EPSC Abstracts
Vol. 6, EPSC-DPS2011-984, 2011
EPSC-DPS Joint Meeting 2011

ISAM - an Interactive Service for Asteroid Models

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Abstract

We present an interactive web service for past and future physical ephemeris of polyhedral asteroid shape models obtained mainly with the *lightcurve inversion* method.

Our tool allows for plane-of-sky views of the models, that can be then compared with asteroid images obtained using different techniques like occultations, radar or thermal infrared. Additionally, lightcurves, animated views, and stereoscopic images can be generated by the users.

The service is available at the address: `http://isam.astro.amu.edu.pl`

1. Introduction

Polyhedral asteroid models are mostly obtained with a *lightcurve inversion* ([3]) method from disk-integrated photometric observations, but can be generated from other techniques as well. Those from the inversion method are being gathered in DAMIT database ([2], `http://astro.troja.mff.cuni.cz/projects/asteroids3D`). The physical asteroid models derived from photometry are described by a sidereal period of rotation, spin axis orientation and a convex shape model. Additional parameters like surface scattering properties, or the period evolution over time can be sometimes determined. But to compare these models with other methods' outcome one needs to orientate them with respect to an earthbound observer. This can be easily done in our service. In what follows there is a general outline of the "ISAM" service, while a detailed description of the service structure and usage can be found in paper [1].

2. Service Functionalities

To use the service, one has to choose from the list of existing asteroid models. For the moment these have been transferred from the DAMIT database, with an addition of (25143) Itokawa detailed model from Hayabusa spacecraft. In the future the polyhedral shape models from any technique can be incorporated into the service. There are three main viewing modes available, these are: Model, Orientation and Video Mode. One can also browse the galleries of various service outcomes for a given object.

2.1. Model

It allows for viewing the shape model from different directions and in different lighting geometries. If the object is nonconvex, the shadowing of various surface areas can be noticed.

2.2. Orientation

This is the main mode for scientific purposes. It allows for displaying an asteroid model plane-of sky view for a requested date. The shape model can be illuminated only by the Sun, or the full silhouette of the model can be displayed. The latter is designed for observers of stellar occultations by asteroids. If needed, the Light-Travel time correction can be applied, because by default a view for an earthbound observer is generated. The spin axis is visualized and its changing orientation in different aspect angles can be seen.

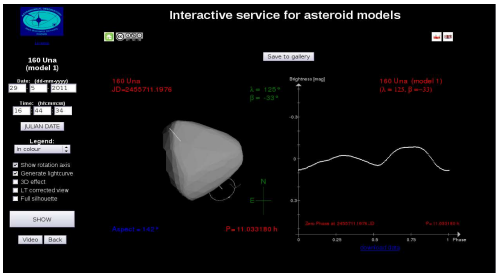

Figure 1: The view of the service page in the Orientation mode

For a given starting epoch, the lightcurve over one rotation can be quickly generated. It can be downloaded, the same as a model view, and used for further research.

In Figure 1 the web page view in the Orientation mode is shown. Possible options are on the left, and the generated view for the model is described by all the model parameters, the date, aspect angle and on-sky directions. If needed, a shape model without any descriptions can be displayed.

One can also generate stereoscopic views in three different forms: an anaglyph, cross-eye view and parallel view. The two latter 3D effects do not require usage of any glasses (see Fig. 2 for a cross-eye view of (25143) Itokawa).

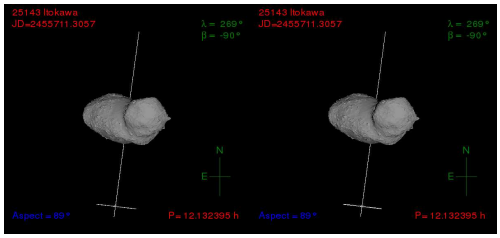

Figure 2: Two views of (25143) Itokawa for a cross-eye stereoscopic effect.

2.3. Video

The video mode allows for the animated rotation of an asteroid model, also with a lightcurve generated in a real time. It enables an analysis of how various features of the lightcurve are bound to certain areas on the model surface. Choosing a greater number of frames per period creates slower movies, thus allowing for more detailed analysis. The movies with rotating asteroid can also be stereoscopic, provided the lightcurve option is not chosen.

3. Summary

We believe that the service fulfills the needs of asteroid researchers and amateur observers, allowing for straightforward and interactive plotting the models on-sky orientations. As a consequence it fills the gap between photometric models and those obtained in other ways. It also allows for visual connecting a rotating shape model with its lightcurve, making it a tool that can be widely exploited, also by a public.

Acknowledgements

This work was supported by grants N N203 302535 and N N203 404139 from the Polish Ministry of Science and Higher Education.

References

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