Geophysical Research Abstracts
Vol. 16, EGU2014-7338, 2014
EGU General Assembly 2014

Estimations on the Interior of Small Icy Bodies in the Solar System

Ruth-Sophie Taubner (1), Johannes J. Leitner (1,2), Maria G. Firneis (1,2), Regina Hitzenberger (1,3)

(1) Research Plattform ExoLife, University of Vienna, Vienna, Austria (ruth-sophie.taubner@univie.ac.at), (2) Institute of Astrophysics, University of Vienna, Vienna, Austria, (3) Faculty of Physics, University of Vienna, Vienna, Austria

During the last decade small icy bodies have become more and more important for the search for potential habitats in the Solar System. This development was primarily attributable to the indications for Europa's subsurface ocean (e.g., Carr et al., 1998) and the detection of Enceladus' plume (Porco et al., 2006). These observations showed that liquid water can exist under certain circumstances even far beyond the classical habitable zone (Kasting et al., 1993). Additionally, the subsurface water reservoirs may contain a significant amount of ammonia which causes the fluid to stay liquid even below 0°C.

If liquid water is in contact with the rocky layer, erosion or similar interaction processes will take place and enrich the water with possible nutrients for potential life forms in this habitat. Therefore, especially the water/rock boundary zone seems highly interesting for astrobiological studies.

We developed a three and four layer model for the interior of small icy bodies, i.e. icy moons, TNOs, and asteroids as small as 200 km in radius. The simulations are based on three different scenarios which consider the diverse interior structures of three selected prototype satellites (Io, Europa, and Titan). On average, the water layer represents approximately 20 % of the bodies' radii for the Europa- and Titan-like model. In contrast, for the Io-like scenario, in which we do not include a global subsurface ocean, just Io, the Moon, Vesta, and Hygiea fit into the model. This may indicate that water/ice-regions or even liquid water shells are far more common in the Solar System than previously assumed.

Furthermore, we estimate the bodies' dimensionless moment of inertia and compare our results to observed values as far as they are available. Moreover, the physical conditions at the bottom of the bodies' potential subsurface ocean and the thickness of each layer will be estimated. This study will give us a good overview about the distribution of potential liquid water reservoirs in the Solar System and should be seen as an addition to Hussmann et al. (2006) with recent data.

References:

M. H. Carr et al., Evidence for a subsurface ocean on Europa. Nature, 391:363–365 (1998).
H. Hussmann et al., Subsurface oceans and deep interiors of medium-sized outer planet satellites and large trans-neptunian objects, Icarus, 185:258–273 (2006).
J. F. Kasting et al., Habitable Zones around Main Sequence Stars. Icarus, 101:108–128 (1993).
C. C. Porco et al., Cassini Observes the Active South Pole of Enceladus. Science, 311:1393–1401 (2006).