
The developments of Laser Timer Transfer with Chinese Space Station

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Abstract

The laser time transfer payload developed by Shanghai Astronomical Observatory is carried on the Mengtian spacecraft of Chinese Space Station(CSS), and two ground stations are also built to build a high-precision and high-stability satellite-ground time transfer link, and evaluate the stability of the frequency signal of the atomic clock in CSS. The payload is an integrated design with integrated modules such as single photon detector, event timer and laser retroreflector, the weight of about 6.4kg and power consumption of less than 24W. Breaking through key technologies such as large-field light intensity stabilization and temperature-drift delay compensation, the stability of payload in laboratory test is 0.8ps@1day. The construction of 10kHz repetition rate laser ranging system has been completed in Xi 'an and Beijing respectively. Based on GNSS time reference on ground, the ranging precision of 4mm for laser retroreflector and the satellite-ground time transfer precision is better than 25ps are obtained. In the future, the ground station will access high-performance time reference such as hydrogen clock to evaluate the stability of the atomic clock of CSS, which is expected to support basic research such as gravitational redshift and breakthroughs in engineering applications such as space-ground and inter-satellite time synchronization.

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