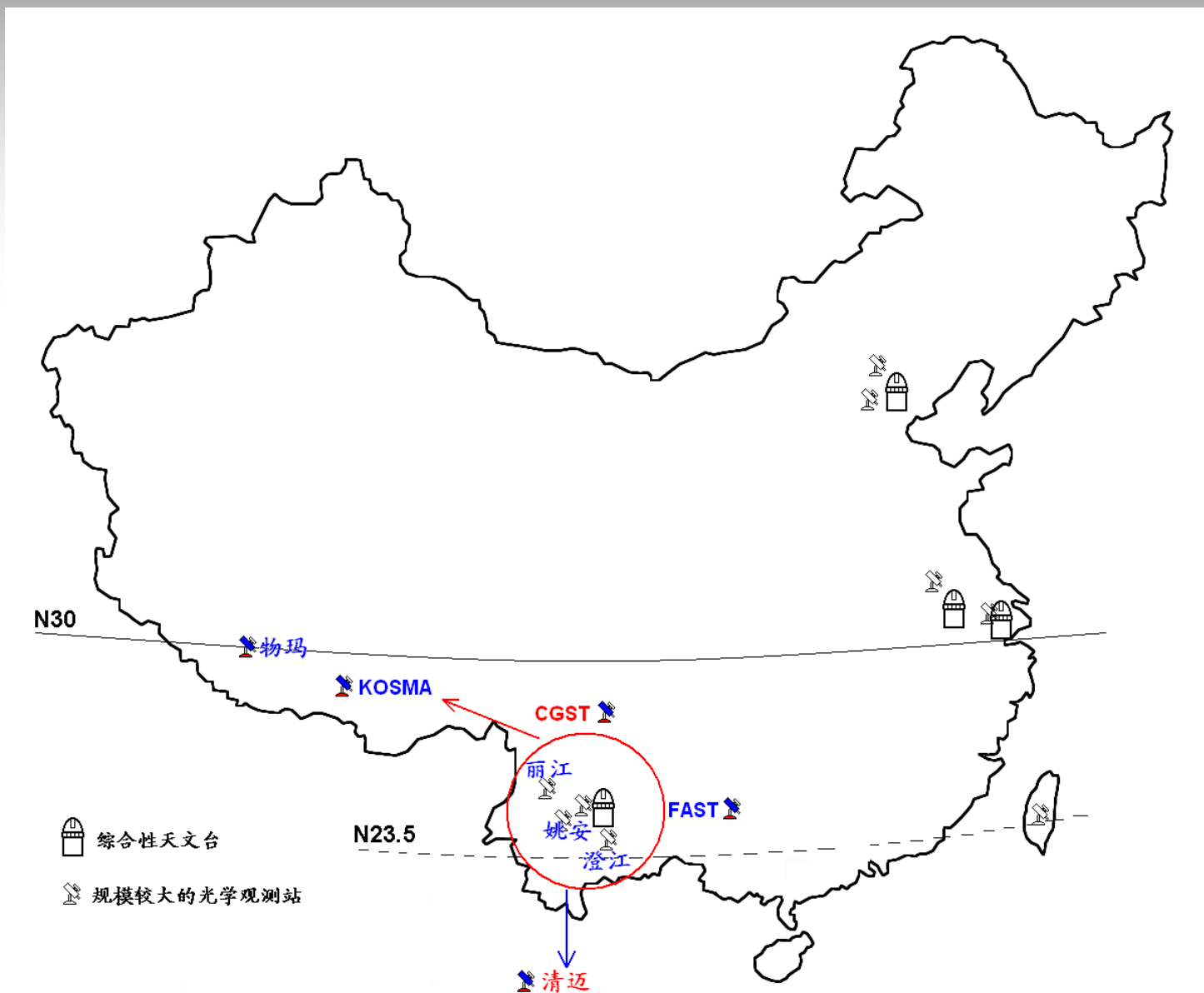
ZHANG Xi-Liang

Yunnan Observatories / CAS, China

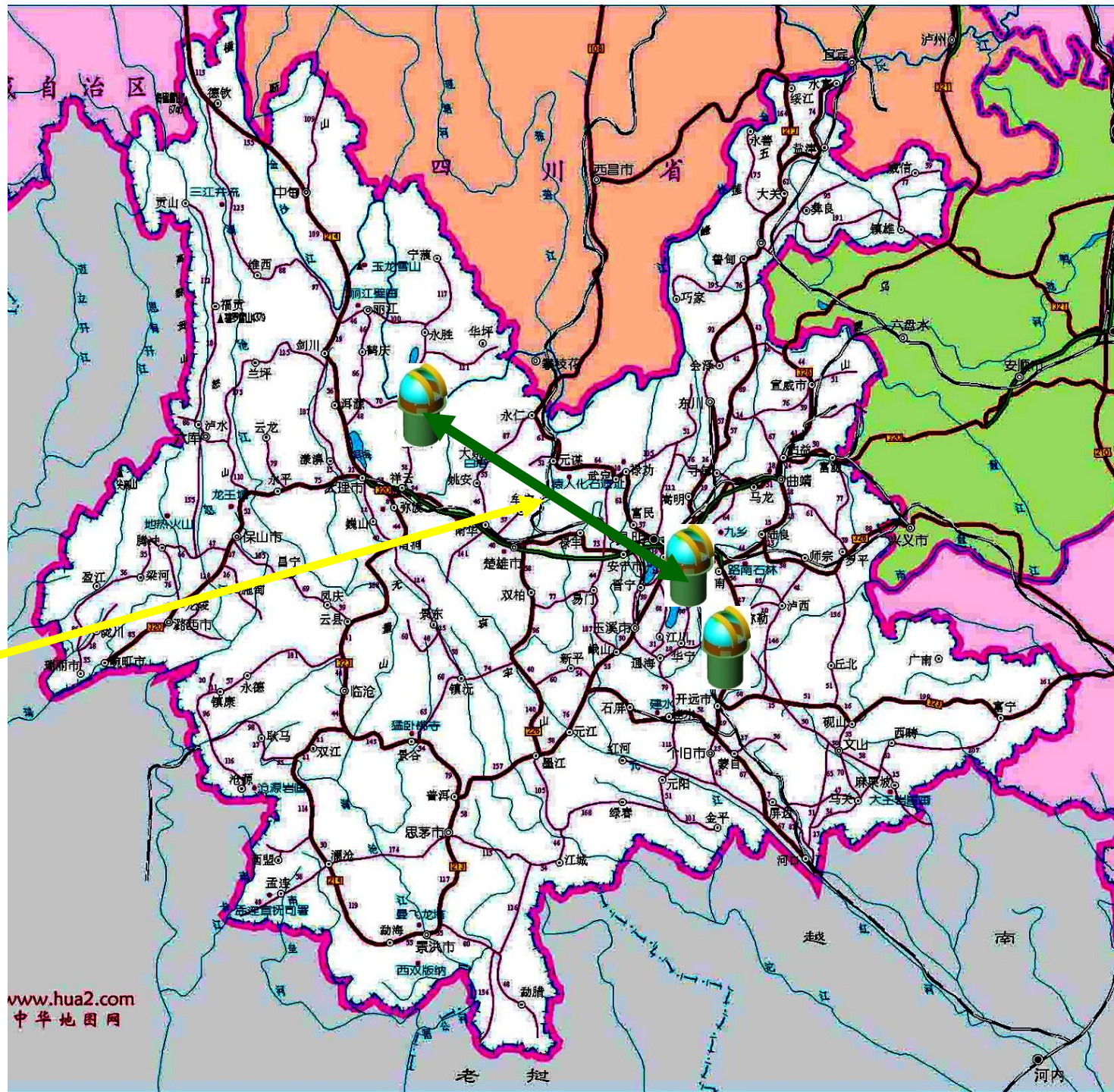
**GAIA-FUN-SSO Workshop -3
Nov. 24-26, 2014, Paris / France**

1, Introduction of Li-jiang 2.4m Telescope

The Location of Yunnan Observatories



560 Km
GaoMeiGU



Astronomical conditions:

† Location: $100^{\circ} 2'$ (E), $26^{\circ} 42'$ (N), 3200m

† Available nights: 210

† Average seeing condition: $0''.9$

† Sky background: $V = 21.54$ mag

$B = 22.34$ mag

† Atmospheric extinction: $V = 0.135$ mag

$B = 0.298$ mag

† Water vapour: 4.3 mm (Oct. ~April)

13.0 mm (May~Sep.)

**Ground View
of
Asia at Night**





Remote view of snow mountains



Clouds at Lijiang Observatory



The morning scenery at Lijiang Observatory

The overall plan of Lijiang Observatory

North

Area: 17.4 acres

Highest point: 3242m

Relative height: 800m

2.4m telescope

Made by the TTL (**T**elescope
Technologies **L**imited,UK)

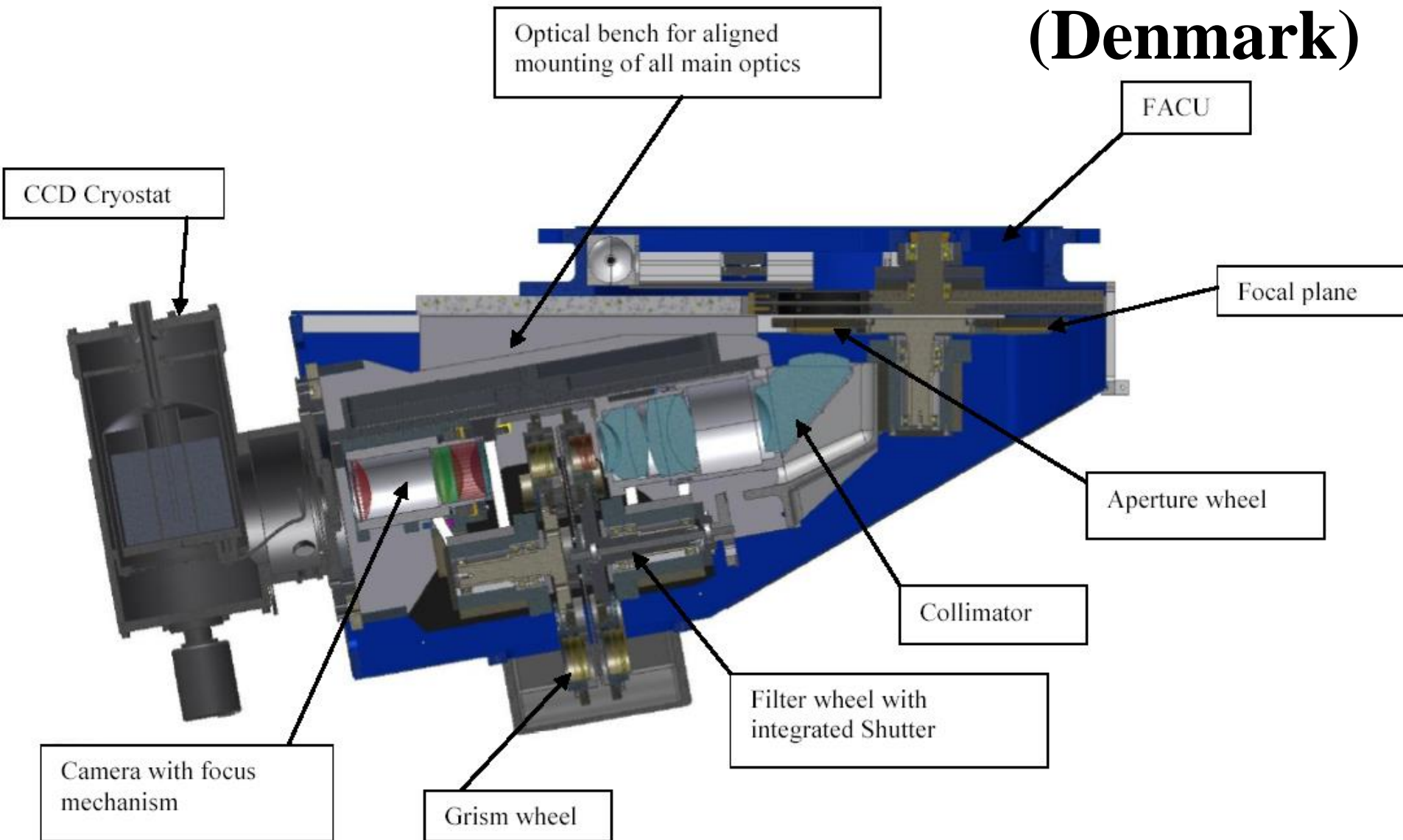
1.8m telescope

**Burst Optical Observer
and Transient Exploring
System (bootes-4)**



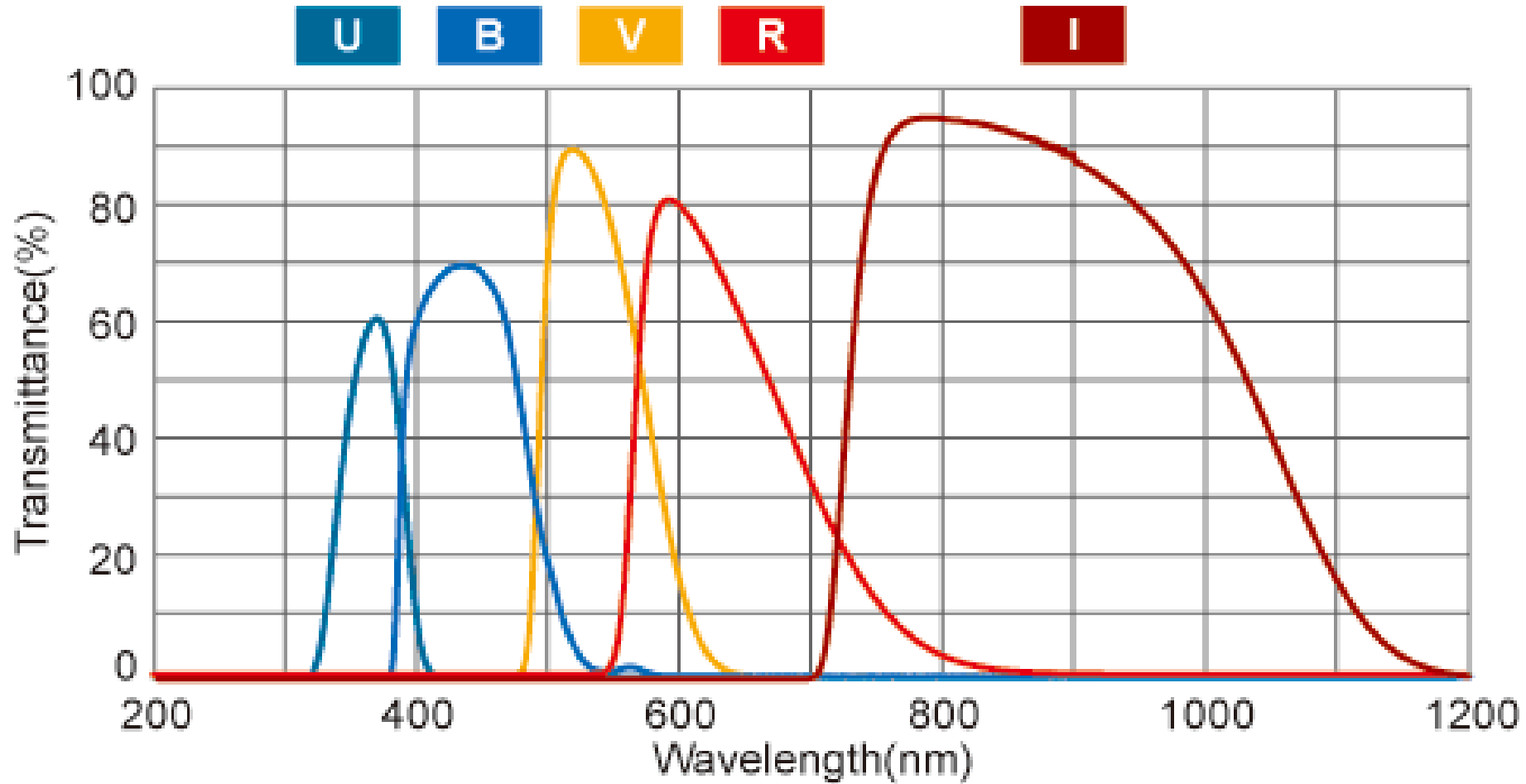
South

Faint Object Spectrograph and Camera (Denmark)

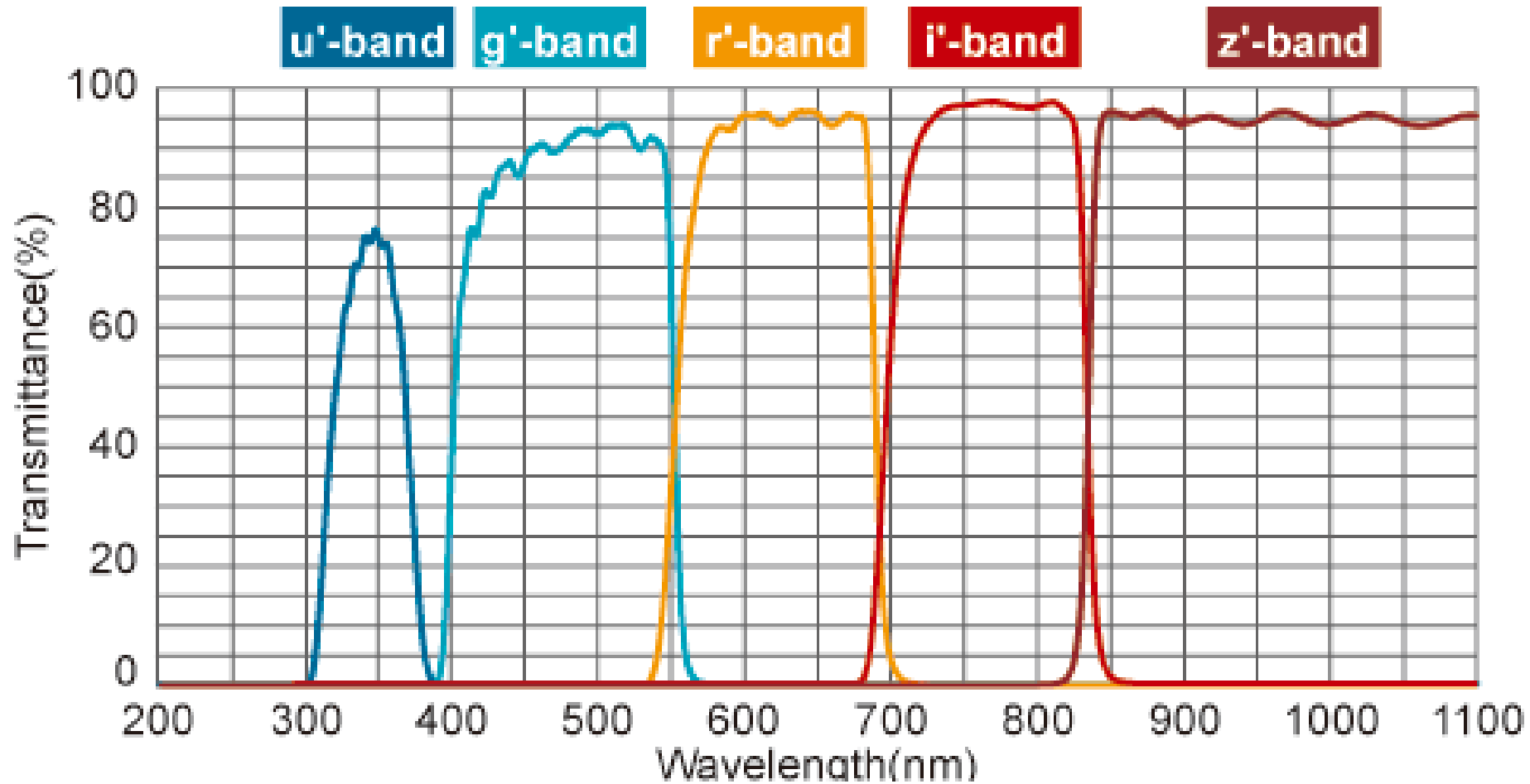


Camera	F-length	CCD FOV	Size of Pixel	Size of CCD	size/pixel
YFOSC	9840mm	10.1' × 10.4'	13.5μm × 13.5μm	2148 × 2200	0".283

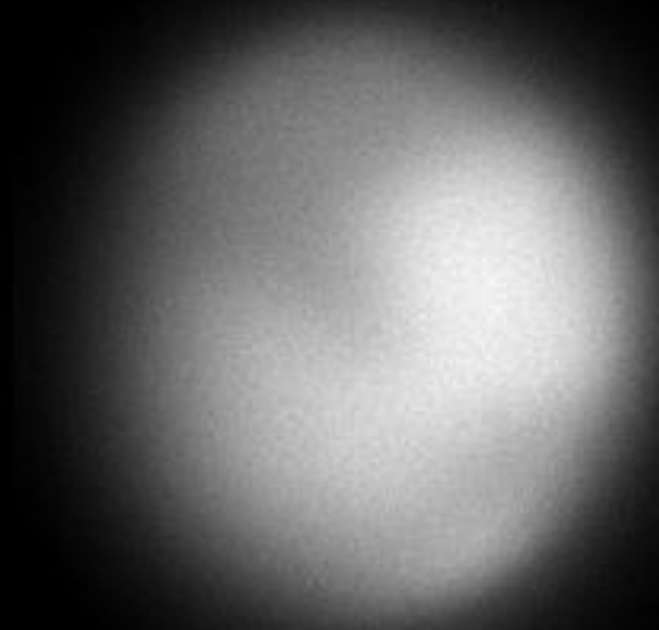
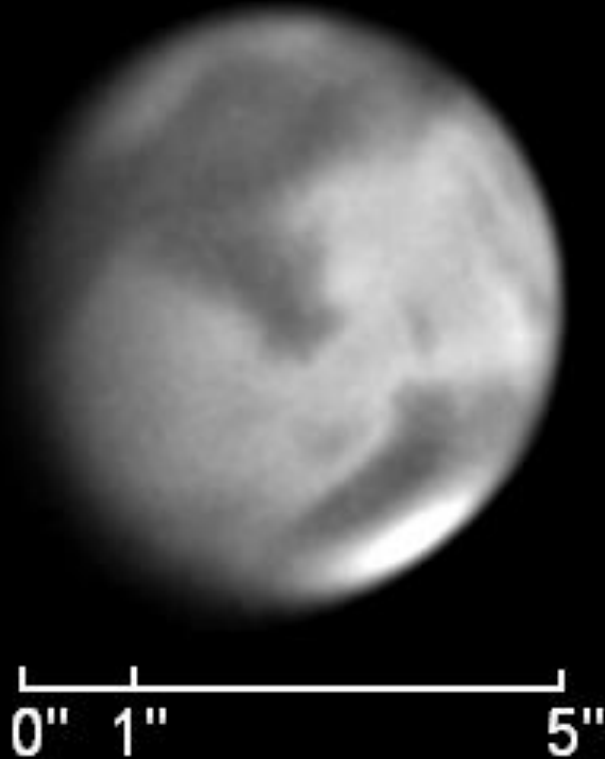
The Filters



The Filters



High resolution image of the Mars



2.4m Telescope + Speckle Camera. The right image is original speckles of the Mars. The left is reconstructed with high resolution. This technic could be used to reconstruct the planets and their satellites. The resolution could reach about $0''.1$.

To Join the GAIA Follow-up Network

- Gaia is an ambitious mission to chart a three-dimensional map of our Galaxy.
- Additional scientific products include:
 - detection and orbital classification of tens of thousands of extra-solar planetary systems,
 - a comprehensive survey of objects ranging from huge numbers of minor bodies in our Solar System,
 - through galaxies in the nearby Universe, to some 500 000 distant quasars.
- It will also provide a number of stringent new tests of general relativity and cosmology....

→ To work with FUN!

2, Astrometry of Three NEAs

a, (367943) Duende – 2012 DA14

Diameter: 45m Type: Apollo

Brightness: 7.2 Vmag Velocity: 1' /s

b, (99942) Apophis: 18 mag, 320m, Aten

c, 2013 TV135: 18~19.2 mag, 400m, Apollo

<ftp.imcce.fr>

2012 DA14 - Observation

NEA: 2012 DA14
(367943) Duende

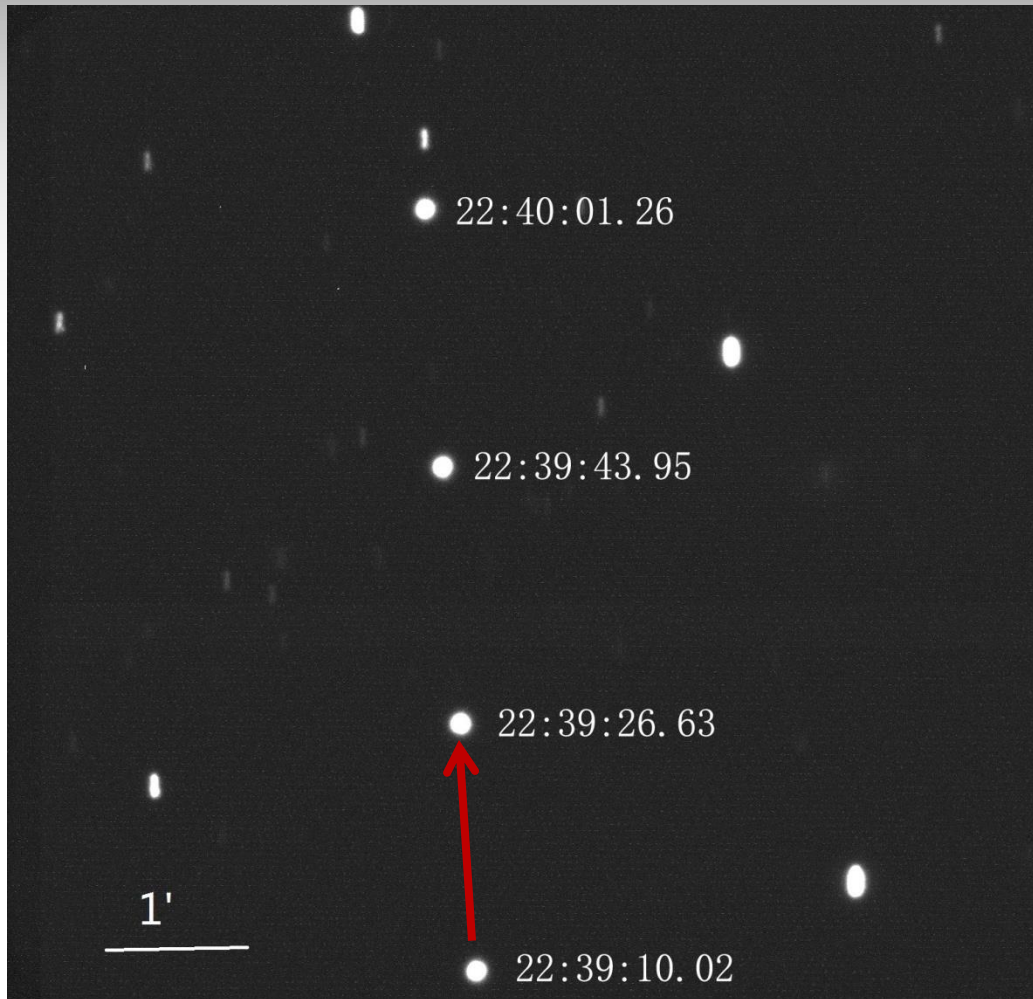
Velocity: 6.4" /s

Date: 2013-2-15

Telescope: Lijiang 2.4m

2013-2-15 19:25 (UT)

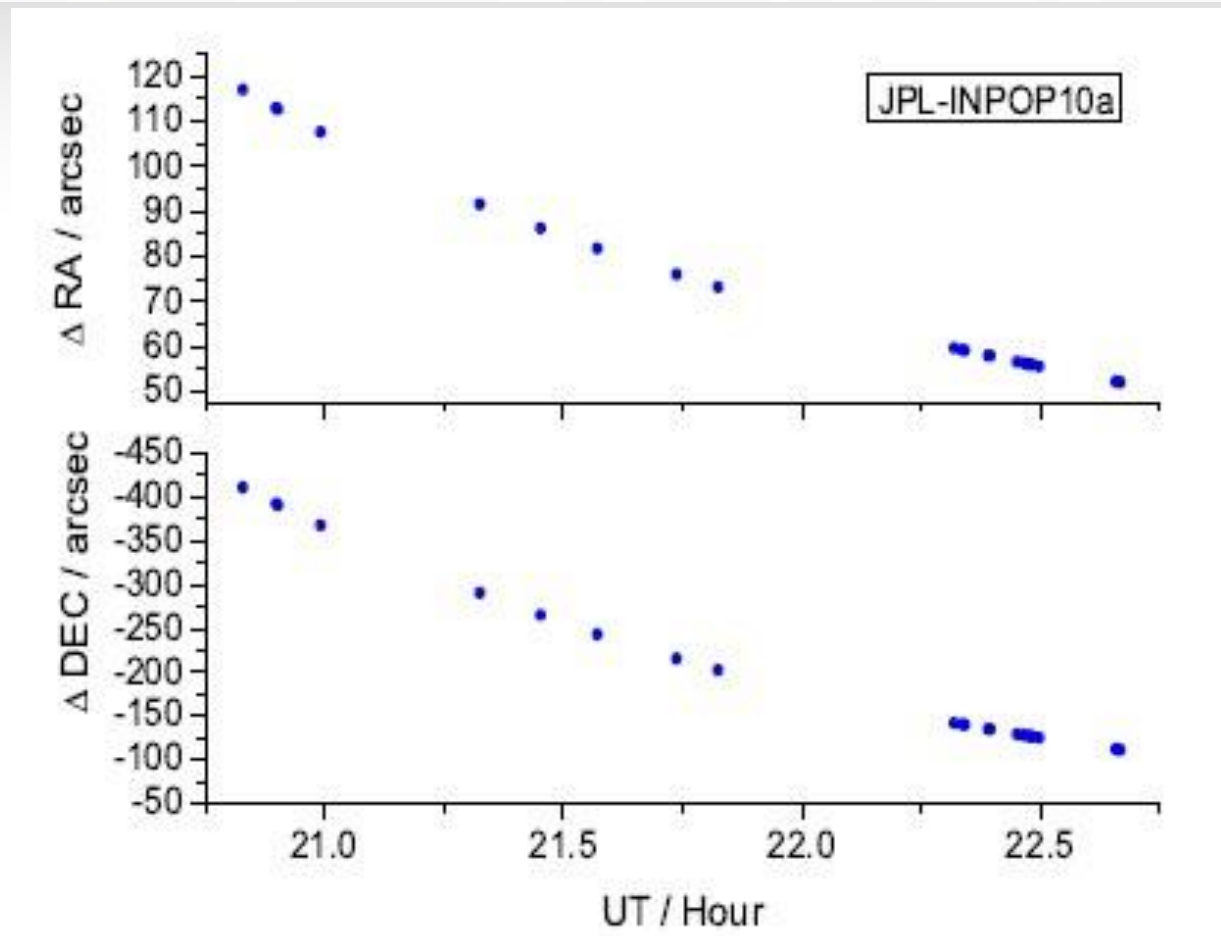
Least distance: 27743 km



Observation for faint and fast objects !

2012 DA14 - comparison

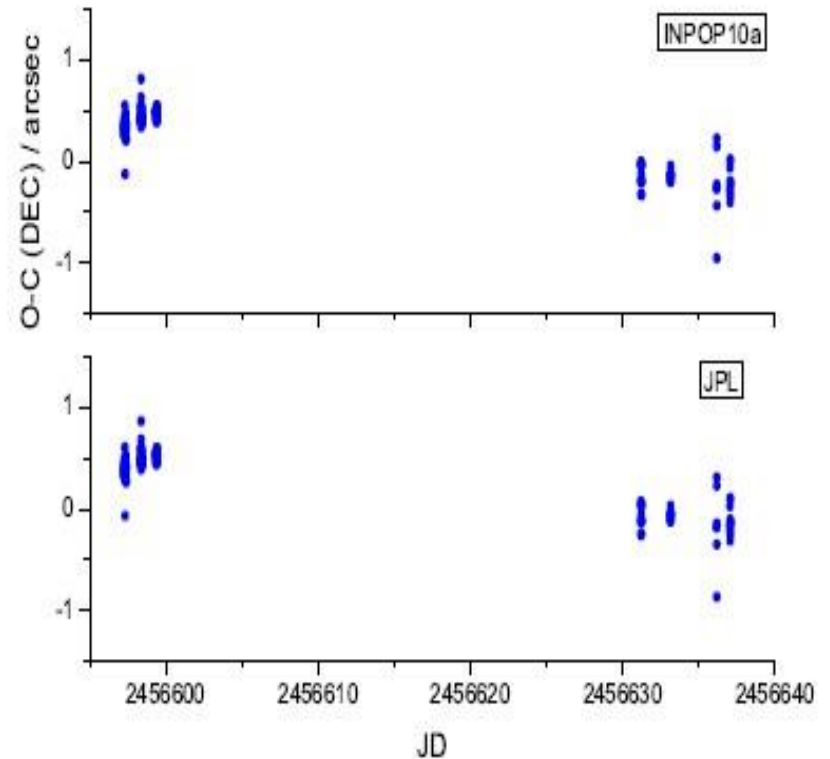
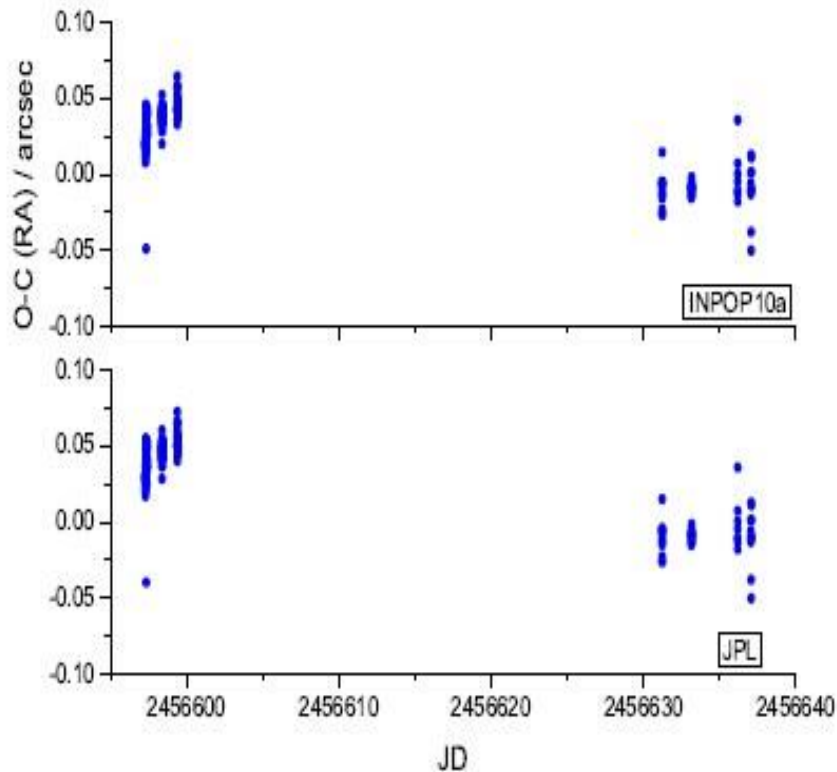
Ephemerides	Mean(//)		StdDev(//)	
	RA	Dec	RA	Dec
JPL-INPOP10a	71.72749	-199.03512	22.19941	103.39296



More astrometric data is necessary !

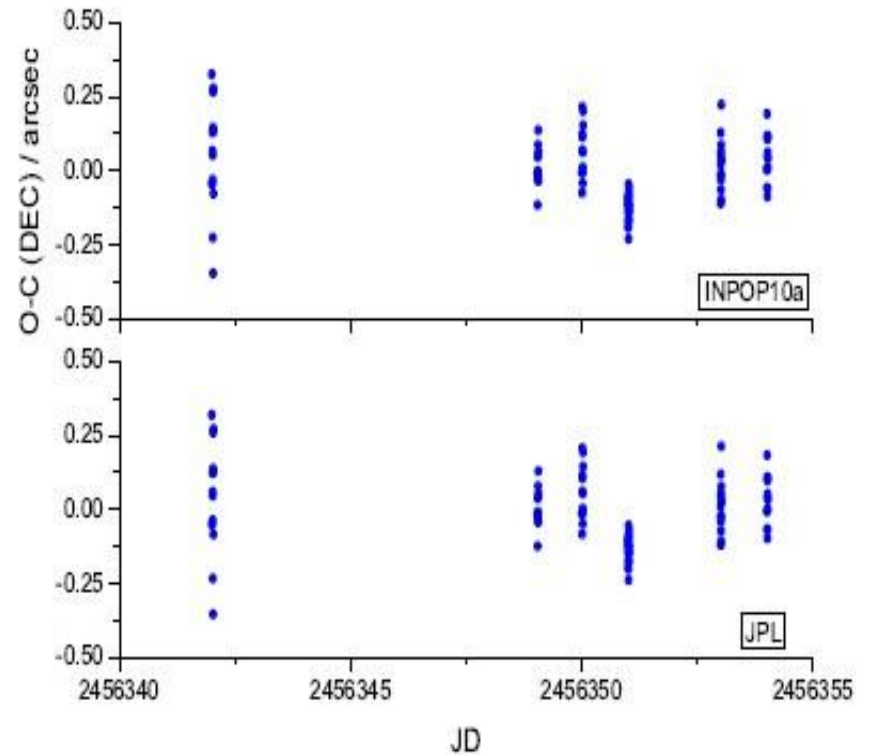
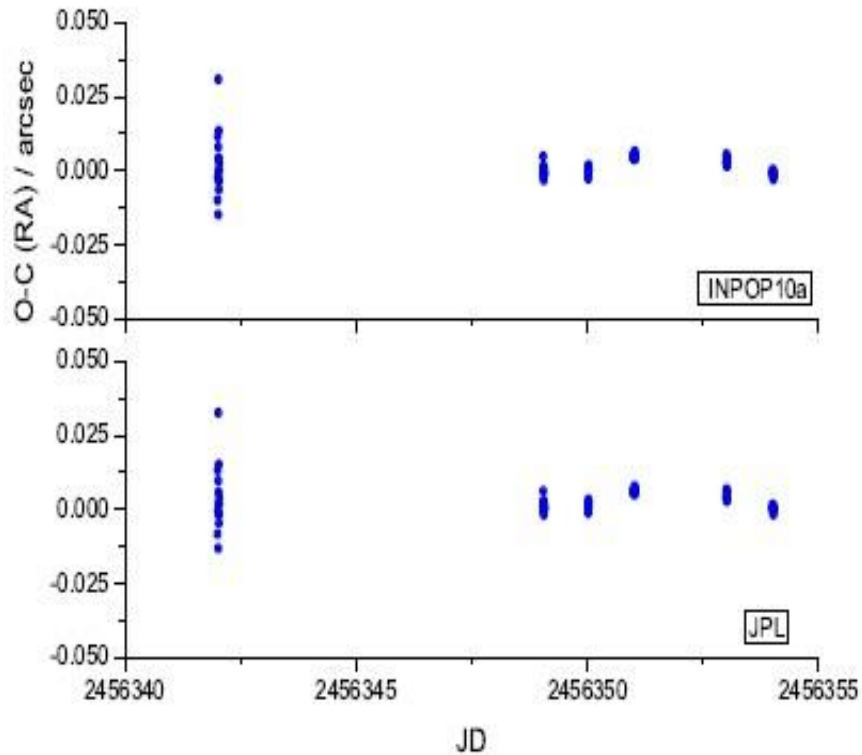
2013 TV135

Ephemerides	Mean(O-C)		StdDev(O-C)	
	RA (arcsec)	Dec (arcsec)	RA (arcsec)	Dec (arcsec)
INPOP10a	0.02582	0.28790	0.02152	0.26514
JPL	0.03263	0.34932	0.02413	0.25487



Apophis

Ephemerides	Mean(O-C)		StdDev(O-C)	
	RA (mas)	Dec (mas)	RA (arcsec)	Dec (arcsec)
INPOP10a	1.900	2.830	0.00501	0.13453
JPL	3.330	-5.610	0.00501	0.13469



Apophis - Comparison

	Ephemerides	Mean(O-C)		Std Dev (O-C)		software
		RA (mas)	DEC (mas)	RA (mas)	DEC (mas)	
ZHANG	IMCCE	2	3	5	135	PRISM
	JPL	3	6	5	135	
PENG	without GD correction	9	6	59	71	own
	IMCCE	21	3	40	64	
D. Bancelin W. Thuillot	JPL			27	38	PRAIA

**Homogenous data,
Consistent way is necessary !**

Je vous remercie!

Welcome to Lijiang !