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Discovery of Alfven waves planetward of the Rings of Saturn

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Between April and September 2017 in the final stages of the Cassini Saturn Orbiter mission the spacecraft executed 22 orbits passing planetward of the innermost ring, the D-ring. During periapsis passes on all these orbits oscillations were detected in the azimuthal magnetic field components on typical time scales from a few minutes to 10 minutes. We argue that the time-varying signals detected on the spacecraft are also primarily time-varying in the plasma frame. Nonetheless, we show that nearly all signals exhibit a distinct spatial effect, namely a magnetic node near the effective field line equator. The oscillations thus have a standing structure along the background magnetic field and it follows that they are field line resonances associated with Alfvén waves. The form of the signals suggests that the local field line resonances are most likely pumped from global sources. This is the first detection in a giant planet magnetosphere of a phenomenon known to be important at Earth.