

Orbiting Astronomical Satellite for Investigating Stellar Systems

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Orbiting Astronomical Satellite for Investigating Stellar Systems (OASIS) is a proposed space based observatory with a 14 m inflatable primary reflector that will perform high spectral resolution observations at terahertz frequencies¹. An inflatable metallized polymer membrane with a large photon collecting area serves as the primary antenna (A1), followed by aberration correction mirror pair, and a FOV scanner that enables a large field of regards of 0.1 degrees while achieving diffraction limited performance over a wide terahertz wavelength ranging from 63 μm to 660 μm .

The shape of the primary antenna is a function of pressure, this offers a unique challenge with respect to optical design. The aberration correction mirror pair is designed to simultaneously tackle the deviation of the primary antenna from the desired ideal parabola and the off-axis aberrations like coma. A tip-tilt mirror system with a HRFZ Si field lens is designed to scan the FOV. To determine the best suitable design that meets all the science goals and system requirements, an analytical model is developed to perform a parametric design study and the results are represented as solution space contour plots.

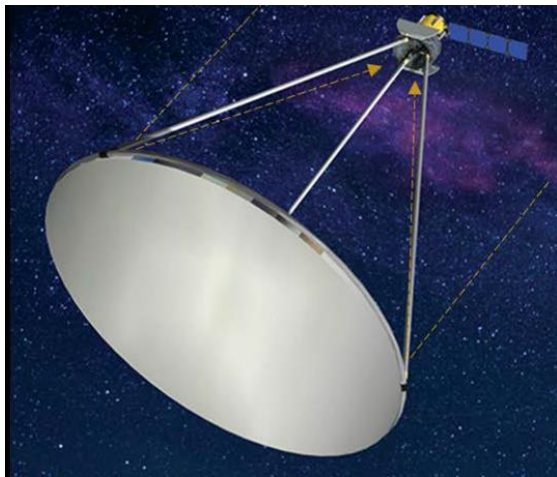


Fig.1 OASIS mission concept showing the fully deployed configuration.

The large diameter and irregular shape contribute to the challenges of accurately measuring the surface profile of the primary antenna. A 1m prototype of primary antenna (A1) is built to investigate whether the Nikon APDIS laser radar can be used to overcome these metrological challenges. The measured data is compared with Fichter solution of Hencky curve, and Finite Element Analyzer for Membranes (FAIM) developed by L'Garde Inc.



Fig.2 Nikon APDIS laser radar measuring the surface profile of 1m A1 prototype.

REFERENCES

- [1] Christopher Walker, et al., "Orbiting Astronomical Satellite for Investigating Stellar Systems (OASIS) Following the Water Trail from the Interstellar Medium to Oceans," SPIE Paper #11820-26, Proc SPIE, Optics+Photonics, San Diego, California, 1-5 August 2021.

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