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**OPTIMAL TRAJECTORY DESIGN OF ASTEROID CAPTURE DURING** [**CLOSE ENCOUNTER WITH EARTH**](https://www.aanda.org/articles/aa/abs/2014/03/aa22364-13/aa22364-13.html)

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##### ABSTRACT

Nowadays, Near Earth Objects(NEOs) have been attracting considerable attention and more and more NEOs have been detected in the recent years. Among these NEOs, the potentially hazardous objects(PHOs) have a greater chance of impacting the earth and causing danger. Thus, more attention needs to be paid to these PHOs. There are more than 2000 asteroids in the current list of PHOs[1]. In order to better defend against these PHOs’ impacts, more in-depth understanding of PHOs is needed. PHOs are asteroids which are around 150 meters in diameter, and had Minimum Orbital Intersection Distance (MOID) with the Earth < 0.05 astronomical units (AU)[2]. They should be placed at the top of the list of objects requiring additional observations.

In this paper, a fictious mission of capturing a PHO to a distant Earth orbit or Lunar orbit for further asteroid exploration is considered. Unlike traditional capture scheme, the current capture scheme is assumed to be performed in the framework of the Luna-Earth-PHO three body system when the PHO approaches the Earth. Then, the design of optimal capture trajectories will be investigated in this study.

In the trajectory design process, the orbit of the selected PHO is propagated using the high-fidelity dynamical model. The impact time and the velocity increment of capture is considered as optimization variables. In order to ensure the asteroid orbits in a relatively stable orbit in the Earth Moon system after impact, the Jacobian constant of the three body system are constrained within appropriate range. Heuristic optimization algorithm such as particle swarm optimisation will be employed to minimize the required capture deltaV. Both direct capture and Lunar gravity-assisted capture are expected to be analysed. Numerical simulation will be performed to check the stability of the orbit after capture.

References:

[1] https://www.minorplanetcenter.net/iau/Dangerous.html

[2] Annals of the New York Academy of Sciences: Volume 822 Near-Earth Objects, The United Nations International Conference, MPC Director Brian Marsden, 1995