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NEOTωIST – Design Study of a Kinetic Impactor Demonstration Mission Featuring NEO Spin Change and Observer Sub-spacecraft

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ABSTRACT

Near Earth Object (NEO) deflection for the purpose of Earth impact prevention is recognized as a valid and valuable endeavour. NEOTωIST stands for Near-Earth Object Transfer of angular momentum (ω) Spin Test. This describes a demonstration mission intended to develop the capabilities required to execute an effective kinetic impactor NEO deflection mission. The mission concept features several novel

aspects. The most important of these are a new technique to quantify momentum transfer from the Impactor spacecraft to the NEO, and the option to use small sub-spacecraft for observation purposes. For momentum transfer measurement, the NEO is struck off-center which changes its spin rate. This rate change, which can be measured from Earth via light curve measurements, allows quantification of the transferred momentum without the need for a rendezvousing observer spacecraft.

To gain additional information about the impact geometry and impact physics, the NEOTωIST Impactor may deploy one or several sub-spacecraft from the main Impactor spacecraft shortly before impact. These sub-spacecraft allow observation of the impact event from multiple vantage points some of which are unique because their destruction is accepted. Different mission variations exist depending on whether the mission is implemented with only the Impactor or with a complement of observing sub-spacecraft. The paper discusses these options. Overall, the concept promises comparatively low cost and features capabilities that are unique and valuable for an operational deflection or reconnaissance mission.

The overall mission concept and measurement principle are described in detail in a different abstract by L. Drube et al. This paper focuses on the results of a preliminary mission design study with the objective of demonstrating mission feasibility. It analyses the key technical challenges of the mission, and describes the concept of operations as well as geometry design for the impact and fly-by phase of the mission. Further, the communications architecture between the different spacecraft and Earth is discussed, and the preliminary design of the individual spacecraft is presented.

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