Finite-Length Diocotron Modes in a Non-neutral Plasma Column

DANIEL WALSH, DANIEL DUBIN, Univ of California - San Diego —

Diocotron modes are 2D distortions of a non-neutral plasma column that propagate azimuthally via $E \times B$ drifts. While the infinite-length theory of diocotron modes is well-understood for arbitrary azimuthal mode number $\ell$, the finite-length mode frequency is less developed (with some exceptions\(^1\)\(^2\)\(^3\)), and is naturally of relevance to experiments. In this poster, we present an approach to address finite length effects, such as temperature dependence of the mode frequency. We use a bounce-averaged solution to the Vlasov Equation, in which the Vlasov Equation is solved using action-angle variables of the unperturbed Hamiltonian. We write the distribution function as a Fourier series in the bounce-angle variable $\psi$, keeping only the bounce-averaged term. We demonstrate a numerical solution to this equation for a realistic plasma with a finite Debye Length, compare to the existing $\ell = 1$ theory, and discuss possible extensions of the existing theory to $\ell \neq 1$.

\(^1\)Supported by NSF/DOE Partnership grants PHY1414570 and DESC0002451