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PUBLIC EDUCATION ACTIVITIES FOR PLANETARY DEFENSE IN JAPAN

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Extended Abstract—

1. Introduction

The Japan Spaceguard Association (JSGA) was founded in 1996 and has taken a main role in planetary defense in Japan. The JSGA has observed near-Earth object (NEO) at the Bisei Spaceguard Center 1.0 m and 0.5 m telescopes under the administration of JAXA. In particular, the JSGA has contributed to the asteroid exploration project as the ground base observation team for Ryugu of the Hayabusa-2 probe and (3200) Phaethon of Destiny+ [1][2]. In addition to such observation and research activities, the JSGA has concentrated the outreach and educational efforts. We introduce these public educational activities by the JSGA.

2. Public education activities in Japan

The JSGA has conducted a variety of outreach activities. One such activity is the publication of "Asteroid" a newsletter for about 250 members of the JSGA. This newsletter has helped provide the general public with information on asteroid science and planetary defense in an easy-to-understand format.

The JSGA have also held events to discover asteroids with elementary school students. Two asteroids have been discovered by elementary school students, one of which was named "(375927) Ibara," as the city where the Bisei Spaceguard Center is located. For high school students, a more challenging research experience event has been held. Students have analyzed data that is obtained by the Bisei Spaceguard Center, and addressed in the light curve observations and multicolor photometry.

As concerned with "Asteroid Day", the JSGA has held lecture events since 2016. Due to the covid-19, the events were held with online style in 2020 and 2021. We especially introduce the lecture events in 2022.

The lecture event was held in the Sagami-hara City Museum, near JAXA/ISAS on July 2nd, 2022. The first half of the lecture consisted of an introductory lecture for beginners, such as "What are asteroids?". This lecture was intended to provide basic knowledge to all participants. In the first half lecture, a remote broadcast connected with the Bisei Spaceguard Center. Such a remote broadcast gave participants a real feeling for planetary defense observation (Figure 1). This lecture



Figure 1. The event photos. Left: A remote broadcast with the Bisei Spaceguard Center. Right: The lecture of DART by Dr. Hirabayashi.

helps them to understand the subsequent lectures in the second half.

In the second half lecture, the NASA/DART mission was explained by Dr. Hirabayashi connecting with the U.S. Most participants were not known well for the DART

mission because of the before impact events to Dimorphos. This lecture gave participants an intellectual delight by glimpsing the newest space probe project. The main generations of participants consist of children and over 40's. The problem came up that we should appeal the planetary defense to the teenagers and 20s generations.

3. Collaboration webcast with a virtual YouTuber

A new-style lecture event was also started collaborating with a VTuber Madoka Hoshimi for the appeal to young generations people. A VTuber (Virtual YouTuber) is an online entertainer who uses a virtual avatar generated using computer graphics. Madoka Hoshimi is a Japanese VTuber and graduate student who webcasts the program of astronomy and planetary science from 2021 (Figure 2). She has about 7,000 subscribers mainly consisting of the teenagers and 20s generation. She webcasted special programs in collaboration with the JSGA for the appeal of planetary defense to the teenagers and 20s generations.



Figure 2. A banner of Madoka Hoshimi

Table 1. Webcast programs

Date	Title and presenter
Oct/8/2022	Save the Earth / Dr. Yoshikawa
Oct/15/2022	Disaster from space / Dr. Yamaoka
Oct/20/2022	Meteorite and meteors / Dr. Abe
Nov/5/2022	Discovery of asteroids / Dr. Urakawa
Nov/12/2022	Exercise of 2017 PDC / Dr. Okumura and above four researchers

The programs show in Table 1. Especially, we report on the fifth program “Exercise of PDC 2017”. The scenario of PDC 2017 is that a hypothetical asteroid impact to the near Tokyo area. We discuss the scenario with live viewers. Moreover, a quiz-style question was used to determine the viewer’s thoughts for planetary defense. A part of the questions and answers are shown in Q1, Q2, and Q3. The number of answers is 47 for Q1 and Q2, 43 for Q3. Japanese people are generally cautious about the use of nuclear device. However, it is interesting to note that 60% of respondents approved the use of nuclear device for the planetary defense. On the other hand, in Q3, 9% of respondents accepted the extinction of the human race. This indicates that we must consider the

opinions of diverse people, including such fatalists when considering how to respond to planetary defense.

Q1. If you get the asteroid impact information, how to treat the information?

Information disclosure for all people	21%
Information disclosure for observers	53%
No information disclosure, but some actions start for planetary defense	17%
No information disclosure and no action	9%

Q2. An asteroid impact is inevitable. Do you use the nuclear device?

Use	60%
Do not use	30%
I don't know	10%

Q3. Asteroids impact have the aspect of promotion of biological evolution, like the extinction of dinosaurs lead to the prosperity of mammals. Does the human race have a right to stop the promotion of biological evolution? Should we accept the destiny of extinction by the asteroid impact?

Accept the extinction	9%
We should make efforts to avoid the extinction	88%
Immigration to other planets	2%

4. Summary

We reported the public education activities for planetary defense in Japan. Due to the “Hayabusa” and “Hayabusa-2” probes, asteroids are well known to Japanese people. On the other hand, planetary defense is treated like science fiction and is not recognized as a real issue to be addressed in Japan. In fact, planetary defense has not been raised as an issue in Japan's disaster management plans. In order to include planetary defense in Japan's disaster management plans, each citizen must recognize to the importance of planetary defense. We keep on our steady public education activities.

Reference

- [1]Müller et al., 2011, A&A, 525A, 145M
- [2]Kim et al., 2018, A&A, 619A, 123