

Recent Observations of Radio and Plasma Waves by Juno and Cassini in Their Similar Orbits at Jupiter and Saturn

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Cassini entered its 'Grand Finale' orbits beginning in late April 2017 with perikrones between the atmosphere and the D ring. The orbit inclination is approximately 63° , hence, the orbits sometimes take Cassini close to or through the source regions of Saturn Kilometric Radiation (SKR). The Grand Finale orbits also carry the spacecraft across magnetic field lines connecting the ring system with the planet, providing the opportunity to investigate electromagnetic connections between the planet and its ring system. The orbits allow for in situ observations of Jupiter's topside ionosphere for the first time with the possibility of penetrating even deeper on its descent into the atmosphere at the end of its mission, depending on how long telemetry can be maintained. Dust apparently eroded from the main ring system is also found in this region, although the number of micron size particles is much less than in the E ring.

Juno is simultaneously orbiting Jupiter in similar orbits. Juno is in a 90° inclination orbit with perijoves between Jupiter's atmosphere and its ring system. Juno has already skimmed through or close to Jupiter's auroral radio emission sources and provided in situ examples of the cyclotron maser instability in operation and the electron distributions driving them. Juno also observes plasma waves of various types on auroral field lines, allowing comparison with terrestrial auroral plasma waves and the possibility to understand the acceleration of auroral charged particles. In addition, Juno has scanned, pole-to-pole, the very innermost region of Jupiter's magnetosphere, inviting comparisons of radio and plasma waves within the inner magnetospheres of these two giant planets. In the case of Jupiter, low-dispersion whistlers are commonly observed at mid-latitudes clearly indicating convective storms including lightning below the spacecraft. Because of the general lack of convective storm activity on Saturn since the Great White Spot storm in late 2010 and the first half of 2011, whistlers have not been observed by Cassini. Juno has observed Jupiter's topside ionosphere near its perijove and dust between the Jovian ring and the atmosphere.

Observations of non-terrestrial in situ auroral radio generation are important in the study of the cyclotron maser instability (CMI) in different planetary settings, so such observations from both Juno and Cassini are of critical interest. Another exciting aspect of these orbits at both planets is the exploratory nature of observing plasma waves in a region not previously sampled with the possibility of investigating interactions between the rings and atmosphere.