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Magnetic insulation of a space-charge dominated flow

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We report experimental results of magnetic insulation of a space-charge dominated electron flow in a low energy vacuum diode with ferroelectric cathode. Although in the absence of the magnetic field the high current densities are measured well above the estimated space-charge limiting current, the diode is shown to be insulated by a relatively low magnetic field controlled primarily by the anode voltage. A model which accounts for the two-dimensional nature of the electrons flow in the diode has been developed and it reveals the microscopic picture of the flow. From the space-charge dominated vicinity of the cathode, electrons leave the small emitting area towards the large radius anode ring, along a trajectory that is parallel to the applied magnetic field. Only in the close vicinity of the anode plane, their trajectory bends towards the ring. Good agreement between the experimental data and theory was found.
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