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Radiation efficiency for exciting whistler modes of electric and magnetic antennas: a comparison[1] J M URRUTIA, R L STENZEL, Physics and Astronomy, UCLA — Low frequency whistler modes ($\omega < \omega_c/2$) are excited in a large uniform laboratory plasma with electric dipoles and magnetic loop antennas oriented perpendicular to the ambient magnetic field. The antennas are driven under identical plasma conditions with short pulses from the same rf source so as to avoid nonlinear effects. The wave propagation and rf field topology are measured with rf probes. As expected, a magnetic loop antenna excites much stronger whistler modes than an electric dipole antenna. This is because the dipole electric field is shielded by sheaths and its current is a small displacement current compared to the conduction current of a closed loop antenna. A power ratio of $P_{\rm loop}/P_{\rm dipole} \simeq 8000$ has been observed. The radiation resistances have also been obtained from first principles ($R_{\rm rad} = P_{\rm rad}/I^2_{\rm rms}$), but cannot be compared since the currents are vastly different. It is interesting to note that the electric dipole excites a wave whose topology resembles that of an $m = 1$ helicon mode. The loop has an elongated shape of the same length as the electric dipole (15 cm) and excites an $m = 0$ mode. These results are relevant to whistler wave injections experiments into space plasmas.

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