A new model to predict Ajisai satellite reflected sunlight flashes and application to the determination of its rotation parameters

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Abstract

As explained by H. Kunimori et al. in 1992, Ajisai is an excellent target to implement the synchronization of distant clocks by means of laser link using passive satellites: Ajisai is equipped with both CCRs for conventional laser telemetry and mirrors that can reflect photons from one station to another. Moreover, its simple spherical geometry facilitates better metrology. Ideally, the analysis of the mutual observations between two laser stations requires to know the points of impact of the photons on the satellite and thus to know its attitude. As demonstrated by several authors, the photometry of the flashes generated by the reflection of the Sun light by the mirrors is an interesting tool to study the rotation of Ajisai. Measurements of the Ajisai's luminous flux has been acquired using a high frequency (5/10 kHz) linear-detection optical photometry technique from the MéO telescope at Grasse station on the Plateau de Calern site of Observatoire de la Côte d'Azur. In this presentation we show that this instrumentation produces very rich information.

In particular, we propose a model reproducing the sequences of flashes emitted by the Ajisai. A decisive novelty was added by introducing the curvature of the mirrors, that allows the reconstruction of the observed light curve given the attitude of the satellite.

The analysis of the observed flashes confirmed the validity of the model and allowed us to reconstruct the attitude of the satellite with an unprecedented accuracy.