

Simulating Thermo-physical Properties of Saturn's Rings

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We have gathered a large amount of Saturn data from two vantage points: Cassini which is orbiting Saturn and its rings, and Earth. We compared ground-based observations with data from Cassini but we also investigated and verified different models. We used the thermo-physical model created by Johan Lagerros because it resembles the Standard Thermal Model and it includes heat conduction, beaming, and shape. This model is actually for the analysis of asteroids, so the aim of this project was to approximate ring particles as asteroids. More specifically, the objective of my project was to install the Lagerros model on a JPL machine, and scale the asteroid objects to represent ring particles. The software itself uses Matlab as a front-end user interface, because there is a good deal of code written in C, C++, and Perl. The model was fully installed and debugged to run correctly. Unfortunately, the scaling of the model has yet to be completed. Completing this project has given my group access to the most up-to-date asteroid software, as well as the beginning of a saturn ring particle model. With this new tool, the lab will be able to compare ground based observations and Cassini data to a new model. If the model is working correctly, we can continue to make better hypothesis' on the composition and behavior of Saturn ring particles.

The software package was initially emailed to me in the form of a tar file, and I had to produce a manual with instructions on how to install the software and all of its requirements. Because of the changes in library files, I made a report on the compatibility of this package with other software. Once the software was fully installed and accessible, the next hurdle was to add M-files (Matlab files) to the current model to represent ring particles. The required M-files take the asteroid constructors and create ring particles with the appropriate parameters so that the newly constructed asteroid will resemble a ring particle with a circular orbit around Saturn. The reflectivity, albedo, and density will all represent standard water-ice particles. In the end, the thermal-light curves produced by the model should match with the ground-based observations and eventually Cassini data.

Contingent on the success of this project, we may be able to predict how and why the rings around Saturn were formed. By understanding the formation of these rings, we can make better predictions on how planets form.