STABILITY OF AN ELECTRON BEAM WITH STRONG SPREAD OVER VELOCITIES IN A SELF-CONSISTENT PENNING—MALMBERG TRAP

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S u m m a r y

A mechanism of electron plasma accumulation and confinement during the injection of an electron beam widely spread in the longitudinal velocity into a drift tube in a strong uniform magnetic field is studied both experimentally and theoretically. The properties and the formation of a collective electron trap for the electron beam that propagates in a conducting cylinder are described. It is experimentally shown that the electron beam stimulates the development of an instability under the above-mentioned conditions. The instability leads to the formation of an electric potential trap. The trap captures electrons during the formation and confines them inside the drift tube. The theoretical explanation of the last stage of the experiment (the confinement of charged particles) is given within the framework of the model considering the shearless motion of a tubular electron beam with constant density profile. The dispersion equation is obtained, and the conditions for the existence of the instability are elucidated. The results of numerical calculations are in good agreement with the experiment.