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[24.10] The ionospheres of Ganymede and Callisto from Galileo radio occultations

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The U.S. Galileo spacecraft, which has been in orbit around Jupiter since December, 1995, has provided opportunities to collect s-band radio occultation data using the 70 meter antennas of the NASA/JPL Deep Space Net(DSN) at Goldstone, California, Madrid, Spain, and Canberra, Australia.

Ganymede (J3) has been observed five times by Galileo radio occultation. The results are almost entirely negative, with only one measurement out of ten yielding a possible observation of an ionosphere having a maximum density of about 5,000 cm^{-3} at an altitude of about 16 km.

The failure to observe an ionosphere on Ganymede is at first glance surprising, in view of the detection of oxygen and hydrogen above its surface (c.f., Hall, et al., Astrophys. J., 499, 1998; Barth, et al., GRL, 24, 1997), and it was thought to be due to the shielding effect of Ganymede's magnetic field upon the impinging particles from Jupiter's magnetosphere.

Callisto has occulted Galileo four times, and these observations have produced some interesting results. Of the eight individual measurements , two are negative, and six are positive. Two of those six show unmistakable classic ionospheric layers, having peak electron densities of 15,000 to 20,000 cm^{-3} .

A closer examination of all of these results has revealed a plausible reason for why some observations yield positive results , and some do not. It appears that in order for an ionosphere to be observed, the trailing hemisphere of the satellite must be in sunlight. In that way, the atmosphere created by sputtering effects of the Jovian magnetosphere can be ionized by solar EUV to produce an observable ionosphere.

The research described in this paper has been conducted at the Jet Propulsion Laboratory and the University of Michigan with support from NASA contracts and grants.

The author(s) of this abstract have provided an email address for comments about the abstract: akliore@jpl.nasa.gov

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