

Revisiting the Saturnian satellites following the
recent Cassini-Huygens spacecraft observations:
Resolving an ancient mystery.*

D. A. Mendis
Dept. of Electrical and Computer Engineering
UCSD

Abstract

A recent report appearing in *Physics Today*⁽¹⁾ pertaining to the large brightness asymmetry between the leading and trailing faces of the synchronous Saturnian satellite, Iapetus, discusses an early model proposed by Prof. Ian Axford and me⁽²⁾ to explain this phenomenon, and states that the “data collected since 2004 by the Cassini-Huygens spacecraft offer the most compelling evidence yet for Mendis and Axford’s view.” I will use this opportunity to revisit the question of the observed brightness variations, with orbital phase, not only of this outermost large Saturnian satellite Iapetus but also of the large inner ones (Tethys, Dione, Rhea, and Titan). While Titan (which has a significant atmosphere) shows no brightness variation with orbital phase, the remaining satellites show small but definite brightness variations with orbital phase, which, curiously, are in a sense opposite to that of Iapetus. In other words, while the leading face of Iapetus is much darker than its trailing face, the leading faces of the other satellites (with the exception of Titan) are somewhat brighter. Here I will explain the latter observation too by invoking the impact on the trailing faces of these inner satellites (which lie inside the planets’ magnetosphere) by a class of negatively charged dust grains in the E-ring, moving in gravitoelectrodynamic orbits with super-Kepler speeds.⁽³⁾

References:

1. Wilson, M., Explaining the two-toned nature of Iapetus, *Physics Today* (February 2010), p. 15.
2. Mendis, D. A. and Axford, W. I., Satellites and magnetospheres of the outer planets, *Ann. Rev. Earth Planet. Sci.*, 2, 419, 1974.
3. Mendis, D. A. and Axford, W. I., Revisiting Iapetus following recent Cassini observations, *J. Geophys. Res.*, 113, A11219, 2008.

Invited Talk:

International Advanced Workshop on the Frontiers of Plasma Physics, Abdus Salam International Center for Theoretical Physics, Trieste, Italy, 5-16 July 2010.