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New Plasma Waves Observed at Saturn during Cassini's Proximal Orbits

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The Cassini spacecraft's first Grand Finale orbit was carried out in April 2017. This set of twenty-two orbits had an inclination of 63° with a periapsis grazing Saturn's ionosphere, thus providing unprecedented coverage and proximity to the planet. Cassini's Radio and Plasma Wave Science (RPWS) instrument repeatedly detected intense electrostatic waves and their harmonics near closest approach in the dayside equatorial topside ionosphere. The fundamental modes were found to scale best with the lower hybrid frequency. The fine-structured harmonics are unlike previous observations which scale with cyclotron frequencies. We explore their generation mechanism and show strong evidence of their association with whistler-mode waves, consistent with theory. Given their link to the lower hybrid frequency, these emissions may offer clues to constraining Saturn's ionospheric properties. In addition, we observe and characterize VLF "saucers" with features similar to those observed at Earth. We calculate their approximate source locations and further discuss their significance in the context of the ionosphere.