HAL
archives-ouvertes.fr

Introduction of Astronomical Telescopes and Instruments in Yunnan Astronomical Observatory

J. Bai, Z. Liu

▶ To cite this version:

J. Bai, Z. Liu. Introduction of Astronomical Telescopes and Instruments in Yunnan Astronomical Observatory. Institut de Mécanique Céleste et de Calcul des Ephémérides (IMCCE). Workshop Gaia Fun-SSO : follow-up network for the Solar System Objects, Nov 2010, Paris, France. 1 vol., 149 p., 2011. <hal-00602458>

HAL Id: hal-00602458
https://hal.sorbonne-universite.fr/hal-00602458

Submitted on 22 Jun 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Introduction of Astronomical Telescopes and Instruments in Yunnan Astronomical Observatory

Bai, J.M.[1,2], Liu, Z.[1,2]

[1] Yunnan Astronomical Observatory, Chinese Academy of Sciences, Kunming, Yunnan 650011, China (baijinming@ynao.ac.cn, lz@ynao.ac.cn)
[2] Key Laboratory for the Structure and Evolution of Celestial Objects, Chinese Academy of Sciences, Kunming, Yunnan 650011, China

Introduction

Gaia spacecraft will be launched in November 2012, and will survey all the sky for about 5 years, aimed at charting a three-dimensional map of our Galaxy, the Milky Way. It will provide unprecedented positional and radial velocity measurements with the accuracies needed to produce a stereoscopic and kinematic census of about one billion objects in our Galaxy and throughout the Local Group, including a huge number of minor objects in our Solar System (Prusti 2011). Photometric and Spectroscopic observations of these objects observed on the average 70 times over 5 year mission will also provide a great chance to study astrophysics of stars, galaxies, AGNs, and to test general relativity and cosmology.

To achieve above scientific purposes, ground-based follow-up network for Gaia mission is necessary because of imposed date and position (Arlot 2011). The 2.4m reflector at Lijiang Observatory of Yunnan Astronomical Observatory (YNAO), Chinese Academy of Sciences, has the potential to play a important role in Gaia Follow-up Network (GAIA-FUN) in East Asia (see Fig. 1), especially for the follow-up of faint solar system objects (SSO) and Gaia itself (Thuillot 2011). The 2.4m optical telescope of YNAO and its receptors are thus presented here.

Fig. 1 – The location of Yunnan Astronomical Observatory (YNAO)

1. The Lijiang Observatory of YNAO

1.1 Location and conditions

The Lijiang Observatory of YNAO is located at 100°2′(E), 26°42′(N), about 35km from the Lijiang City, Yunnan Province, China. It is at an elevation of 3200m, about 800m higher than cities nearby. The seeing (0".9 on the average) and air transparency at Lijiang Observatory is the best among observatories in China, and on the average, there are 210 nights usable for astronomical observation each year. The sky background is B = 22.34 mag, V = 21.54 mag, and the atmospheric extinction is K_b = 0. 299, K_v = 0.150.

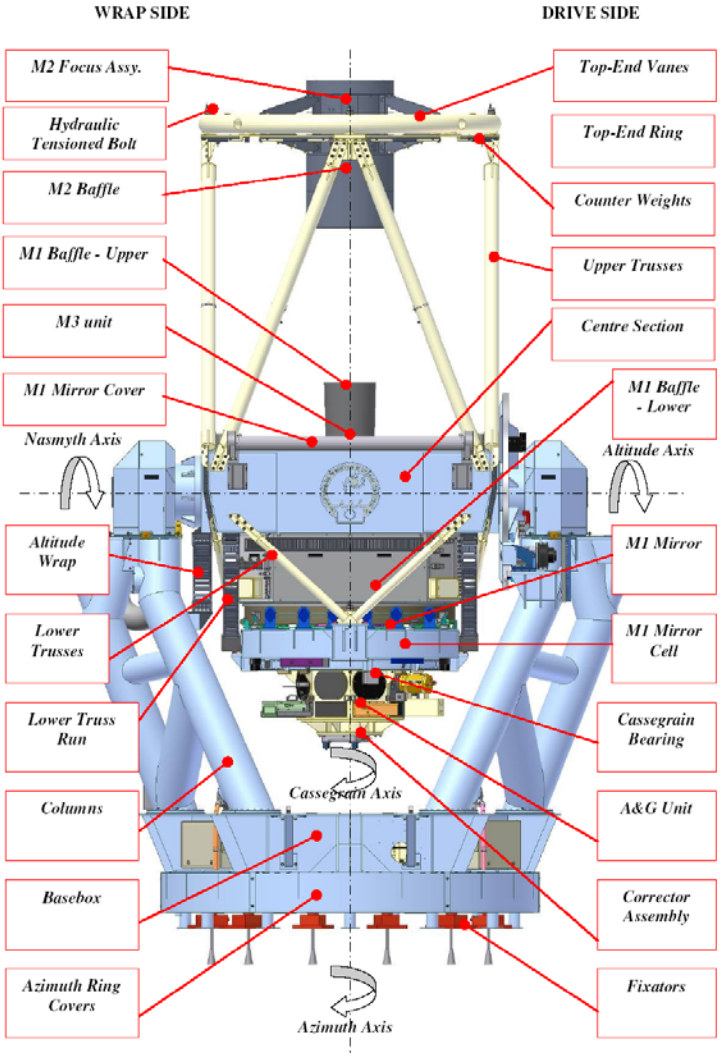

Fig. 2 – Layout of the 2.4m Telescope

1.2 The 2.4m telescope

The 2.4m optical telescope at Lijiang Observatory was made by the TTL Company, UK, and was installed at Lijiang Observatory in 2007, open to astronomers in May 2008. At present, it is the largest general-use optical telescope in East Asia. The telescope is a Ritchey-Chrétien Cassegrain optical design, on an altitude-azimuth (alt-az) mount, and designed for fully automated robotic operation (see Fig. 2). The telescope tube has Cassegrain and Nasmyth focal stations. Its focus ratio is f/8, with a focal length of 19.2m and FOV of 40′x 40′. Its image quality is <0.35″ (on axis) and <0.5″ (off axis). Its pointing accuracy is better than 2″,

and tracking accuracy is better than 0.5″ /hr (close loop). The tracking speed is fast enough to follow fast moving SSO.

At the Cassegrain focal station there is an Acquisition and Guidance Unit (A&G Unit, see Fig. 2) which enables the optical beam to be passed through to a wide-field focus 40 arc minutes in diameter. In addition, the Cassegrain focal station is rotated in order to de-rotate the field rotation which results from the alt-az mount design. The A&G Unit can direct the Cassegrain beam to a straight-through port or one of four side ports using a deployable Science Fold mirror. The straight-though port has a fully illuminated field of view of diameter of 40 arc minutes. Each side port has a fully illuminated field of view of 9 arc minutes diameter.

1.3 The receptors at the 2.4m telescope

At present the 2.4m telescope is equipped with three receptors: a PI VersArray 1300B CCD camera, the Yunnan Faint Object Spectrograph and Camera (YFOSC), and the Lijiang Exoplanet Tracker (LiJET). All three receptors work at the Cassegrain focus of the telescope, and can switch to each other within a second by rotating deployable Science Fold mirror, which enables the telescope to observe efficiently ToO discovered by Gaia.

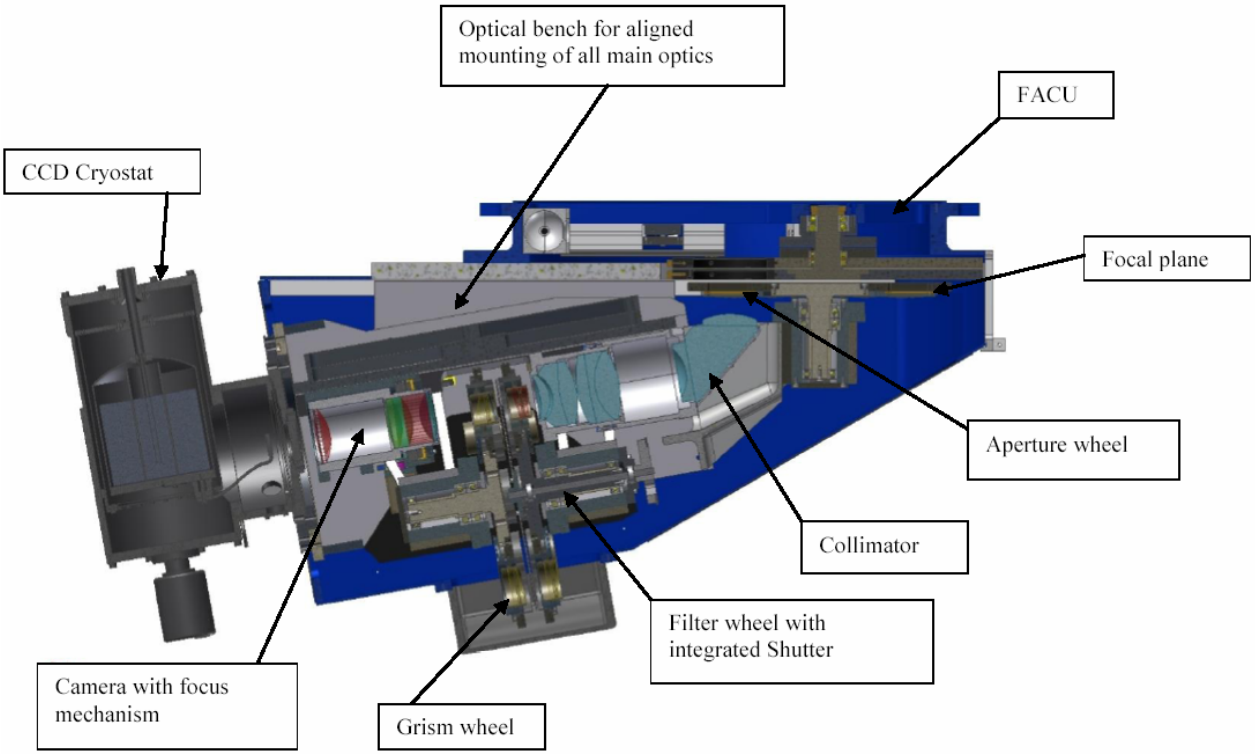

Fig. 3 – Layout of the YFOSC

The PI CCD camera can be used to do photometry and astrometry. It utilizes a back-illuminated CCD chip, with a 1340 x 1300 imaging array, 100% fill factor, and 20 x 20-micron pixels. Its dark current is negligible. The YFOSC can work as direct image camera and a low resolution spectrograph (see Fig. 3). Both receptors can be used for Gaia follow-up. Their specifications are shown in Table 1.

The LiJET is a combination of a thermally compensated monolithic Michelson interferometer and a cross-dispersed echelle spectrograph for extremely high precision Doppler measurements for nearby bright stars (e.g. 1m/s for a V=8 solar type star in 15 min exposure).

It has R=18,000 with a 72 micron slit and a simultaneous coverage of 390-694 nm. It also has a direct cross-dispersed echelle spectroscopy mode fed with 50 micron fibers. It has spectral resolution of R=27,000 and a simultaneous wavelength coverage of 390-1000 nm. As a spectrograph, LiJET can follow up stars observed by Gaia as well.

Table 1 – The specification of YFOSC and PI CCD camera

	YFOSC	PI CCD camera
CCD size	2048×2048	1300×1340
Pixel size (arcsec/pix)	0.283	0.214
Field Of View (arcmin)	9.66′×9.66′	4.8′×4.64′
Filters	Bessell U,B,V,R,I, SDSS u,g,r,i,z	Bessell U,B,V,R,I

Conclusion

YNAO has the potential to play a important role in Gaia GAIA-FUN in East Asia. The tracking accuracy and speed, the receptors of the 2.4m telescope at Lijiang Observatory of YNAO are satisfied with the demands of Gaia-FUN-SSO.

References

Arlot J.-E. : 2011, The Evolution of the network of observers, in this proceedings

Prusti T.: 2011, Gaia Status, in this proceedings

Thuillot W.: 2011, Objectives and management of Gaia-FUN-SSO network, in this proceedings