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Electron Heating and Light Emission from Whistler Spheromaks[1]

J.M. URRUTIA, R.L. STENZEL, K.D. STROHMAIER, Physics & Astronomy, UCLA — Large amplitude whistler modes with wave magnetic field exceeding the ambient field have been produced in a laboratory plasma. In one configuration, the topology resembles that of spheromaks. In this case, strong electron acceleration and heating are observed. Energetic electrons (>10 eV) produce light emission in the ambient dark afterglow plasma ($T_{e0} \sim 2$ eV). The light source travels along with the slow whistler spheromak ($v_{\|} \sim 20$ cm/μs $< v_{e,th}$). Space and time resolved probe and light emission measurements indicate that the heating mechanism is due to the acceleration of electrons in a magnetic null layer by an inductive electric field associated with the decay of the free magnetic energy. The electron distribution has both energetic tails and exhibits bulk heating. Due to heat conduction and radiation, little heat and light remains after the passage of the spheromak. In a whistler mirror, supported by electron Hall currents, there is negligible electron heating. Near the antenna exists an X-type null line where also energetic electrons are produced.

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