

**Follow-up Observations and  
New Astronomical Facilities on Lijiang  
Observatory**

**Yufeng Fan & Xiliang Zhang**

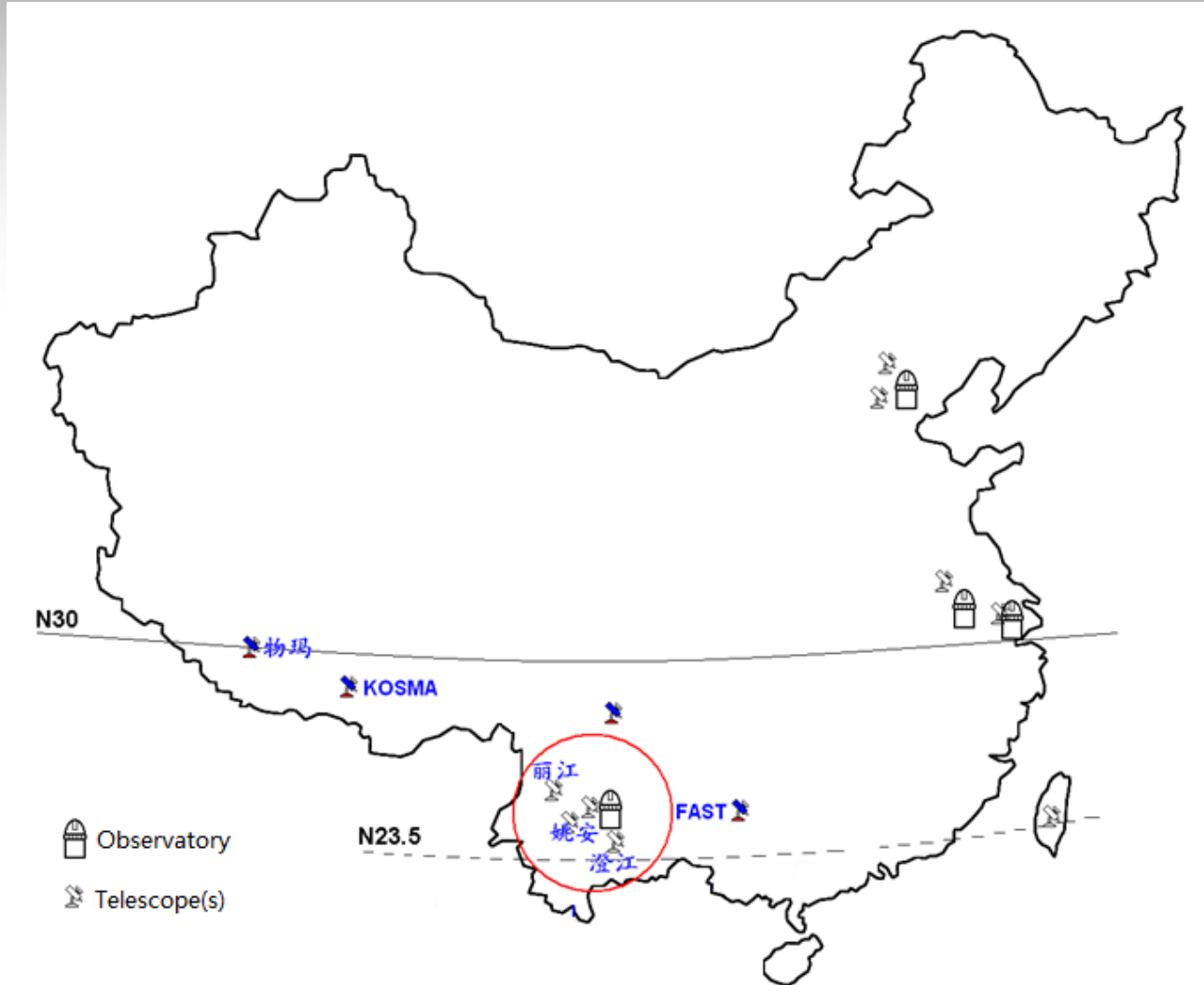
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**Yunnan Astronomical Observatory, Chinese Academy of Sciences**

# Outline

- Lijiang Observatory
- 2.4m telescope
- Obs. 2005 YU55
- 60cm robotic telescope (New built)
- Gaia-FUN-SSO Observation

# Location of Yunnan Observatory





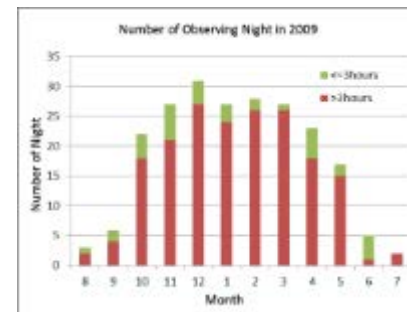
## Astronomical conditions:

### Coordinates

Lat:  $26^{\circ} 41'43''\text{N}$

Long:  $100^{\circ} 01'47''\text{E}$

Elev: 3231m



Available nights: 220 (most in winter)

Average seeing condition:  $0''.9$

Sky background:  $V = 21.54 \text{ mag}$

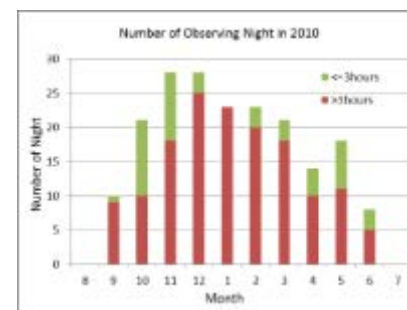
$B = 22.34 \text{ mag}$

Atmospheric extinction:  $V = 0.135 \text{ mag}$

$B = 0.298 \text{ mag}$

Water vapour: 4.3 mm (Oct. ~ April)

13.0 mm (May ~ Sep.)





**Remote view of snow mountains**





H-P comet and the zodiac light

# Lijiang Observatory

Area: 17.4 acres

Highest point: 3242m

Relative height: 800m

2.4m telescope

Made by the TTL (Telescope Technologies Limited, UK)

60cm robotic telescope  
(new built)

1.8m telescope







- RC system, one Cassegrain focus, one Nasmyth platform
- Aperture: 2.4 meters
- Focal ratio: F/8
- Image quality:  $<0''.35$  (on axis) &  $<0''.5$  (40arc min FOV)
- Pointing accuracy:  $<3''$
- Tracking accuracy:  $<2''$  /hr (open loop) &  $<0''.5$ /hr (off axis auto-guided)
- Capable for Remote control



**\*Yunnan Faint Object Spectrograph/Camera (YFOSC)**

**\*PI VersArray 1300B CCD camera**

**\*Lijiang Exoplanet Tracker (LiJET)**

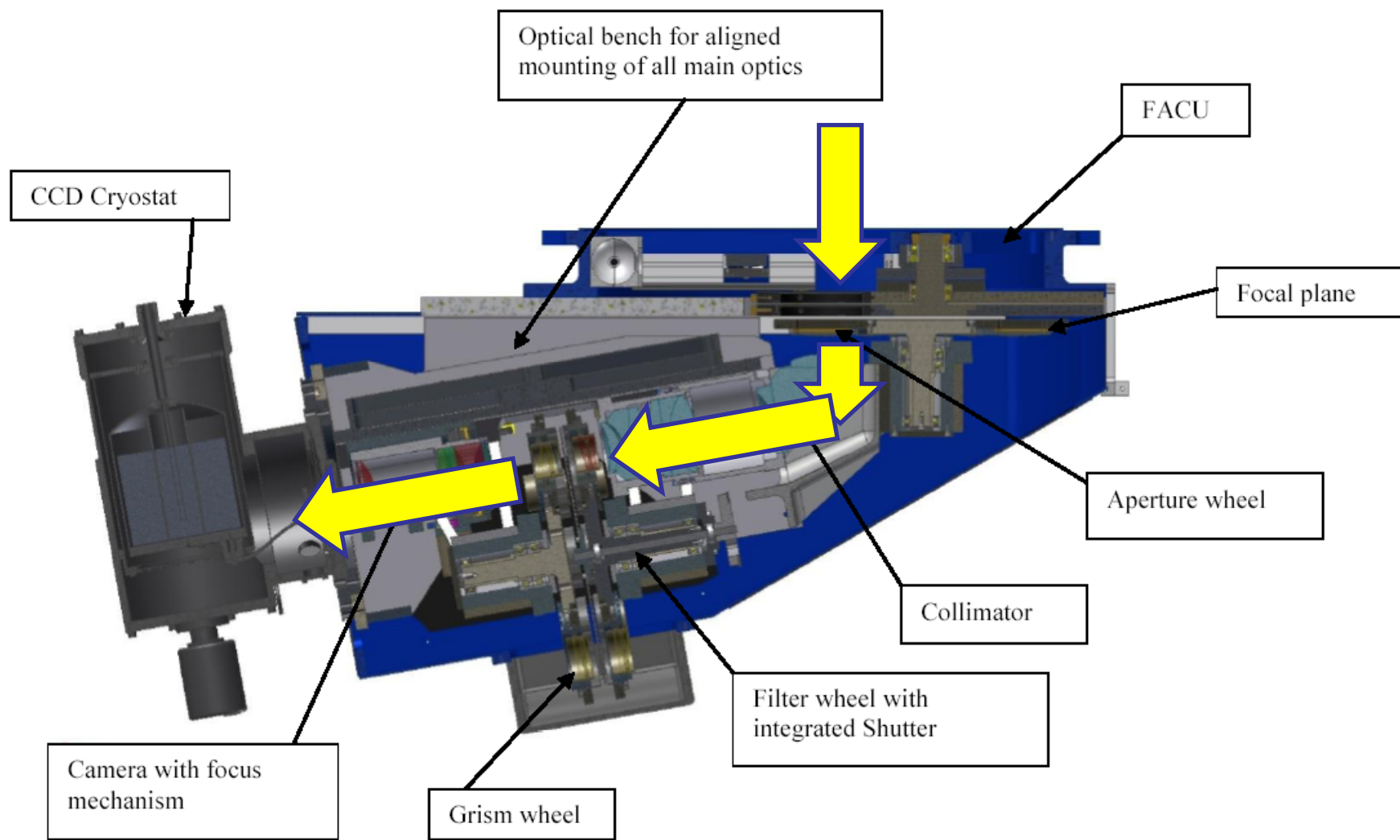
**+ High resolution spectrograph(Fibre feed)**

**+ Near infrared CCD camera**



- **Made by NBI, Copenhagen University**
- **Similar to EFOSC**
- **Wavelength band 3400-10000Å, R=200-4000, limiting magnitude 18<sup>m</sup>.5 (10 minute exposure)**
- **Photometry of faint objects, limiting magnitude V=24<sup>m</sup> (10 minute exposure)**
- **9 grisms, 9 long slits, 5 short slits, 3 pinhole, 10 filters**
- **The efficiency: 79.3% @405nm, 89.6% @670nm,  
95.8% @830nm**
- **The CCD E2V 42-90, 2K × 4K**
- **0.283"/pixel, 10' FOV**





数字孪生 > 访问和观测(Visit and Observe) > YFOSC Manual 使用手册 > YFOSC Optics Installed

数字孪生 访问和观测(Visit and Observe) 百科知识

YFOSC Manual 使用手册

YFOSC 使用手册

- YFOSC 简介
- Filters for Photometry
- YFOSC Optics Installed
- YFOSC简介
- 光路
- YFOSC FAQ
- 数据处理
- CCD Camera成像器件和控制

数字孪生添加。数字孪生系统更新于Jun 08, 2012 (查看更改)

## YFOSC Optics Installed

### 目前光学元件配置

This page describes the current installed optics on YFOSC, incl. All filters, grisms, slits, etc.

更新时间Updated: 2012-4-20

记录人By:

#### YFU-A

| 位置Position | 0    | 1    | 2     | 3     | 4       |
|------------|------|------|-------|-------|---------|
| 元件Optics   | Ha9# | open | Ha10# | Ha11# | SDSS z' |

#### YFU-B

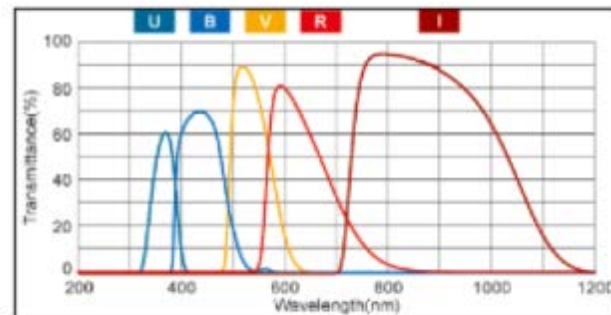
| 位置Position | 0    | 1       | 2     | 3       | 4       |
|------------|------|---------|-------|---------|---------|
| 元件Optics   | Open | SDSS r' | Ha12# | SDSS g' | SDSS i' |

数字孪生添加。数字孪生系统更新于May 11, 2012 (查看更改)

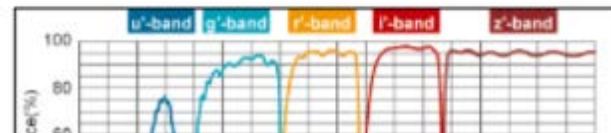
## Filters for Photometry

### Wide Band Filters

Johnson U,B,V,R,I

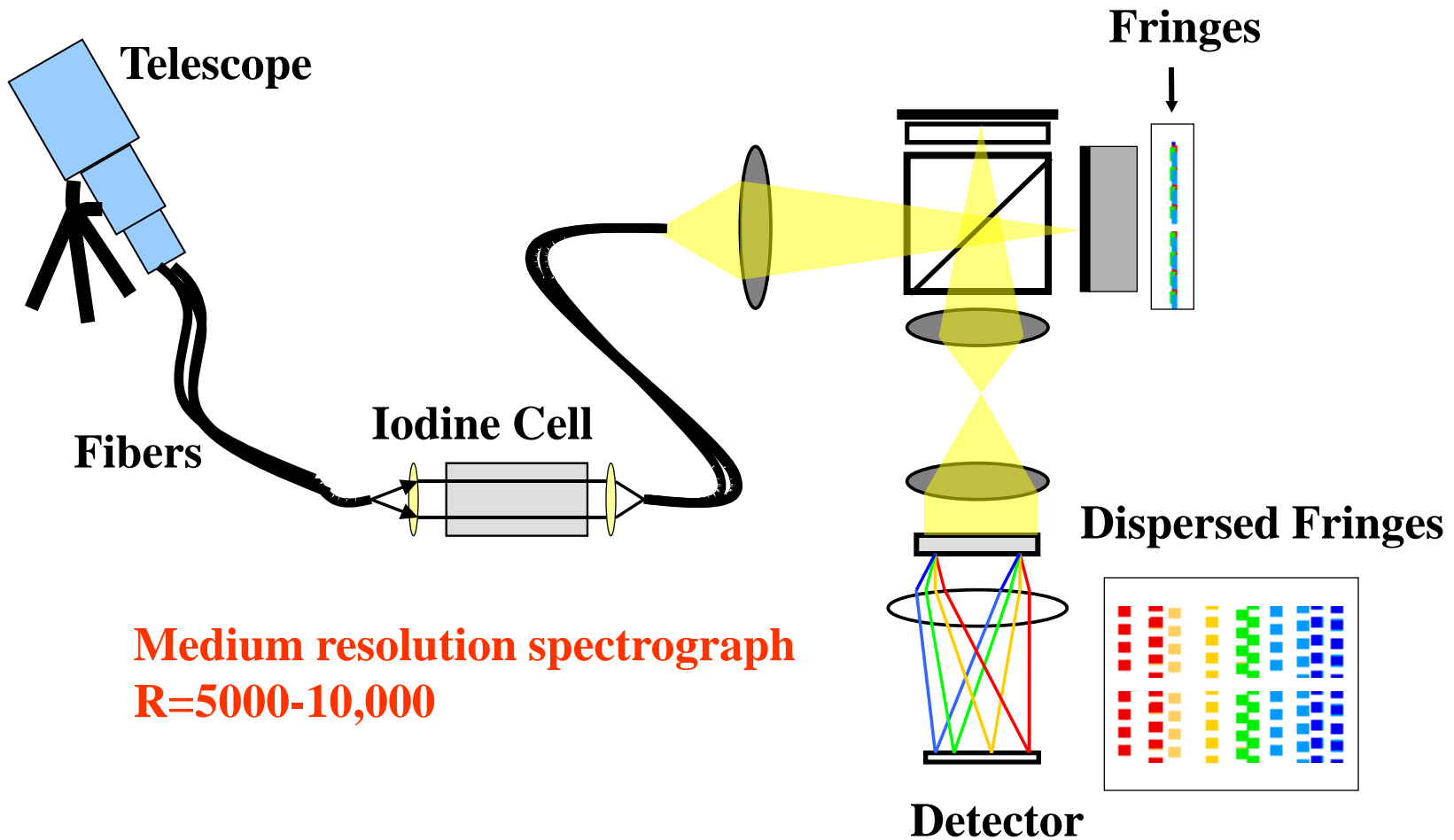


SLOAN u', g', r', i', z'



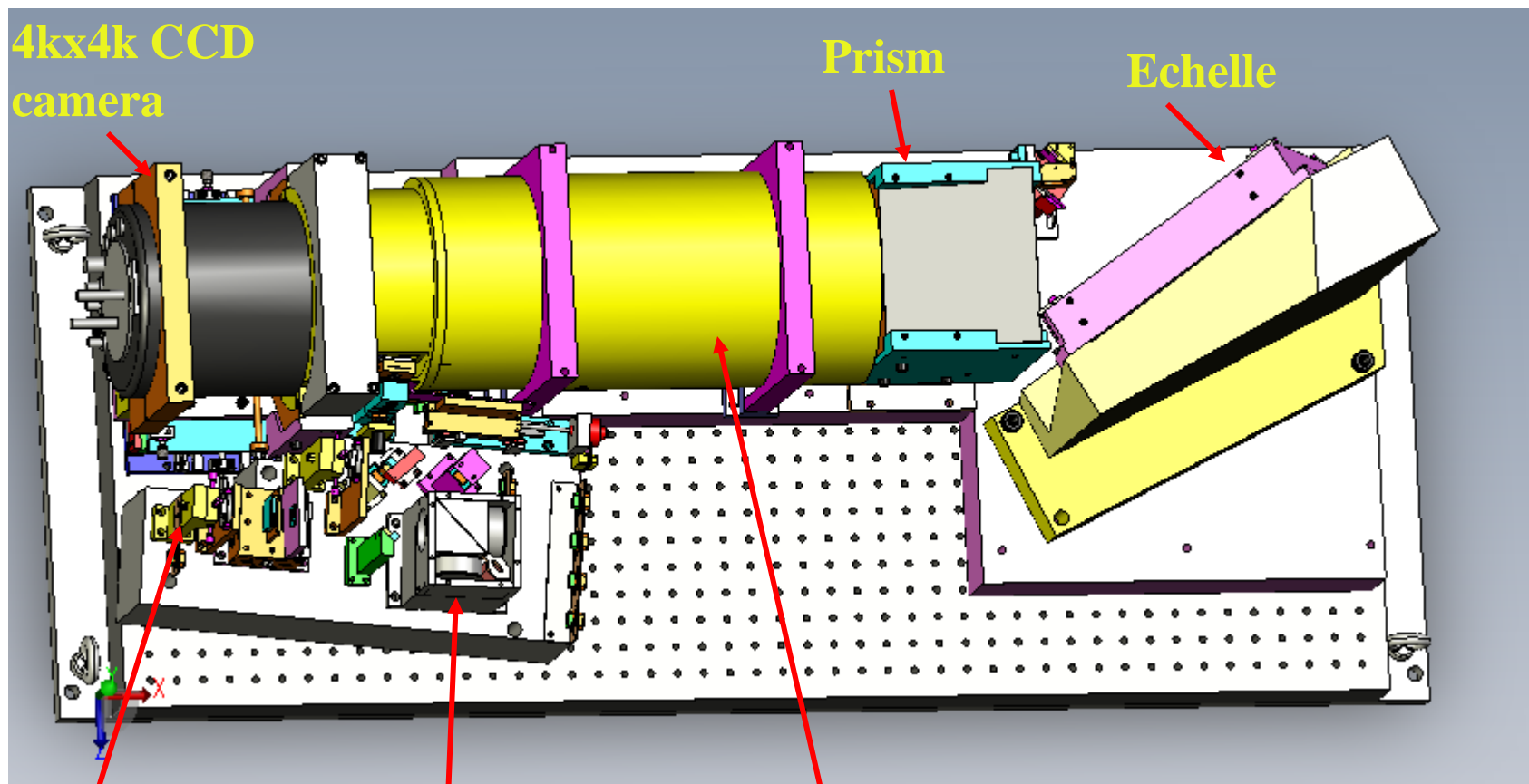
<http://wiki.gmg.org.cn/display/yfoscmanual/YFOSC+Optics+Installed>





Erskine & Ge (2000), Ge et al. (2002), Ge (2002)

# Inside LiJET inner isolation chamber



4kx4k CCD camera

Prism

Echelle

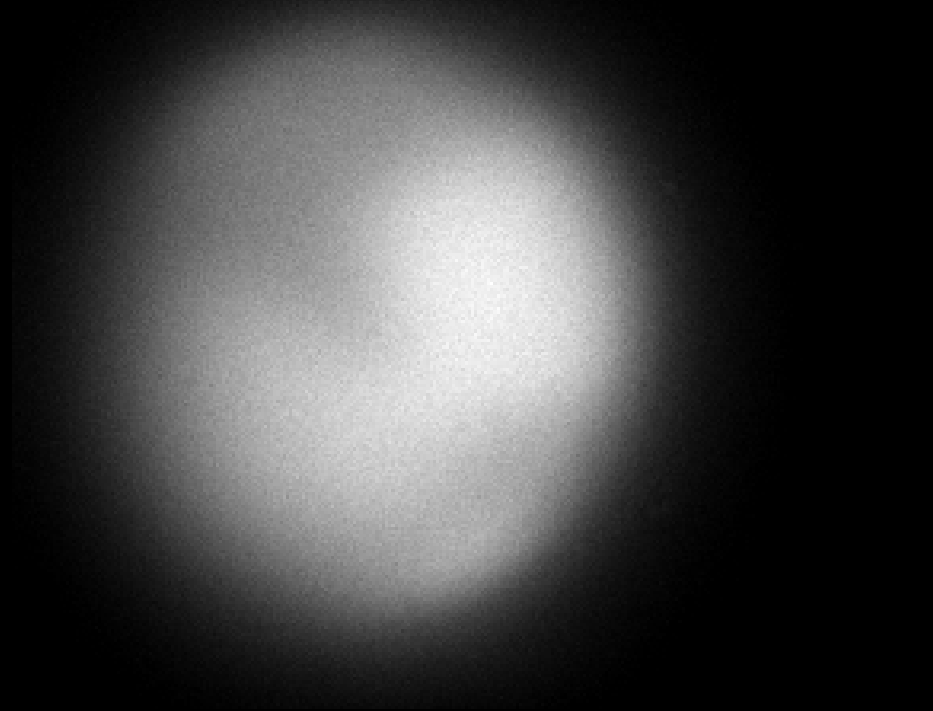
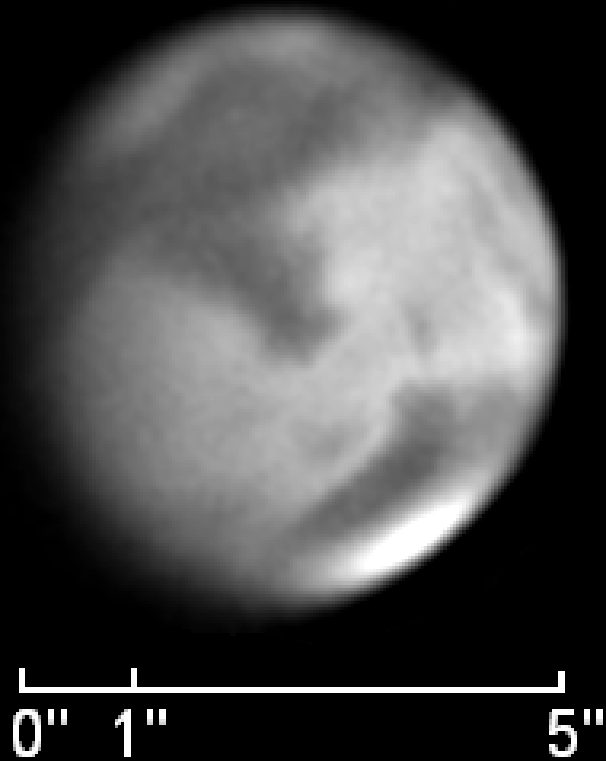
Input fiber feed

Interferometer

Collimator/camera

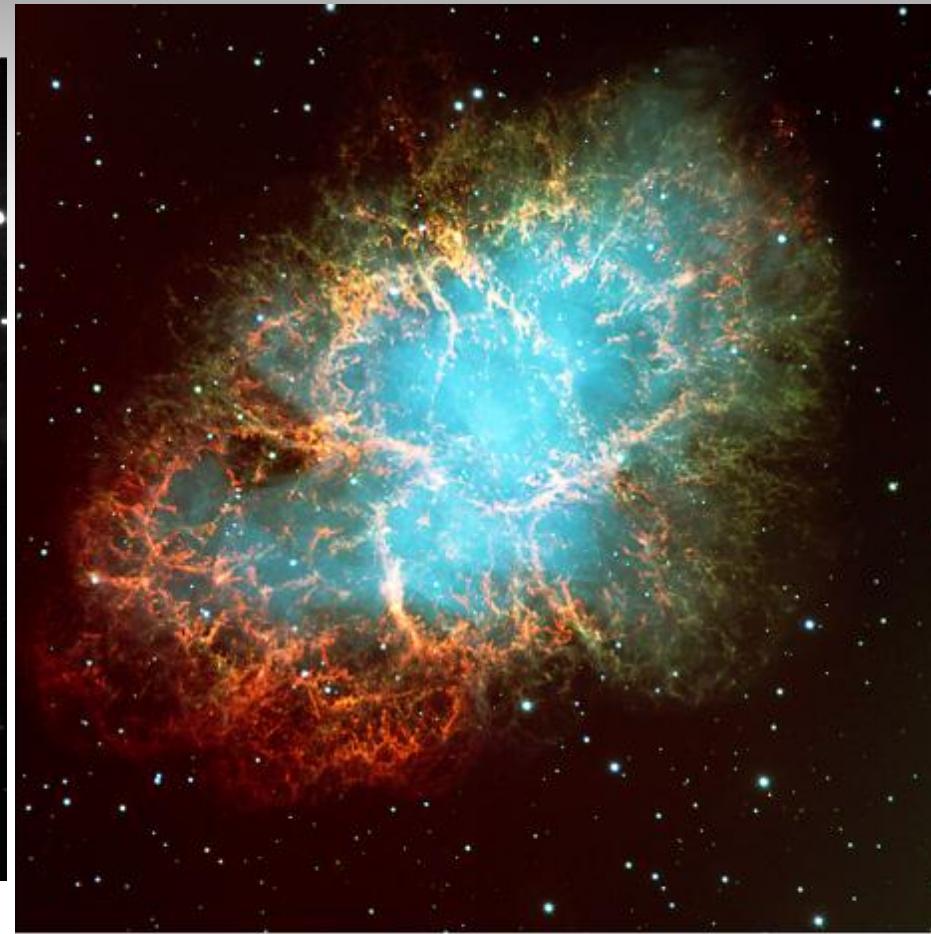


# High resolution image of the Mars



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  $0''.1$ .

# Images of the Crab Nebula



The Crab Nebula in Taurus (VLT KUEYEN + FORS2)

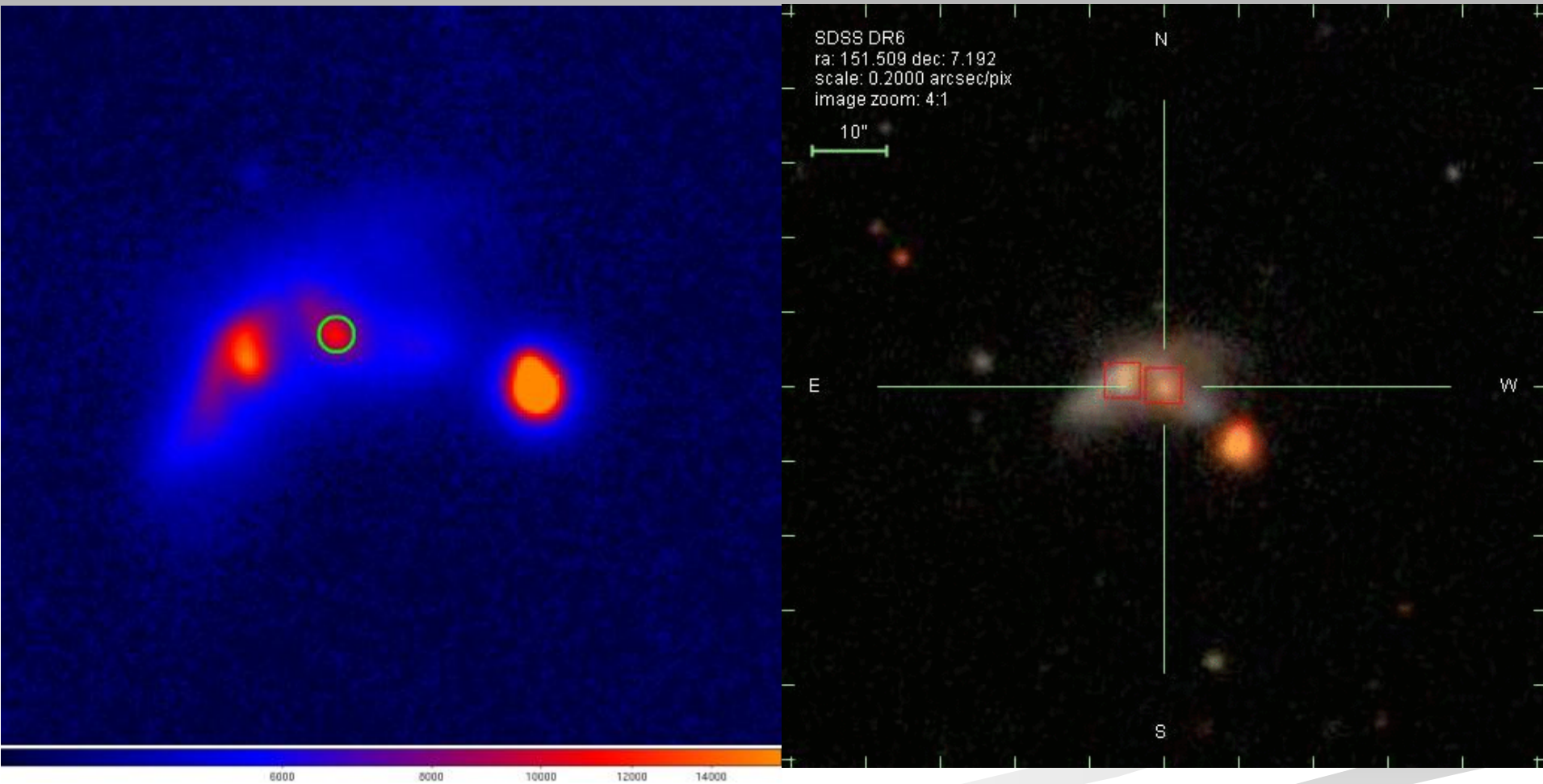
ESO PR Photo 40/99 ( 17 November 1999 )

© European Southern Observatory



**The R band image of Crab Nebula taken on March 14, 2009, compared with the VLT image (right).**

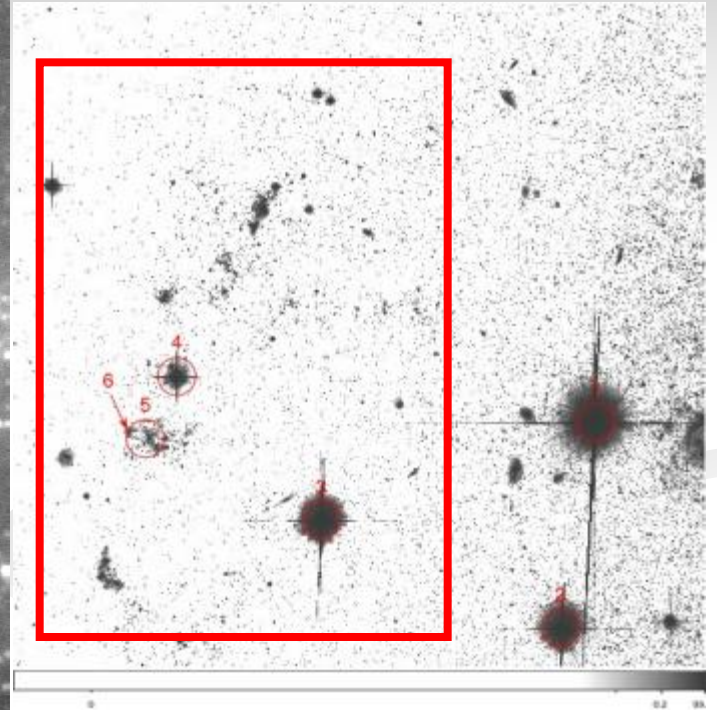
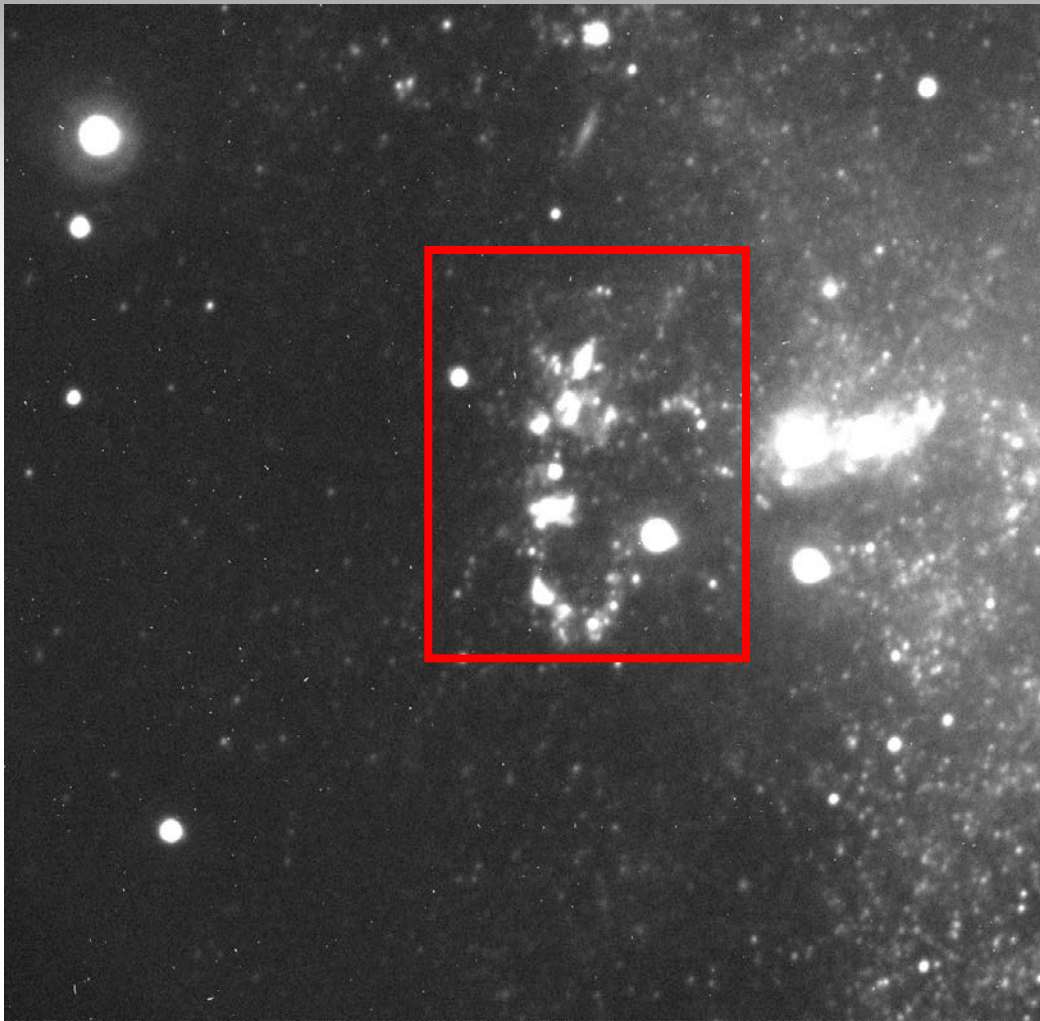
# Observation of binary Black holes



**The R band image of J1006+0711(left), compared with the SDSS image of the same object (right).**



# A Demonstration of Good Tracking



**A long exposure (1800'') B band image of a ULX on March 14 2009 (left), compared with the HST image of the same objects (right).**

# Two Asteroid Observations by 2.4m Telescope at Yunnan Observatory

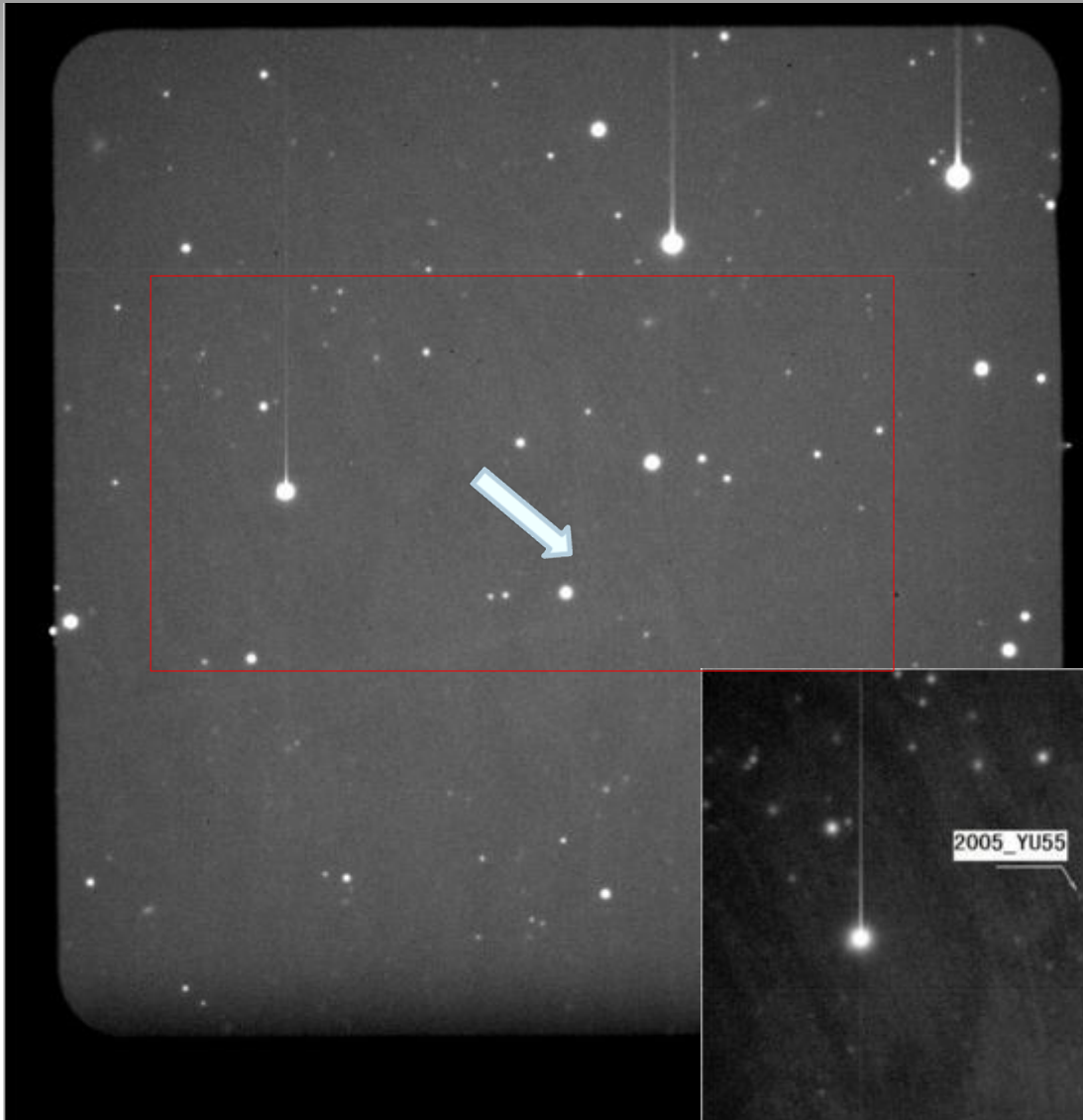
Q.Y. Peng (tpengqy@jnu.edu.cn, Department of Computer Science, Jinan University, China)

- 1). 2005\_YU55:  $V_{\text{mag}} \approx 21$   
3 night observations during Dec 16-18, 2011.
- 2). 1996\_FG3:  $V_{\text{mag}} \approx 20$   
1 night observations on Feb 19, 2012

Raw data sent to William Thuillot soon after the observations;

For Details: <https://www.imcce.fr/gaia-fun-sso/>

# Observations for the asteroid 2005\_YU55



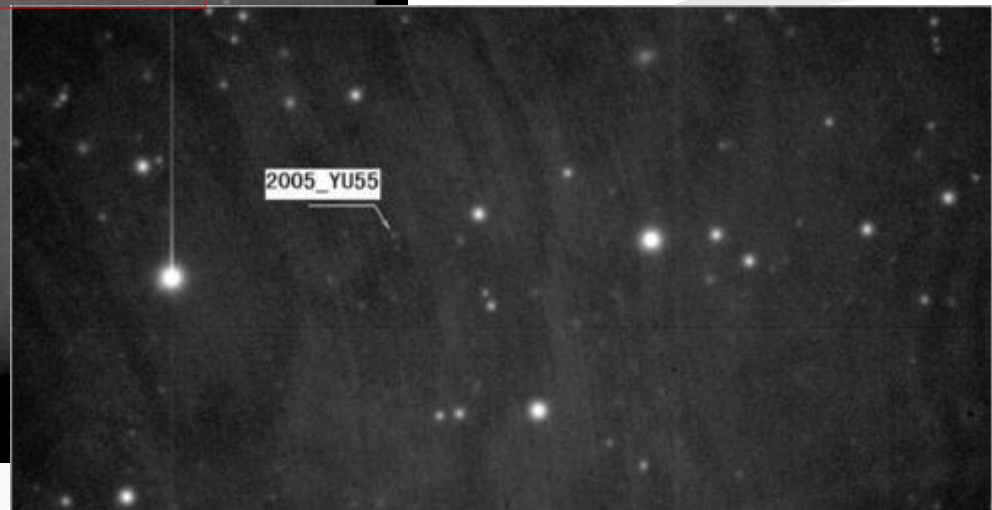
$V_{\text{mag}} \approx 21$

Dec 16-18, 2011

No filter

44 exps. in 3 nights

120-180 s

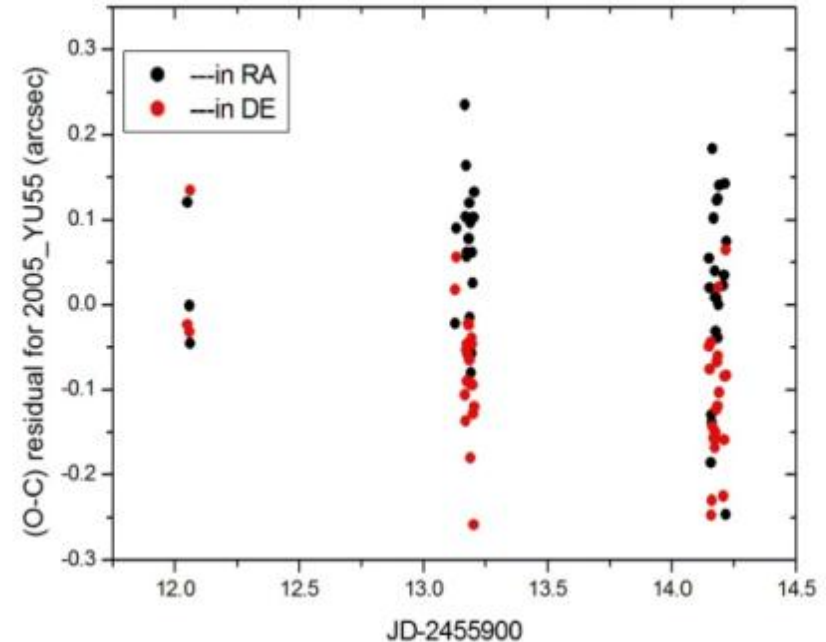


A typical CCD frame for the asteroid 2005\_YU55 by 2.4m telescope at Yunnan Obs



# Results

- ✓ Obvious geometric distortion for the CCD FOV. Caused by YFOSC optics?
- ✓ Calibration : only some reference stars arround (about 5-7 stars in UCAC2).
- ✓ 6 constant plate model used to calibrate the CCD FOV.
- ✓ Telescope is powerful for the faint asteroids.
- ✓ Derive GD of CCD to improve positional precision.
- ✓ PI-CCD(1340x1300x20um)CCD = 0.21"/pix?



(O-C) residuals for 2005\_YU55 in 3 nights

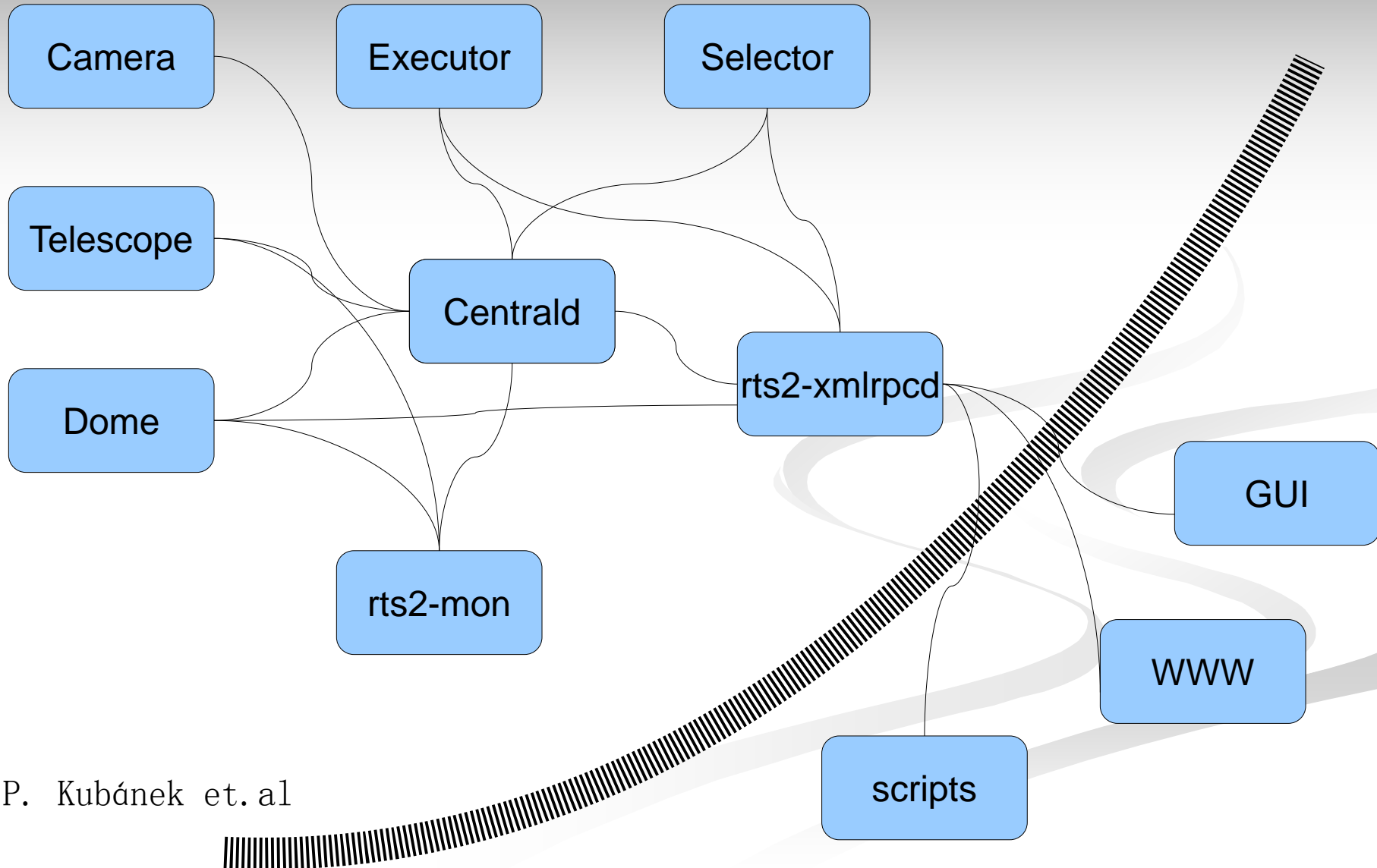
**Mean (O-C) residuals:** 35mas(R.A.) -89mas(DEC)  
**Positional precision (SD):** about 0."10 (each direction)



- 60cm Ritchey-Chretien OTA on Astelco NTM-500 Direct-Drive Mount
- Andor EM CCD(use no EM, only fast Read-out), 1k\*1k ( $13.5\mu\text{m} \times 13.5\mu\text{m}$ ),  $0.57''/\text{pixel}$ ;
- SDSS filters: u, g, r, i, z
- UKIRT filters: Z, Y
- Fixed All-sky camera (Apogee)







# BOOTES-4 Web User Interface

- ✓ Fully Robotic or Remote mode
- ✓ Target selector and queue (GRBs have top priority)



RTS2-Web Interface - Mozilla Firefox

RTS2-Web Interface

火狐官方网站 | 新手上路 | 最新头条 | 网址大全 | Most Visited | 访问最多 | 常用网址 | Latest Headlines | Latest Headlines | 弄1, 这赤道仪太好吧... | Getting Started | Getting Started | 下载Firefox书签扩展...

RTS2 Web Interface 2011 - BOOTES Say Dear Lijiang, On behalf of the BOOTES (IAA-CSC) Team

ON OFF StandBy UNKNOWN | 16 IMGP | IDLE | 0 FW | 0x0 WEATHER | 0x0 Current target: Dark frames

LOCAL 2012年7月8日 17:52:48 UTC Sun, 08 Jul 2012 09:52:48

C0 NO Exposing|NO Reading|NO FOCUSING|NO TRACKING|NO CORRECTING|NO DOME MOVING|NO SYNCING|NO EXEC OBSERVING|NO TRACKING|NO CORRECTING|NO DOME MOVING|NO SYNCING|NO

DOME COVERED|NOT MOVE|NOT SYNC|OK SEL 1x0

Act Menu S/H LOG

## Lijiang Observatory - BOOTES 4 - CENTRALD

RELOAD

|         |                   |                                   |
|---------|-------------------|-----------------------------------|
| C0      | infotime          | Sun Jul 08 2012 17:50:06 GMT+0800 |
| CLOUD   | longitude         | 100.0312                          |
| DOME    | latitude          | 26.6955                           |
| EXEC    | mornig_off        | off                               |
| FOC     | mornig_standby    | 0                                 |
| FW      | required_devices  | WEATHER,CLOUD                     |
| GRBD    | failed_devices    | CLOUD                             |
| IMGP    | weather_reason    | CLOUD: crossed TRIGBAD            |
| MOOD    | next_state_change | Sun Jul 08 2012 20:07:11 GMT+0800 |
| SEL     | next_state        | 1                                 |
| T0      | night_horizon     | -10                               |
| UPS_B4A | day_horizon       | 0                                 |
| UPS_B4B | evening_time      | 300                               |
| WEATHER | mornig_time       | 180                               |
| Targets | night_start       | Sun Jul 08 2012 21:03:19 GMT+0800 |
|         | night_stop        | Mon Jul 09 2012 05:45:29 GMT+0800 |
|         | sun_alt           | 30.08333609                       |
|         | sun_az            | 101.66398542                      |
|         | sun_rise          | Sun Jul 08 2012 06:32:03 GMT+0800 |
|         | sun_set           | Sun Jul 08 2012 20:16:19 GMT+0800 |
|         | moon_alt          | -62.71234984                      |
|         | moon_az           | 200.57518281                      |
|         | lunar_phase       | undefined                         |
|         | lunar_limb        | 64.3191046                        |
|         | moon_rise         | Sun Jul 08 2012 23:22:58 GMT+0800 |

BOOTES-4 (Lijiang, CHINA) E 2012-07-08 17:52:50 (L)

BOOTES-4 (Lijiang, CHINA) I 2012-07-08 17:56:03 (U)

- Service and Remote mode on 2.4m telescope
- Robotic mode on BOOTES-4
- Time allocate and ToO
- Other telescopes in Yunnan Observatory:
  - Lijiang 1.8 m telescope
  - Kunming 1m telescope



1m telescope in Kunming



**Thank you!**

2m4 (at) ynao. ac. cn