



Proton cyclotron waves occurrence and amplitude dependence on IMF cone angle: MAVEN observations

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Proton cyclotron waves (PCWs) are observed upstream of the Mars bow shock and are often believed to be related to ion pick up process, in which exospheric hydrogen atoms can be ionized and subsequently accelerated by solar wind electric field. These waves are at about the proton gyrofrequency in local plasma environment. Moreover, these waves are usually left-hand polarized and propagating quasi-parallel with respect to interplanetary magnetic field (IMF), which is subject to IMF cone angle. Using magnetic field measurements from the Mars Atmosphere and Volatile Evolution (MAVEN), we report on a decreasing tendency of PCWs' amplitude to the increase of IMF cone angle, and the tendency is consistent with previous simulation results. We also find that the occurrence rate of PCWs is greater when IMF is quasi-parallel with respect to solar wind velocity than quasi-perpendicular conditions, and this is independent to seasonal variabilities. These results imply that pickup geometry not only regulate PCWs' amplitude which is expected to be related to pickup ion density, but also has a strong impact to the wave activity at Mars.