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NON-EQUILIBRIUM ELECTRICAL CONDUCTIVITY AND ELECTRON TEMPERATURE MEASUREMENTS IN ELECTRIC FIELDS AND CROSSED ELECTRIC AND MAGNETIC FIELDS

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The non-equilibrium electron temperature in a streaming argon-potassium plasma was measured as a function of current density in the range 0,01 to 10 amps/cm^2. The electron temperatures determined by the potassium and sodium resonance lines were measured by the line reversal method at gas temperatures of 1500°K and 2000°K. The optical thickness of the plasma has also been estimated from the measurements. The temperatures measured from different lines differ by about 100°K. The electron temperature as a function of the current density initially does not rise as fast as the simple theory predicts. The conductivity calculated from the measured electron temperature was compared with the measured conductivity.

Measurements have also been made of the non-equilibrium electron temperature and electrical conductivity in an argon-potassium plasma under MHD conditions (i.e. with crossed electric and magnetic fields). The scalar conductivity $\sigma = j_x/E_x$ and the Hall coefficient of the plasma were derived from the electric field potential distribution by assuming a uniform current density distribution. The conductivity has been theoretically derived as a function of electron temperature and magnetic field. The measured conductivity is compared with the conductivity calculated from the measured electron temperature. A magnetic field appears to cause the measured conductivity to drop from its B = 0 value (50% at B = 10 Kf). This theoretically unexplained result could be caused by short circuiting currents within the plasma. These and other possible disturbances are currently under investigation.