Correct Kepler asymptotic distribution of electron microfield in a nonideal plasma

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The asymptotic behavior of an electric microfield distribution in a shielded point of charge particle in plasmas is determined by a motion of the nearest charged particle. It is the generalization of the nearest neighbor distribution [1]. For closed enough located charges, this motion is the Kepler motion since the action of other plasma particles can be neglected. The problem of electric microfield in this motion is formulated in term to find some value of an electric field created by one particle in a shielded location of another one while the first particle randomly occurs on the trajectory of motion (a hyperbola). The nearest neighbor distribution of an electric microfield E in case of attractive two-body hyperbolic Kepler motion is stronger than standard $E^{-5/2}$ law. The repelling particles produce some decrease of standard $E^{-5/2}$ law in these conditions. Calculating the total electric microfield distribution as a sum of the above nearest neighbor distributions, one find the Holtsmark distribution in an ideal plasma limit as well as corrected Holtsmark distributions with lifted or dropped “tails” for two-component (TCP) and one-component (OCP) slightly non-ideal plasmas.

The Kepler model provides correct asymptotic tail of electron microfield distribution on ions in case of real non-ideal TCP plasmas, this tail ~ $E^{-9/4}$. This gives differences in Stark ionic lineshapes wings in ideal and non-ideal plasmas: $\omega^{-5/2}$ and $\omega^{-9/4}$ respectively. Above that, some many-particles processes in non-ideal plasmas like nuclear fusion, collision ionization etc., can be accelerated sufficiently due to the lifted tail of microfield distribution.

1. S.Chandrasekhar. Stochastic problems in physics and astronomy. Rev.Mod.Phys. **15**, 1 (1943).

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