PDC2019
Washington, DC, USA

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 the DART kinetic impactor and crater formation using realistic spacecraft shapes

J. Michael Owen[(1)]
[(1)] *Lawrence Livermore National Lab, M/S L-38, P.O. Box 808, Livermore, CA, USA, +1-925-423-7160, mikeowen@llnl.gov*

Keywords: *Planetary defense, DART mission, kinetic impactors, hydrocodes, crater formation*

ABSTRACT

The Double Asteroid Redirection Test (DART) is a NASA mission to test the kinetic impactor concept for altering the orbits of hazardous asteroids [1]. As kinetic impactors are the first choice for diverting small ($\leq 150m$) objects, understanding the physics and efficacy of this technology, especially the critical diversion momentum enhancement due to ejecta (i.e., the β factor), is of critical importance. The DART mission is the first full-scale experiment designed to test a kinetic impactor; the goal of DART is to impact the $\sim 160m$ secondary in the Didymos binary asteroid system (Didymos B) and measure the resulting deflection by observing the change in Didymos B's orbit around the Didymos primary. Recent studies have shown that the local topography of the asteroid surface at the impact site can result in significant (~ 2) variations in the net β deflection enhancement [2]. A related question which we examine in this work is if and how the geometry of the kinetic impactor itself might influence the outcome of the experiment. This talk will describe simulations using realistic models of the DART spacecraft impacting different realizations of the Didymos B surface, ranging from a simple, smooth, porous monolithic body to a heterogeneous rubble-pile model. We focus on the influence of the spacecraft

geometry combined with these variations in the nature of the target surface on the resulting ejecta from the impact crater, which ultimately determines the net deflection. We expect these studies to be quite valuable in understanding the outcome of the DART impact and the resulting deflection of the Didymos B.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-ABS-762703.

****

References

[1] A. F. Cheng *et al.*, “Asteroid Impact and Deflection Assessment mission,” *Acta Astronaut.*, vol. 115, pp. 262–269, Oct. 2015.

[2] J. M. Owen, M. Bruck Syal, R. P. T. Miller, D. C. Richardson, and E. Asphaug, “Modeling the Effect of Kinetic Impactors on a Rubble-Pile Asteroid,” in *IAA Planetary Defense Conference*, 2017.