Tailored Electrostatic Beams From Single-Component Plasmas

TOBIN WEBER, UCSD — A non-destructive technique was recently developed to create high quality, magnetized electron (or positron) beams in a high magnetic field Penning-Malmberg (PM) trap. Expanding upon this technique, a class of electrostatic beams has been produced by extracting these beams from their guiding magnetic field. This procedure involves adiabatic transport of the beam to lower magnetic field, followed by a fast, nonadiabatic extraction to zero field. Once in the zero-field region, the beam is focused with an Einzel lens to small transverse dimensions ($r = 0.12$ cm). Experimental results are presented for beams from a $4.8$ T field PM trap. Details of the extraction physics, including the unavoidable velocity kick that the particles suffer upon extraction, are discussed. A generalized beam emittance is introduced to characterize beam quality. Applications and prospects for the future are discussed, including use of a magnetic spoke arrangement to further improve beam quality.

1This work is supported by NSF, grant PHY 07-13958.