PDC2019
Washington, DC, USA

☐ **Key International and Political Developments**
☐ **Advancements and Progress in NEO Discovery**
☐ **NEO Characterization Results**
☒ **Deflection and Disruption Models & Testing**
☐ **Mission & Campaign Designs**
☐ **Impact Consequences**
☐ **Disaster Response**
☐ **Decision to Act**
☐ **Public Education & Communication**

Momentum Transfer Measurements of Hypervelocity Impacts up to 8km/s by using Ballistic Pendulum

Zou Shengyu, Li xin, Luo Qing, Jiao Dezhi, Li yi, Liu Sen

Hypervelocity Impact Research Center,
China Aerodynamics Research and Development Center, Mianyang 621000, China.
0816-2465287, zoushengyu999@163.com

Keywords: *planetary defense, hypervelocity impact, experiment, momentum transfer, ballistic pendulum*

ABSTRACT

The momentum transfer of hypervelocity impact is crucial to the evaluation of future asteroid deflection strategy. Because of the existence of crater ejecta during hypervelocity impact process, there is momentum multiplication phenomenon in the impacted target body after collision. The effect of momentum multiplication is generally characterized by dimensionless coefficient β. In order to measure the momentum transfer coefficient in hypervelocity impact, hypervelocity impact experiments based on a ballistic pendulum method have been carried out.
This paper presents the setup of the ballistic pendulum measurement system at the hypervelocity impact ballistic range and the experiment method of measuring the momentum transfer coefficient. The ballistic pendulum uses a four-wire bracket to suspend the impact target, and a high-speed camera and a Photonic-Doppler Velocimetry(PDV) are used to measure the speed and position of the target, Monocular image recognition technology is adopted to calculate the space translational and angular motion of the target after being impacted. To investigate the influence of ejecta on hypervelocity impact momentum transfer, a sequence laser schlieren device is also used to capture the sequential images of ejecta cloud during the impact process.The system measurement error caused by instrument deviations has been analyzed theoretically, and used to correct experiment results. A series of hypervelocity impact experiments have been conducted, with aluminum, nylon or PE projectiles striking semi-infinite targets of aluminum, granite or basalt, at speeds up

to 8 km/s. The dependence of momentum multiplication coefficient β on the impact velocity and the target's material is analyzed and discussed.