

## Accepted Manuscript

Title: Removing small scale space debris by using a hybrid ground and space based laser system

Authors: Quan Wen, Liwei Yang, Shanghong Zhao, Yingwu Fang, Yi Wang



PII: S0030-4026(17)30613-7  
DOI: <http://dx.doi.org/doi:10.1016/j.ijleo.2017.05.075>  
Reference: IJLEO 59224

To appear in:

Received date: 23-2-2017  
Accepted date: 22-5-2017

Please cite this article as: Quan Wen, Liwei Yang, Shanghong Zhao, Yingwu Fang, Yi Wang, Removing small scale space debris by using a hybrid ground and space based laser system, *Optik - International Journal for Light and Electron Optics* <http://dx.doi.org/10.1016/j.ijleo.2017.05.075>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Removing small scale space debris by using a hybrid ground and space based laser system

Quan Wen, Liwei Yang, Shanghong Zhao, Yingwu Fang, Yi Wang

Information and Navigation College, Air Force Engineering University, Xi'an 710077, China

**Abstract:** High power pulsed laser orbiting debris removal is considered as one of the most efficient and feasible methods to mitigate the threat from the small scale space debris. It is divided into two methods in accordance with its placement of the laser system, i.e. the ground-based system and the space-based system. However, each of the systems has its inherent advantages and drawbacks. Therefore, this article combined the advantages of both laser systems to propose a hybrid ground and space based laser system. First, we established a laser ablation impulse coupling model according to the analysis of the rotation characteristic of the small scale space debris. Then, a momentum transfer model of space debris orbit was built up through the analysis of orbit transfer. Finally, the proposed scheme is investigated by numerical simulation, and the small scale space debris in typical altitude of 800 km was removed through 1553 laser pulses by using the hybrid laser system within one pass. The simulation results shown that, the proposed system can effectively remove the small scale space debris.

**Key words:** space debris; laser irradiation; laser system; orbit transfer

## 1. Introduction

Currently, the increasing number of space debris poses a considerable danger to orbiting satellites, humans in space and further space exploration activities. Especially, the small scale space debris can be neither monitored and tracked, nor shielded from orbiting spacecraft, posing a significant hazard for its large kinetic energy [1-3]. Hence, small scale space debris is considered as the most dangerous debris in Low Earth Orbit (LEO). It is urgent to remove small scale space debris in LEO actively to guarantee space environment security [4-6]. At present, the proposed solutions of space debris active removal mainly include chasing and grappling the objects, deploying nets to capture objects, attaching an electrodynamic tether and pulsed laser orbiting debris removal [7-9]. Pulsed laser orbiting debris

Download English Version:

<https://daneshyari.com/en/article/5025429>

Download Persian Version:

<https://daneshyari.com/article/5025429>

[Daneshyari.com](https://daneshyari.com)