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Radiation patterns and reciprocity of whistler mode antennas[1] J. MANUEL URRUTIA, REINER STENZEL, Dept of Physics and Astronomy, UCLA
— Whistler modes can be excited and received with magnetic loop antennas. The radiation pattern has been measured in a large laboratory plasma for a low frequency whistler mode ($\omega \simeq 0.3\omega_c \ll \omega_p$). The difference in the radiation patterns for group and phase velocities is shown and discussed. Plane waves have been generated using antenna arrays. These are used to measure the antenna patterns of receiving antennas which are usually different. Examples are small loops which radiate along the resonance cone but receive all waves within the resonance cone. The reciprocity of antennas has been investigated. Directional antennas and phased array antennas are not reciprocal. A relative motion between an antenna and a plasma modifies transmitting and receiving properties. When a loop antenna moves rapidly across the dc magnetic field a continuous wave of the source excites wave packets in the form of a whistler wing in the stationary plasma. Moving receiving antennas are subject to frequency shifts by the convective derivative such as Doppler shifts. Motion violates reciprocity, e.g. radiation cannot be received from a downstream source, but transmitted to a downstream receiver. These results are of interest to space and laboratory plasmas.

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