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Magnetic induction signatures from an ocean within Triton

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Abstract

The subsurface (or mediterranean) ocean within Europa was detected through its induced magnetic dipole. This is generated by the changing background magnetic field from Jupiter, which rotates with a 11.2 hour (synodic) period. This signature shows that there is an electrically conductive layer within the body, but it does not uniquely determine the depth, thickness or conductivity of the ocean. To do so requires variations in the background field on different time scales. Suggested time scales are the orbital period of Europa (since the current sheet varies with local time) and harmonics of the synodic period (since the field is not perfectly sinusoidal in System III longitude.) However there oscillations are very weak compared to the main, 11.2 hour driving field.

It is possible that Neptune's moon, Triton, also contains an ocean. This raises the possibility of observing such an ocean through magnetic induction [1], [2]. The magnetic signature differs from that of Europa in two respects. First, it is driven at a large number of frequencies. The internal field of Neptune is complex, with strong quadrupole and octupole terms, and the orbit of Triton is inclined. This produces variations in the background at the synodic period, the orbital period, harmonics of the two and beat frequencies of the two. Second, unlike Europa, the conductivity of Triton's atmosphere is significant compared to that of the ocean [3]. As a result, Triton's induced field involves two, concentric conducting layers. In this presentation, we examine the detectability of such an ocean, how presence of multiple exciting frequencies could enhance such studies of the ocean, and how the ionosphere would affect such results.

References

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