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Ion Flows in Quasi Equilibrium Magnetized Plasmas WILLIAM EDWARDS, Physics Dept. Utah State University, Logan, Ut., 84322-4415, ERIC HELD, Physics Department, Utah State University, Logan, UT 84322-4415, AJAY SINGH, Physics Dept. Utah State University, Logan, UT 84322-4415, BOYD EDWARDS, Physics Dept. West Virginia Univ., Morgantown, WV — In an ionized gas, conductivity perpendicular to a magnetic field generally is reduced over its free-space value by the factor $[1+(\omega_c/\nu)^2]$ where ω_c and ν are the electron cyclotron and collision frequencies respectively. On the other hand, in a cylindrical Z-pinch plasma in a minimum-total-energy equilibrium with the minor radius just larger than the electron skin depth, $[m_e/(\mu_o n_o e^2)]^{1/2}$, forces on electrons and ions include not only magnetic and thermal but an electrostatic force resulting from unequal electron and ion charge distributions. Except for the force driving the current, the resulting net force is zero. As a result the magnetic field does not cause a reduction in the conductivity even though the velocities of both electron and ion fluid particles are perpendicular to the magnetic field, In this case electrons dominate the current. On the other hand, if the equilibrium minor radius is on the order of the ion skin depth, the electron current is impeded by the magnetic field but the ion current is not, consequently ions dominate. Such ion current appears to be present in Venus flux ropes, filaments during the rundown phase in the plasma focus, reverse field configurations, and other magnetic systems.

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