

**RESEARCH ON DEFENSE OF SMALL SIZE ASTEROIDS WITH BOTH  
MONITORING WARNING AND IN-ORBIT DISPOSAL OF KINETIC IMPACT**

**Kaiduo Wang<sup>(1) (2)</sup>, Mingtao Li<sup>(1) (2)\*</sup>, Qi Zhou<sup>(1)</sup>, Yirui Wang<sup>(1)(2)</sup>**

*<sup>(1)</sup> National Space Science Center, Chinese Academy of Sciences, Beijing, 100190,  
People's Republic of China*

*<sup>(2)</sup> University of Chinese Academy of Sciences, Beijing, 100049, People's Republic of  
China*

**Keywords:** *kinetic impact, monitor warning, in-orbit disposal, interceptor deployment  
scheme design*

**ABSTRACT**

Asteroids with a diameter under 50 meters are more numerous and fainter, which have a high probability of impacting the Earth with a short warning time. Their impact would not cause a global disaster but would cause a Chelyabinsk-level disaster. In this paper, an interceptor deployment scheme based on multi-class orbits was designed, which combines monitoring warning and in-orbit kinetic impact. The feasibility and scheme of deflecting or destroying small size asteroid structures by kinetic impact under short warning time are studied. Firstly, we studied the characteristics of small size asteroids' impact on Earth, analyze the necessity of kinetic impact destruction, and use iSALE combined with numerical simulation to study the critical conditions of kinetic impact deflection and destruction of different types of asteroids. Then, considering both monitoring warning and in-orbit kinetic impact, we studied the deployment of space-based interceptors in DRO (Lunar Distant Retrograde Orbit) orbit, the libration points in the Sun-Earth system (Lagrange points), the libration points in the Earth-Moon system, Earth leading orbit and Venus-like orbit. We designed the deployment scheme of space-based kinetic impact interceptors based on the above orbits. In those schemes, the space crafts can not only act as monitors to monitor the hazardous asteroids and warn before they impact the Earth, but also become impactors, which respond quickly, timely and efficiently, to deflect the asteroid or destroy its structure within a limited warning time. Finally, we analyzed and compared the early warning and in-orbit disposal efficiency of the above orbital deployment schemes, and studied the factors that affect the defense capability of the kinetic impactors, and demonstrated its defense effect on small size asteroids.