PROTON CYCLOTRON WAVE GENERATION MECHANISMS UPSTREAM OF VENUS

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Recent long term observations of proton cyclotron waves in the upstream region of Venus raise the question, under which general solar wind conditions these waves are generated and maintained. Magnetometer data of the Venus Express spacecraft for two Venusian years of observations are analyzed before, during and after the occurrence of the waves. The classical mechanism for nearly perpendicular configurations of the interplanetary magnetic field (B_{IMF}) and the solar wind velocity (V_{SW}) with ion pick-up into a ring-distribution in velocity space is investigated for its efficiency, as well as wave generation under quasi-parallel conditions for the V_{SW} and B_{IMF} , when the solar wind motional electric field is weak. It is found that stable magnetic field conditions for up to 20-30 minutes are required to enable sufficient ion pick-up and growth of the left-hand polarized wave component to obtain observable waves in the magnetometer data. Only few cases with persistent waves under quasi-perpendicular conditions of B_{IMF} and V_{SW} are detected. This indicates that instabilities driven by field-aligned planetary ion beams act as main generation mechanism for the proton cyclotron waves observed upstream of the Venus bow shock.

Venus upstream waves

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