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NEOSHIELD: POST MITIGATION IMPACT RISK ASSESSMENT FOR ASTEROID DEFLECTION DEMONSTRATION MISSIONS

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ABSTRACT

Today, natural disasters caused by impacts of Near-Earth asteroids (NEAs) are believed to be avoidable, if the resources to launch a deflection mission can be made available. Laboratory experiments and numerical simulations provide a basis on which such deflection attempts can be built upon. This has been shown, for instance, in the framework of the NEOShield project, an international initiative under European leadership aimed at investigating asteroid deflection options. However, uncertainties in the physical characteristics of potentially hazardous asteroids as well as the deflection process itself can make accurate predictions of deflection outcomes difficult.

Only through a deflection demonstration mission can we assess the completeness of our understanding of the processes involved in deviating an asteroid from its nominal trajectory. As financial constraints play an important role in mitigation demonstration mission design, potential targets have to be cheap to reach. Asteroids orbiting in the vicinity of the Earth such as NEAs are, thus, a preferred option, as many of them retain small minimum distances to Earth in the medium term. Naturally, any orbit manipulation of potentially hazardous asteroids has to be carefully planned in order

to avoid creating or increasing impact threats. To this end it is especially important to quantify the influence of uncertainties present in the mitigation process.
Here, we present a framework to perform a post mitigation impact risk assessment of deflection test missions based on Kinetic Impactor and Gravity Tractor concepts. Using a state of the art mission design and impact monitoring tools we show that deflection actions and their corresponding uncertainties have to be considered on a case by case basis to ensure that the target asteroid's threat potential is not increased due to mitigation demonstration attempts.

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