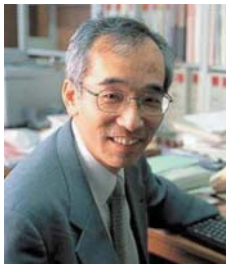
【Grant-in-Aid for Scientific Research (S)】

Science and Engineering (Mathematical and physical sciences)



Title of Project : Observational Study of the Hearts of Star-Forming Regions by a Far-Infrared Interferometer with Arcsecond Resolution

Hiroshi Shibai
(Osaka University, Graduate School of Science, Professor)

Research Area : Observational Astronomy

Keyword : Infrared Astronomy, Extrasolar Protoplanetary Disk, Far-Infrared Interferometer

【Purpose and Background of the Research】

Observations in far-IR spectral domain (30–300 μm) have become critically important in contemporary astronomy, especially for investigations of star and planetary-system formation, galaxy evolution, and interstellar physical and chemical processes. The Japanese AKARI satellite and other far-IR facilities have delivered unique and fruitful results for various fields of current astronomy, while the Space Infrared Telescope for Cosmology and Astrophysics (SPICA) will open the new far-IR eye with very high sensitivity in the next decade. However, little progress has been made to achieve high spatial resolution in far-IR. The purpose of this research is to dramatically increase the resolution at these wavelengths.

【Research Methods】

We have developed a balloon-borne Fizeau type interferometer with a baseline of 8 m, named FITE (Far-IR Interferometric Telescope Experiment, Figure 1). Extending the baseline up to 20 m will provide the spatial resolution of one arcsecond in far-IR for the first time in the world.

Figure 1. Hanging test conducted in front of the assembly room of the launch base in Brazil.

FITE will be launched from the balloon base in the Brazilian National Institute of Space Science (INPE) in 2010. Once the performance of FITE is validated, we will conduct observations for objects with scientific importance in succeeding flights during the research period of this program. The variable baseline mechanism will be equipped for high-resolution imaging. In addition to this, the sensitivity must be improved.

【Expected Research Achievements and Scientific Significance】

One of the key sciences is to reveal the density and temperature distribution in protoplanetary disks, which have strong impact on planet-forming process. Theoretical studies have often assumed a simple, symmetric disk to discuss planet formation mechanisms, but the structural asymmetry has commonly been observed by optical and near-IR imaging (e. g. Fukagawa et al. 2004). As we have pointed out in Matsuo et al. (2007), it is also possible to confirm planet formation activity through gravitational instability in the outer disk.

【Publications Relevant to the Project】

"New High Resolution Imaging Method For Fizeau Interferometer," Matsuo, et al., Publ. Astron. Soc. Jp., 60, 303, 2008.

"Far-Infrared Interferometeric Telescope Experiment (FITE): sensor optics," Kohyama, et al., in Proc. SPIE-7013, 70133O-10, 2008.

"Planetary Formation Scenarios Revisited: Core-Accretion versus Disk Instability," Matsuo, et al., Astrophys. J., 662. 1282, 2007.

"Spiral Structure in the Circumstellar Disk around AB Aurigae," Fukagawa, et al., Astrophys. J. (Letters), 605, L53-56, 2004

【Term of Project】 FY2010-2014

【Budget Allocation】 151,300 Thousand Yen

【 Homepage Address and Other Contact Information】

http://www-ir.ess.sci.osaka-u.ac.jp/www_fite/
shibai@ess.sci.osaka-u.ac.jp