THE INDUCED LIBRATION OF DIDYMOS B RESULTING FROM THE DART IMPACT. H. F. Agrusa[*1,2], D. C. Richardson[1], A. B. Davis[3], E. G. Fahnestock[4], M. Hirabayashi[5]. [1]University of Maryland, College Park. [2]Lawrence Livermore National Laboratory. [3]University of Colorado, Boulder. [4]Jet Propulsion Laboratory, California Institute of Technology. [5]Auburn University. [*]hagrusa@astro.umd.edu

Introduction: NASA's Double Asteroid Redirection Test (DART) is designed to be the first demonstration of a kinetic impactor for planetary defense against a small body impact hazard. The target is the smaller component of the binary asteroid 65803 Didymos. We have conducted high-fidelity Full Two-Body Problem (F2BP) simulations of the mutual dynamics of the system as part of a larger benchmarking exercise.

Results: We find that the coupled dynamics of the system are highly sensitive to different numerical methodologies and initial conditions. For example, the secondary's true anomaly is strongly dependent on the initial rotation phase of the primary, due to the irregular shape and resulting gravitational field of the primary. This makes numerical predictions of the secondary's location untenable, since pre-impact observations of the system are unlikely to resolve the primary rotation phase. However, ground-based measurements of the binary mutual orbital period to high precision are expected to sufficiently constrain the secondary's true anomaly for mission success.

Notably, we find that the DART spacecraft should excite a significant libration on the secondary, by creating a discrepancy between the secondary's orbit and spin periods. We find that the magnitude of the libration angle is strongly dependent on the momentum transfer efficiency of DART, and the frequency of the libration is dependent on the mass distribution of the secondary. If the induced libration is measurable by ESA's proposed follow-up spacecraft, Hera, it may be possible to infer properties of the secondary's interior and make an independent measurement of the momentum transferred by DART.

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