Erratum: ''Transition to turbulence in a crossed-field gap'' [Phys. Plasmas 1, 3725 (1994)]

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The critical current, for the case of zero initial velocity, is *not* achieved under the space charge limited condition of zero surface electric field whenever the magnetic field $B > B_H$, the Hull cutoff value. Thus Eq. (3) in Ref. 1, which is derived under the assumption of zero surface electric field, is not the critical current. However, it deviates from the correct critical current only by a small amount, so that it still serves as a useful estimate (see Fig. 1 of this Erratum). The correct value of the critical current does not have a closed form solution for $B > B_H$. For small initial velocity u_0, it is given by the following equations:[2]

$$\tilde{V} = \tilde{J}^2\tilde{T}[4\tan(\tilde{T}/2) - 2\tilde{T}] + 2\tilde{J}\{\tilde{T} - \tan(\tilde{T}/2) + \tilde{u}_0[\tilde{T}\cot(\tilde{T}) - 1]\} - \tilde{u}_0\cot(\tilde{T}), \tag{1}$$

$$0 = 4\tilde{J}^2\frac{\sin(\tilde{T}) - \tilde{T}\cos(\tilde{T})}{1+\cos(\tilde{T})} + 2\tilde{J}\left(\frac{\cos(\tilde{T})}{1+\cos(\tilde{T})} + \frac{\tilde{u}_0}{\sin^2(\tilde{T})}[\cos(\tilde{T})\sin(\tilde{T}) - \tilde{T}]\right) + \frac{\tilde{u}_0}{\sin^2(\tilde{T})}, \tag{2}$$

where $\tilde{u}_0 = u_0/\Omega D$ and the same notations as in Ref. 1 have been used. These two equations determine the critical current $\tilde{J}_c$ in terms of $\tilde{V}$, with $\tilde{T}$ as a running parameter. The correct value of J_c, according to these two equations, is shown in Fig. 1, where the previous result based on the space charge limited condition (Fig. 1 of Ref. 1) is also shown for comparison.

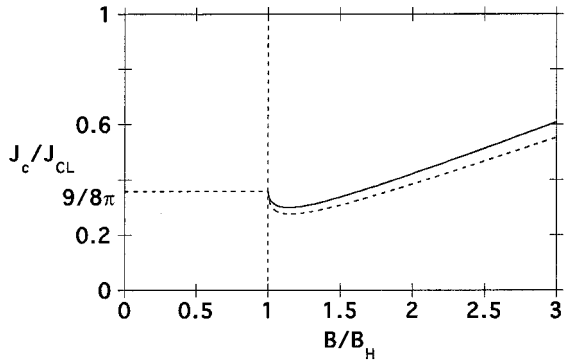

FIG. 1. The critical current density J_c for zero electron emission velocity (solid curve). The dash curve shows the emission current density obtained from the space charge limited condition of zero surface electric field (cf. Fig. 1 of Ref. 1). Both are in units of the Child–Langmuir value as a function of the magnetic field, B, in units of the Hull cutoff value.

The critical current, for the case of zero emission velocity, is indeed achieved under the space charge limited condition if $B < B_H$. The rest of Ref. 1 remains valid. The details are given in Ref. 2.

[1] P. J. Christenson and Y. Y. Lau, Phys. Plasmas **1**, 3725 (1994).
[2] P. J. Christenson, Ph.D. thesis, University of Michigan, Ann Arbor, Michigan, 1996.

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