Hitomi Fujii

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Space
Structure
Stystems

Miyazaki
Laboratory

◆Education

- Apr. 2020 – current : Master of Engineering in Aerospace Engineering, Nihon University, Funabashi, Chiba, Japan
- Apr. 2016 – Mar. 2020 : Bachelor of Engineering in Aerospace Engineering, Nihon University, Funabashi, Chiba, Japan
- Apr. 2013 – Mar. 2016 : Gifu Shotoku Gakuen High School, Gifu, Japan

◆Qualification

- Amateur 3rd-Class Radio Operator (2019)
- Driver's License (2017)
- CATIA V5 Assembly Design Specialist (2016)
- CATIA V5 Part Design Specialist (2016)
- Passed EIKEN Grade 2 (2013)

◆Presentation

- **Hitomi Fujii**, NEXUS Development Team, Yasuyuki Miyazaki, Mission Progress of Amateur Communication Technology Demonstration Satellite "NEXUS", The 63rd Space Science and Technology Conference, JSASS-2019-4395, 2019(Oral)

◆Experience of Satellite Project

NEXUS

I have participated in CubeSat "NEXUS" project since 2018 and I'm in charge of ground station system. I have been developing $\pi/4$ DQPSK decoder. Communication technology demonstration satellite "NEXUS" was launched on January 18th, 2019, and still have been operated to achieve remaining mission and contribute to amateur radio operators. For further information, please visit "NEXUS" homepage.

I also belong to the project of starshade technology demonstration satellite "Euryops". It is in phase of design and analysis, and I'm mainly in charge of telescope design.

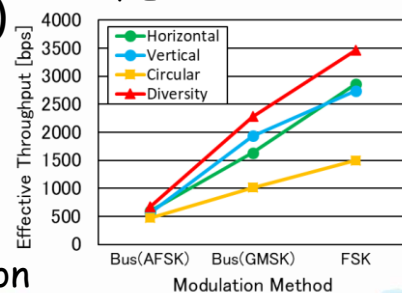## ◆Research Experience (Graduation Thesis)

One of Evaluation Results

I evaluated communication system of CubeSat "NEXUS" in 2018 for contributing to improve effective throughput of CubeSat. I suggested evaluation method of CubeSat communication and showed parameters that influence communication. Then I actually evaluated influence on communication of NEXUS so that evaluation data helps to improve effective throughput. I also improved S/N (Signal to Noise ratio) of $\pi/4$ DQPSK decoder in order to develop high-speed communication system.

◆Research Keyword

Exoplanet, Starshade, Space telescope, Optical design

◆Research

Design of Telescope System for Starshade

#### ➢ Exoplanet and Starshade

Recently, observation of exoplanets has been active for the purpose of discovering traces of life. For characterization of exoplanets, starshade system, which is the system of directory observing planets by blocking the host star light with shield called occulter placed between the star and the telescope, is suitable. However the technology is not established yet.

Starshade Concept Image[1]

➢ "Euryops"

In my laboratory, micro satellite "Euryops" is under development. It aims at technology demonstration of starshade system using SDMT (Self-Deployable Membrane Truss) and direct imaging of exozodiacal disk of Epsilon Eridani. We applied SDMT, which is lightweight and simple deployment mechanism, to occulter to solve the difficulty of deployment and the problem of cost.

Telescope Satellite
50kg, 50x50x50 cm³

80cm
50cm
Occulter Satellite
65kg (Occulter : 35kg)

10m
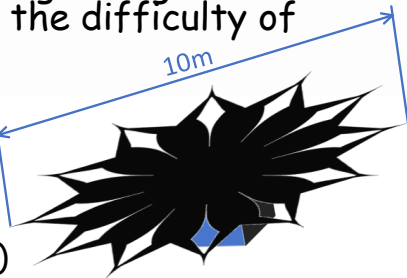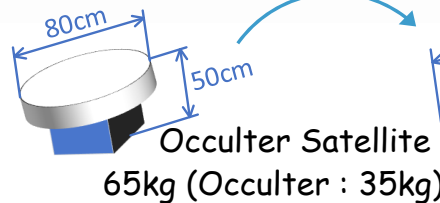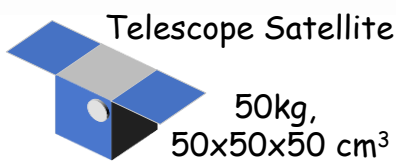
➢ Telescope System

Instead of existing telescope, it is required to design telescope system that has necessary functions to realize starshade. Also, it is required to show actual image through designed telescope, considering parameters such as accuracy of satellite attitude, occulter shape and manufacturing telescope lens, and temperature in the telescope. In addition, it is necessary to show required values for the parameters to obtain objective image.

Example of Objective Image[2]
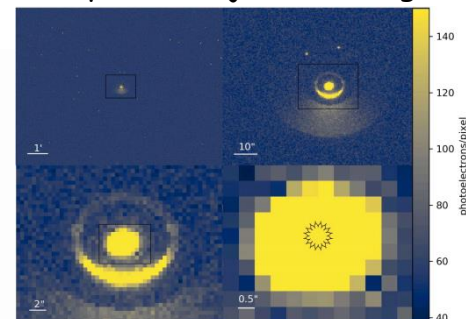
Thus, the purpose of this research is to design telescope system suitable for starshade and show that objective image can be obtained using the telescope, and to clarify how the parameters above affect the image and to show required values for each parameter.

Now, I'm designing telescope using optical design software based on requirements which telescope suitable for starshade should meet. I will develop software which shows actual image through designed telescope, considering parameters above. Then, I will show the influences of the parameters on the image and required values for each parameter.

[1] https://www.spaceanswers.com/futuretech/new-worlds-mission-hunting-for-alien-life-using-a-starshade/
[2] Simone D'Amico, Adam Koenig, Bruce Macintosh, David Mauro, Stanford University, NASA ARC, System Design of the Miniaturized Distributed Occulter/Telescope (mDOT) Science Mission, 33rd Annual AIAA/USU Conference on Small Satellites, 2019, SSC19-IV-08, p6

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