Cyclotron Resonances in a Non-Neutral Multispecies Ion Plasma\textsuperscript{1}

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Shifts of cyclotron mode frequencies away from the single particle $\Omega_c$ are observed to be proportional to the $E \times B$ rotation frequency in non-neutral ion plasmas. These cylindrical ion plasmas consist of Mg24\textsuperscript{+}, Mg25\textsuperscript{+}, and Mg26\textsuperscript{+}, with H\textsubscript{3}O\textsuperscript{+}, O\textsuperscript{2+} and H\textsubscript{2}\textsuperscript{+} impurities. Laser cooling of the majority species, Mg24\textsuperscript{+}, enables temperature control over the range $10^{-5} < T < 1$ eV, as well as determination of cyclotron mode frequencies from launched wave absorption. At moderately low temperatures, the $m = 1$ and $m = 2$ cyclotron frequency shifts are well described by cold fluid theory for an equilibrium square profile.\textsuperscript{2} However, at $T < 10^{-3}$ eV centrifugal mass separation can cause order unity changes in these shifts. For $T \geq 1$ eV, the observed frequency shifts are reduced substantially. Prior high temperature experiments\textsuperscript{1} saw majority species shifts consistent with cold fluid theory, and theoretically unexplained minority species shifts $\Delta f \sim 2f_{Dio}$. Comparisons will be made with nascent theory to determine the effects of temperature and profile shape on these cyclotron modes.

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