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**Analysis of Trajectories and Multi-Dimensional Phase Space Diagrams for Electrons Injected Orthogonal to Plasma Waves, and Laser and Scattered Radiation** ARNESTO BOWMAN, RONALD WILLIAMS, Florida A&M University — Plasma waves have been shown to be capable of accelerating electrons over very short distances beyond what is capable by conventional accelerators. The orthogonal injection of electrons is being explored as a diagnostic to infer the amplitude of the large accelerating electric fields associated with plasma wave accelerators. The orthogonal geometry suggests that the particles have trajectories in three dimensions, and we will describe simulation studies of these trajectories. We will also discuss the results of our studies of the multi-dimensional phase space diagrams of electron dynamics in the lab and wave frames. We also describe the changes to the trajectories and diagrams that occur when transverse laser fields and scattered laser radiation fields are included with the longitudinal plasma wave fields. It is necessary for electron beams used for plasma wave diagnostics to have very small transverse emittance. We describe our studies of scanning and photographic methods for measuring beam emittance in our experiments. We are attempting to characterize our thermionic cathode and to compare the predicted emittance, based on power input, with the emittance measured using our apparatus.

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