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THE RELEVANCE OF THERMAL INERTIA TO PLANETARY DEFENSE

Alan Harris[(1)] and Line Drube[(1)]
[(1)] *German Aerospace Center, Rutherfordstr. 2, 12489 Berlin, +49 (0) 3067055-0*
alan.harris@dlr.de; line.drube@dlr.de

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ABSTRACT

One of the largest uncertainties in the outcome of an attempt to deflect an asteroid with a kinetic impactor is the momentum enhancement factor, β, which is related to the amount of momentum carried off by ejecta produced by the impact. The momentum enhancement of an asteroid due to ejecta is proportional to (β-1). The amount and velocity distribution of ejecta depends on the porosity and density of the surface material, characteristics that are closely related to thermal inertia. We show how it is possible to estimate the surface thermal inertia of an asteroid from Earth-based infrared observations, such as those carried out by NASA's Wide-field Infrared Survey Explorer (WISE) space telescope, and thereby provide information on physical characteristics relevant to asteroid deflection. Recent research results suggest the thermal inertia of near-Earth objects (NEOs), and therefore the density and thermal conductivity of near-surface material, increases rapidly with depth within the topmost 1m. If density increases with depth, the value of β relevant to the kinetic impactor concept will be larger in general than that implied by the properties of material on the surface. Furthermore, thermal conductivity is an important parameter in calculations of the Yarkovsky orbital drift of NEOs.
We briefly describe the relevant observational results and discuss their implications for the effectiveness of the kinetic impactor deflection concept, and for calculations of the Yarkovsky effect relevant to the impact hazard.

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Comments:

Oral presentation strongly preferred.