

## **Propagation of Saturn's radio lightning studied by three-dimensional ray tracing**

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Saturn Electrostatic Discharges (SED) are the radio signature of lightning flashes originating from Saturn atmosphere. Their source is well correlated with cloud features rotating with Saturn's atmosphere. However comparisons of Cassini/RPWS (Radio and Plasma Waves Science) and Cassini/ISS (Imaging Science Subsystem) data have shown that when Cassini is at specific Local Time positions relative to Saturn (e.g.  $\sim 06:00$  LT), radio detection starts before the cloud system is in the hemisphere visible from Cassini : this phenomenon has been called the “over the horizon” effect, and it appears to be frequency-dependent. Using our 3D ray tracing code which computes the wave propagation through a realistic model of Saturn's ionosphere, where electron density varies with the local time, altitude, and latitude, we show that this effect can be explained by temporary trapping of the SED radio waves below the ionosphere, before their escape from Saturn's vicinity. These results are obtained with propagation on the free-space mode, i.e. neglecting background magnetic field. But it has also been shown that below  $\sim 2$  MHz, SED are circularly polarized in a sense consistent with magneto-ionic O-mode propagation. Thus we have implemented mode-dependent propagation in our ray-tracing code, in order to further explore SED propagation through Saturn's magnetized ionosphere. We present the results of this study.