Geophysical Research Abstracts,
Vol. 11, EGU2009-10301, 2009
EGU General Assembly 2009

How did the Dark Crater Surfaces in the Bright Areas of the Saturn Moon Iapetus Evolve?

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The global brightness dichotomy of Iapetus has raised interesting questions since its discovery by Giovanni D. Cassini in the year 1671: What is the bright material, what the dark one? How did the dark areas evolve? Those questions are satisfyingly solved only for the dark area covering two-fifth of the surface on the leading side, called *Cassini Regio*. It has been suggested by Spencer (J. R. Spencer et al. 37^{th} DPS Meeting 2005, J. R. Spencer et al. 39^{th} DPS Meeting 2007) that dark organic material is embedded in ice on the whole surface of Iapetus, only some areas are suited for an enrichment of dark material on the surface. A runaway process is started by a slight increase in local heating. This enables increased sublimation of ice. A higher amount of the dark organic material remains behind. This enrichment leads to a decreased albedo and therefore increased absorption. The local temperature rises even more. The Surface of Iapetus has areas where the runaway process did not occur – the bright areas - and areas where the runaway process was triggered - those that are darkened.

Within the large *Cassini Regio* the process in all probability was triggered by exogenous material (T. Denk and J. R. Spencer 40^{th} DPS Meeting 2008). A remaining question is how the troughs und crater bottoms in the bright areas on the trailing side darkened. Here exogenic material can be excluded and an intrinsic mechanism has to be found as a trigger for the runaway process.

We suggest that the scattering of sunlight on the crater surface led to a local increase in intensity on the inside of the crater comparable to the caustic of a concave mirror. This increase triggered the aforementioned runaway process in case of the crater surfaces. As Iapetus is a very slow rotator (sideric rotation period: 79.3 days) the incidence angle for the craters changes very slowly with time and the surface enters a local equilibrium between absorption and reemission and heat conduction. Models of the irradiation, reflectance and absorption using geometrical optics and different scattering models were used for the calculations. The crater surfaces were modeled by facets on a grid. We will present models of the increased local intensity that explain darkening of the surfaces of craters.