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EXPERIMENTAL STUDY ON THE INTERACTION OF PULSED LASER ABLATION OF ASTEROIDS FOR PLANETARY DEFENSE

Abstract

In recent years, the multiple fireball events of asteroids entering the atmosphere have aroused widespread concern about asteroid threats. In the history of the earth, asteroids have impacted the earth many times, posing a serious threat to the life of the earth. The most famous event caused by asteroids hitting the earth was dinosaur extinction. In order to deal with the threat of asteroid impact, it is necessary to carry out research on asteroid defense technology. Laser ablation of asteroids is considered to be an effective defense technology to deal with the threat of asteroids with a long warning time. This technology focuses high power density continuous laser or pulse laser on the asteroid, which makes the surface material of the irradiated asteroid gasify or even plasma due to energy deposition. The reaction force generated by gasification or high-speed ejection of plasma material can drive the asteroid. At the same time, the gasification or plasma of the asteroid material can also reduce the mass of the asteroid, Finally, due to the long-term effect of driving force generated by laser ablation and the cumulative change of asteroid mass, the asteroid will have a large orbital offset, so as to achieve the purpose of defense. In this paper, experimental studies have been carried out on the interaction law between pulsed laser and asteroid materials, and the effects of different laboratory environments and asteroid porosity on the impulse coupling law have been obtained. In addition, mass removal rate experiment of laser ablation of asteroid material has also been carried out, and the best mass ablation rate power density has been obtained. The research in this paper will help to understand the interaction between pulsed laser and asteroid, and thus provide a basis for designing an efficient defense mission of laser ablation of asteroids.