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R N Franklin

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Comment on Brinkmann (*J. Phys D : Appl. Phys.* **44** (2011) 042002)

R. N. Franklin, Oxford Research Unit, Open University, Oxford, OX1 5HR U.K.

In a recent Rapid Communication Brinkmann [1] claims to have discovered a collisionally-modified Bohm Criterion. He introduces a new local variable length λ defined by $\lambda = n_i dx/dn_i$, where n_i is the ion density, this has the effect of locally compressing the natural length scale where n_i is rapidly varying and has maximum effect near the point of inflexion in $n_i(x)$. This point he calls the Bohm point and the ion speed there is given the name the collisionally-modified Bohm Criterion – let us call it c_s^* , with c_s being the ion sound speed. It can readily be shown that $d^2n_i/dx^2 = (1 - d\lambda/dx)n_i/\lambda^2$. There is no doubt that the spatial distributions of both ions and electrons have a point of inflexion somewhere between the centre of the plasma and the wall in a real active plasma, but it is difficult to see how such a point can be given the significance suggested when its location is a function of the plasma size L , the ion mean free path λ_i , and the Debye length λ_D based on the plasma density at the centre n_0 . c_s^* is likewise a function of these three variables.

For specific gas and a finite plasma one needs to include the ionization rate by electron impact Z , and this varies with the nature of the gas, and not just the ion mass. Thus for a given situation it is possible to write the plasma balance equation as – $(Z(Z + \nu_i))^{1/2}L/c_s = K(\nu_i/Z, \lambda_D/L)$ where K is a number of the order of 1, and depends on the geometry, albeit plane or cylindrical, ν_i is the ion collision frequency for momentum transfer. While the ion sound speed enters here unmodified, one could devise a modified expression for $c_s^* = c_s N(\nu_i/Z, \lambda_D/L)$, N being a number between 1 and 0 with limiting values $N = 1$ for $\nu_i/Z \rightarrow 0$, and $N \rightarrow 0$ for $\nu_i/Z \gg 1$. I cannot see how such a two-dimensional plot, even when for $\lambda_D/L \rightarrow 0$, N has known values given in my book [2], gives additional physical insight.

All of this was fully explored in my Topical Review [3], which was not acknowledged by Brinkmann.

References

[1] Brinkmann R.P. 2011 *J. Phys D : Appl. Phys.* **44** 042002.

[2] Franklin R. N 1976. *Plasma Phenomena in Gas Discharges* (Oxford : Oxford University Press).

[3] Franklin 2003 *J. Phys. D : Appl. Phys.* **36** R309-R320.