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APPLICATIONS OF DART IMPACT SIMULATION RESULTS

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ABSTRACT

The Double Asteroid Redirection Test (DART) mission will include the first test of an asteroid deflection by kinetic impactor. In October 2022, the DART spacecraft will impact the secondary of the 65803 Didymos system (Didymos-B) at a speed of ~6 km/s. The resulting change in the orbital period of Didymos-B will be measured using Earth-based observations, and these measurements will be used to calculate the momentum change of the asteroid due to the DART impact.

In a kinetic deflection the momentum transfer to the target may be enhanced relative to the impactor momentum due to ejecta leaving the target surface. This is typically parameterized by a momentum transfer enhancement factor, β, which is calculated as the ratio of the momentum change to the impactor momentum. The DART Impact Simulation Working Group is using numerical simulations in ongoing studies to predict the range of possible deflection outcomes and values of β resulting from the DART impact, and to determine the relationship between the measured deflection and the properties of Didymos-B. Post-impact these simulations will also be used to infer physical properties of the asteroid. Numerical simulations of the DART impact

have shown that β is highly dependent on the impact site conditions and the material properties of the asteroid, particularly the porosity and yield strength, and can be as low as ~1 or as high as ~5 in the end-member cases.

In this presentation we will show recent simulations of the DART impact performed using the CTH hydrocode, and implications for how the measured deflection of Didymos-B and momentum enhancement factor β can be used post-test to infer properties of the asteroid. We will also discuss the applications of these simulations for potential future kinetic impactor missions.

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