Post Deflection Impact Risk Assessment and Avoidance

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Résumé

Even after decades of large-scale near-Earth asteroid discovery and observation programs the census of objects that can collide with our planet is not complete. As the well documented case of the Chelyabinsk boldie has shown in 2013, even relatively small objects have the potential to cause infrastructure damage and harm the local population. Impacts of hundred-meter-sized asteroids on our planet are one of the few natural desasters that can - in theory - be averted, however. Deflecting the trajectories of near-Earth asteroids is deemed technically feasible. Several methodologies have been envisaged to achieve such goals. Kinetic impactors are among the most mature concepts in this respect. Hyper-velocity collisions between kinetic impactors and asteroids are expected to produce a significant amount of ejected material that can rival that of the impactor itself, thus improving the deflection performance. Uncertainties in magnitude and direction of the momentum carried by the ejected material are substantial, however, and weaken predictions on the asteroid's post-impact orbit. This makes it difficult to guarantee that the deflection does not cause the target asteroid to enter a secondary gravitational keyhole. Such a scenario would lead to a high probability of the same object to collide with the Earth at a later date. This contribution deals with the question how to best target an asteroid during an impulsive deflection maneuver so as to avoid creating concerns for planetary safety in the future.
The proposed methodology promises a more efficient and safe application of deflection actions via kinetic impacts.

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