

# A Research of the Correction Method of the Spacecraft Near-earth Ranging Based on Compton Effect

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**Abstract:**  $\gamma$ -ray altitude control system is an important equipment for deep space exploration and sample return mission in which its main purpose is a ground altitude measurement of the spacecraft based on Compton Effect at the moment when it lands on extraterrestrial celestial or sampling returns to the Earth's land, and an ignition altitude correction of the spacecraft retrograde landing rocket at different landing speeds. This paper presents an ignition altitude correction method of the spacecraft at different landing speeds, based on the number of particles  $\gamma$ -ray reflected field gradient graded. Through the establishment of a theoretical model of the method, its algorithm feasibility is proved after a mathematical derivation and an experiment is designed to verify it, and also the adaptability of the algorithm under different parameters are described. The method provides a certain value for landing control of the deep space exploration spacecraft landing the planet's surface.

**Keywords:** Gama ray spacecraft altitude measurement

## Introduction

Manned spaceflight and deep-space exploration are two major scientific exploration works carried out by China in the field of aerospace, what they all have in common is the presence of EDL process, namely the need to return to Earth or the spacecraft landed on the moon. When the spacecraft near the planet's surface time, especially in the moment of contact with the surface of the planet, the relative velocity of the spacecraft and the planet's surface is expected to be zero. In order to achieve this goal, the general spacecraft landing system is equipped with a retrograde landing rocket spacecraft landing deceleration final step process, based on the Compton effect of near-Earth spacecraft ranging widely used during the last spacecraft landing deceleration control.

Because the spacecraft's retrograde landing rocket has a working time and specific impulse, the spacecraft requires the retrograde landing rocket to start work in a specific altitude to ensure that retrograde landing rocket just ends work at the moment when the spacecraft landing to the ground at a certain speed. When the spacecraft fall speed changes, retrograde landing rocket ignition altitude should correspondingly change to ensure that at other fall speeds, the speed of spacecraft landing on the surface of the planet can be zero as much as possible.

Due to the different landing floor is not necessarily flat, what the laser altimeter or mechanical touch altimeter measures are all the altitude value for a particular point which can not reflect the real landing point within a certain region. Gamma photons altimeter emits gamma photons diffused through certain area and the receiver receives the statistical value of the reflected photon in the area to reflect accurately the altitude of the plane.

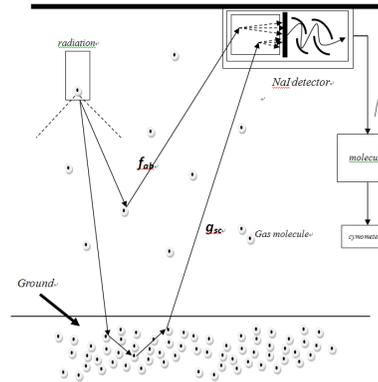


Fig1 The physical process of altitude measurement

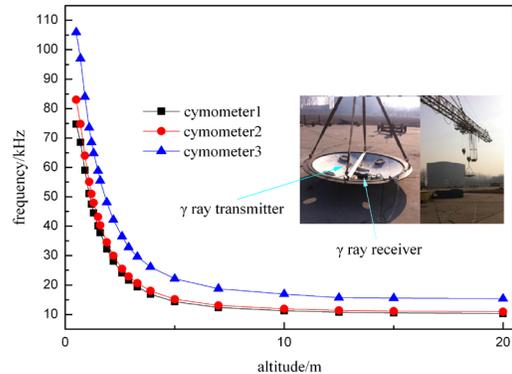


Fig.2. The static H-V curve.

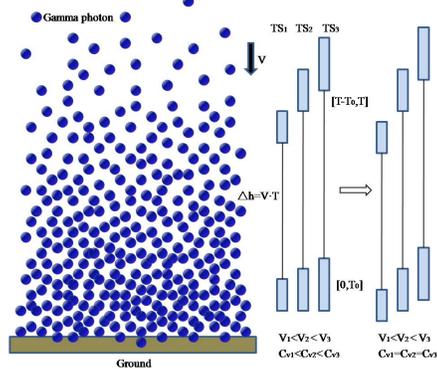


Fig.3. The physical model of altitude correction.