CIROI PROJECT

J.Y. XU Z.M. WANG
Shaanxi Astronomical Obs, Academia Sinica
P.O. Box 18, Lintong, Xian, China PR

ABSTRACT. CIROI (China InfraRed Optical Interferometry) Project would be probably divided into three stages: prototype, moderate aperture, and large aperture. The prototype with two collection apertures of 10 cm and baseline of 12 m for first testing stage is being manufactured.

1. Introduction

Stellar interferometry has been developed very rapidly during the past two decades, and manifested tremendous potential for both astrometry and astrophysics. It is expected that some new discoveries in astronomy and new results with high angular resolution and high precision will be obtained in 1990s when SUSI, IOTA, AOI and BOA, etc. come into use, and more important contributions to astronomy will appear after VLTI, KIA, and OVLA etc. are completed. There is no doubt that stellar interferometry will play very important role in optical astronomy in the next century. An obvious trend of development for large telescopes is to combine large apertures with adaptive optics and interferometry. In China, under the economic condition in a developing country, CIROI project is one of the developing fields in astronomy and would work on both optical and infrared region, and be divided into three stages: prototype, moderate apertures and large apertures. The last one will depend on a project of building large telescope(s) which is under consideration.

2. Prototype

The prototype of CIROI is used mainly for demonstrating technical availability, and for developing software in both control system and astronomical subjects. At the first testing phase, only two siderostats with diameter of 20 cm (the collection aperture is 10 cm) form a north-south baseline of 12 m. After testing, one or two more siderostats would be added possibly in the east or west, and the north-south baseline would be extended up to 40 m.

J.G. Robertson and W.J. Tango (eds.), Very High Angular Resolution Imaging, 171–173.

2.1 SIDEROSTAT

The two Alt-Azimuth mounting siderostats both reflect the incoming star light to the east with an altitude of 35^0. The light beams are then reflected horizontally by two fixed mirrors and enter the Central Optical Lab. through vacuum pipes. With this design, the sky coverage of the interferometer could reach a wide span of declination. The siderostats are driven by microstepping motors with resolution of 0.04 arcsec. Each siderostat will be controlled by a single chip computer (8098), which communicates with the master computer IBM PC 80386. Each axis of the siderostats is connected with an optical encoder with the resolution of 1 arcsec. The azimuth axis with a special design (Wang et al., 1991) would make the fiducial point very stable in space.

2.2 STAR TRACKER

The design of star tracker is similar to the one used in MARK III (Shao et al., 1988) except the detector. Four PMTs will be used to detect quadrifid images divided by a pyramid, or a pair of quadrant detectors like those used in SUSI (Davis et al., 1991) for both beams of the two arms alternatively by using a chopper(Xu et al., 1992). Each tilt mirror is driven by two PZTs with the resolution of 0.05 arcsec and the adjustable range for tracking star light is ±20 arcsec with 100 Hz of servo bandwidth.

2.3 OPTICAL PATH LENGTH COMPENSATOR (OPLC)

With same design, each of the two OPLC consists of a cat's eye retroreflector moving on a rail of 3 m, which is driven by a microstepping motor with the resolution of a few microns per step. The PZT mounted on the back of the secondary mirror of the cat's eye drives the small mirror with the resolution of a few hundredth of micron. One of the OPLC moves during observation while the other sits at a calculated position, and their motions are both monitored to an accuracy better than 1 micron by laser metrology system.

2.4 FRINGE DETECTOR

Two PMTs will be used for detecting fringes, perhaps with cooling system around each PMT.

2.5 CONTROL SYSTEM

IBM PC 80386 computer will serve as the master computer which does all the calculations for OPLC positioning and moving,

siderostat pointing and so on, and communicates with all the single chip computers for different parts of the interferometer. C language and UNIX system are used.
We try to assemble the prototype by the end of 1993, and get the first light and the first fringe by the summer of 1994.

3. Moderate Aperture

At the first stage, three elements are movable in Y-shaped or L-shaped configuration, and each arm would be 40 m long, which could work on both infrared and optical (multi-r_0) wave region. The diameters of siderostats and collection aperture are about 60 cm and 40 cm respectively. Also they could work as synthesis aperture. At the second stage, two or three more elements will be added to the system, in order to do image reconstruction.
The siderostats mounting, OPLC and tilt mirrors will be similar to those in the prototype and some parts of the prototype will be used for the moderate aperture interferometer. Some kind of detector array will be used.

4. Large Aperture

At this moment, we could say nothing more than mentioned in the introduction. Only one thing which should be pointed out that the moderate apertures with five or six siderostats might be combined with a large telescope about 4 m of aperture to form an optical and infrared interferometer array with baseline up to 300 m or even longer, which would be the last stage of CIROI project.

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Reference

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