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Juno Waves observations at Jupiter

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Abstract

The Juno spacecraft successfully entered Jupiter orbit on 5 July 2016. One of Juno's primary objectives is to explore Jupiter's polar magnetosphere. An obvious major aspect of this exploration includes remote and in situ observations of Jupiter's auroras and the processes responsible for them. To this end, Juno carries a suite of particle, field, and remote sensing instruments. One of these instruments is a radio and plasma wave instrument called Waves, designed to detect one electric field component of waves in the frequency range of 50 Hz to 41 MHz and one magnetic field component of waves in the range of 50 Hz to 20 kHz. Juno has now made scientific observations on several perijove passes beginning with Perijove 1 on 27 August 2016. This paper will focus on waves observed on or near auroral field lines.

Auroral radio emissions known as kilometric, hectometric, and decametric emissions have been observed even at or close to their sources. Analysis of Jovian Auroral Distributions Experiment (JADE) electron distributions show sources of free energy sufficient to drive the cyclotron maser instability that is responsible for Jupiter's auroral radio emissions. Remote observations provide source locations for broadband kilometric radiation that are consistent with auroral field lines and UV auroras. Auroral crossings are often marked by auroral hiss emissions with a characteristic funnel shape presumably due to propagation near the resonance cone. This whistler-mode hiss is particularly intense when the Jupiter Energetic particle Detector (JEDI) observes very intense precipitating electrons with a broad energy spectrum extending up to 1 MeV. Lower frequency waves, below the proton cyclotron frequency, are also often observed with intensities greater than those at higher frequencies, suggesting ion-cyclotron waves. We will summarize the major wave phenomena on auroral field lines and attempt to assess their roles in the physics of Jupiter's auroras.