PDC2017
Tokyo, Japan

IAA-PDC-17-04-08

Please send your abstract to iaapdc (at) iaamail.org

You may visit www.pdc.iaaweb.org

(please choose one box to be checked)
(you may also add a general comment - see end of the page)

- ☐ **Key International and Political Developments**
- ☐ **Advancements and Progress in NEO Discovery**
- ☐ **NEO Characterization Results**
- ☒ **Deflection and Disruption Models & Testing**
- ☐ **Mission & Campaign Designs**
- ☐ **Impact Consequences**
- ☐ **Disaster Response**
- ☐ **Decision to Act**
- ☐ **Public Education & Communication**

Modeling Kinetic Impactors on a Rubble Pile Asteroid

J. Michael Owen[(1)], Megan Bruck-Syal[(1)], Tane Remington[(1)], Paul Miller[(1)], Derek C. Richardson[(2)], and Erik Asphaug[(3)]
[(1)(]*LLNL, P.O. Box 808, M/S L-38, Livermore, CA 94550, USA, 925-423-7160, mikeowen@llnl.gov, syal1@llnl.gov, remington6@llnl.gov, miller3@llnl.gov*
[(2)]*Department. of Astronomy, University of Maryland, College Park, MD 20742, USA, dcr@astro.umd.edu*
[(3)]*ASU, School of Earth and Space Exploration, P.O. Box 871404, Tempe, AZ 85287, USA, easphaug@asu.edu*

Keywords: *Hypervelocity impacts, asteroids, impact modeling*

ABSTRACT

Kinetic impactors, wherein a spacecraft impacts an asteroid and thereby imparts a momentum change, are an important option for deflecting hazardous asteroids. Although the concept is simple, predicting the detailed outcome of a kinetic impactor mission is quite complex. One of the most important questions affecting the effectiveness of a kinetic impactor is the amount of ejecta escaping the target, which can serve to enhance the total momentum change imparted to the asteroid. A major complication is that very little is understood about the internal structure or surface properties of likely asteroid targets, the details of which could affect the properties of any ejecta produced by the impact and thereby critically sway the total deflection achieved.

In this study we examine the role of the internal structure of a rubble pile body on the outcome of a kinetic impactor mission. We use the proposed DART mission as our scenario, wherein NASA (as part of the proposed AIDA collaboration with ESA) is planning to impact a spacecraft on the 163m secondary body in the Didymos binary asteroid system[4] in 2022. This mission offers a rare opportunity to perform a full-scale experiment and directly measure the effectiveness of the kinetic impactor concept. It also affords us the chance to directly assess numerical modeling of such asteroid diversion techniques. In this study we will compare the importance of a complex rubble pile structure in the target body on the mission outcome (deflection achieved, ejecta produced, and structural consequences for the target) vs. simple homogenous models of the target employing the ASPH (Adaptive Smoothed Particle Hydrodynamics) technique. Exercises such as this are crucial in assessing the reliablity and accuracy of our modeling capabilities for asteroid diversion, as well as offering understanding of the applicablity of such modeling approaches to larger questions in planetary science.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

[4] Richardson, D. C., Barnouin, O. S., Benner, L. A. M., et al. 2016, Lunar and Planetary Science Conference, 47, 1501

LLNL-ABS-716442

****