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Surveying Outreach and Citizen Science Opportunities for Planetary Defense

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Abstract

Planetary defense stands out among the various topics of space science as an endeavour which the general public can understand, for which they can readily appreciate the value, and in which they can find significant relevance to their own lives. This is well illustrated in the extensive coverage that the international general media continues to give to the IAA Planetary Defense Conferences and their hypothetical NEO/Earth impact event scenarios. However, frequent doomsday predictions and bad movie plots illustrate that this is also an area for misinformation, misconceptions, and misunderstanding. In an endeavour as high-profile and critical as planetary defense, a campaign of accurate and effective public outreach is essential. In this presentation, we will survey some of the existing programs and opportunities that are particularly applicable to planetary defense outreach. This is done to stimulate discussion about how to best leverage existing resources and how to use lessons learned in creating new resources.

1. Introduction

With such a large and diverse audience, planetary defense outreach will require great diversity in content, activities, and entry points. However, amidst all that diversity, there is utility in dividing these activities into three general categories. The first is Informational: getting accurate and accessible information out to an audience interested in learning more, and countering misinformation. The second is Participatory Emphasizing Citizen Science. NASA puts great effort into citizen science and has realized great rewards. However, there are also excellent and highly successful existing citizen science programs outside of NASA which offer great potential for partnership. The third is Participatory Emphasizing Mission Support. Directly involving the public in a mission in a way that provides direct benefits to the mission is a challenging task. However, examination of how past missions have done this successfully will yield critical lessons learned for future planetary defense missions.

2. Informational Outreach

Outreach and communications converge especially in this area. We will survey a number of the existing resources available. These include informational programming such as NASA Science Now, online resources such as solarsystem.nasa.gov provide wide-ranging information while NASA's Solar System Treks is partnering with the OSIRIS-REx and Hayabusa2 missions to allow members of the public to conduct their own interactive flyovers and explorations of the NEAs Bennu and Ryugu using real mission data. Key informational outreach resources also include dissemination networks such as the NASA Night Sky Network, NASA Solar System Ambassadors, NASA Museum Alliance, and NASA@ My Library. Note that the informational category does not exclude some level of participatory activity that ends up extending short of actual citizen science. For example, simple instructions can show members of the public how their common DSLR camera and a simple tripod can be equipment enough to allow them to image the brightest asteroids and track their motions in the sky night to night, giving participants first-hand experiences with these bodies.

3. Citizen Science

Citizen science allows members of the public to provide information that is specifically useful to the planetary defense community and effectively brings members of the public into that community. We will take a look at some existing programs that have particularly exciting potential for planetary defense.

Multiple levels of entry points exist. At the easy end of the spectrum are programs like the Desert Fireball Network's Fireballs in the Sky program providing a

free augmented reality app for mobile devices that allows users to make, record, and submit fireball observations that help characterize the near-Earth environment and even have the potential to help make association between recovered meteorite falls and actual asteroid families.

At the advanced end are programs such as OSIRIS-REx's "Target Asteroids!" program, the Association of Lunar and Planetary Observers' program of amateurs observing and recording lunar meteoroid impact flashes, and the International Occultation Timing Association's continuing work on asteroidal occultations of stars providing exquisitely detailed information on asteroid positions, sizes, and shapes. All of these require sophisticated instrumentation, but it is instrumentation that is already in the hands of and being used by a growing number of advanced amateur astronomers. While it is true that the great majority of amateur observations deal with main belt asteroids rather than NEOs, it is also true that the main belt objects are the source population for most of the NEOs, and a better understanding of these objects and their motions is quite relevant.

An intermediate entry point in this category could be exemplified by amateur radio enthusiasts' help to better characterize the near-Earth environment by identifying and monitoring daytime meteor streams that are essentially invisible to optical means of study.

4. Mission Support

Thundering, fiery launches and spectacular space missions are among NASA's most unique and successful ways of engaging and inspiring the public. There is more than ample opportunity in these missions to conduct effective and inspirational Informational Outreach. But select missions have demonstrated how the public can actually become a part of the mission itself, providing useful information and support. The Stardust mission's Stardust@home crowds the border with citizen science. Stardust's campaign for public images and videos of their record-breakingly fast and hot re-entry into Earth's atmosphere was more in the mission support camp. Both programs proved to be remarkably successful. We will examine these as well as other examples from NASA's Deep Impact, LADEE, and LCROSS missions. We will specifically discuss the partnership between LCROSS, the NASA Deep Space Network, and the Lewis Center for Educational Research in establishing the mission's Student Telemetry Teams in which students in classrooms around the country monitored the spacecraft's health and status in flight. As the planetary defense community makes plans for future missions, there is great value to be gained from the lessons learned in past missions that have directly involved the public.

6. Summary and Conclusions

Planetary defense is assuming a very important, prominent, high-profile role as a global endeavor. This effort will benefit greatly from well thought-out and coordinated public outreach efforts. The time is now to survey the existing assets and resources available that can be leveraged in their existing forms and that can provide valuable lessons learned for future efforts.