**Main parameters**

”flattened” function distribution of the electrons;

beam diameter;

length of the cooling section;

longitudinal velocity of the electrons (from );

longitudinal temperature of the electrons;

transversal temperature of the electrons;

density of the cooling electron beam (from );

magnetic field of the cooling section;

cyclotron frequency of the electrons;

plasma frequency of the electron beam;

longitudinal rms velocity of the electrons;

transversal rms velocity of the electrons;

Larmor radius of the electrons;

rms Larmor radius of the electrons;

number of cyclotron revolutions of the electron during the time of the interactions with ion;

number of the electrons inside “Debye” sphere with “radius”  for low electron density or for small : ;

number of Larmor radii as intermediate section of impact parameter: ;

factor in expressions for friction forces;

ion velocity in the electron frame.

**Maximal and minimal impact parameters and other values**

|  |  |  |  |
| --- | --- | --- | --- |
| Parameters | Ion velocity | | |
| “H”: High | “L”: low | “S”: superlow |
|  |  |  |
| “m”: (1.32) from [15] |  | | |
| “m”: (1.32) from [15] |  | | |
| “b”: (3.12) from [26] |  | | |
| Like “Debye”:  “b”: (3.13) from [26] |  | | |
| “m”: (1.34) from [15] |  | | |
| “m”: (1.34) from [15] |  | | |
| “m”: (1.34) from [15] |  | | |
| “b”: (3.34) from [26] |  | | |
|  |  | | |
| “m”: (1.33) from [15] |  | | |
| “m”: (1.35) from [15] |  |  |  |

maximal impact parameter ((1.33) from [15]);

 exists in “Meshkov” (index “m”) and “BETACOOL” (index “b”) approaches due to different formulas for  in these approaches.

For all these Figures: left – “Meshkov”, right – “BETACOOL” approaches.

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Figure 1. Comparison of values, defined maximal impact parameter .

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Figure 2. Maximal impact parameter .

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Figure 3. Minimal impact parameter .

**Coulomb logarithm** 

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Figure 4. “Fast” and “Critical” impact parameters.

Table 1. Coulomb Logarithm.

|  |  |  |  |
| --- | --- | --- | --- |
| Type of interaction between ion and electron | Ion velocity | | |
| “H”: High | “L”: low | “S”: superlow |
|  |  |  |
| Fast (“F”): |  |  |  |
| Adiabatic (“A”): | This type of interaction is absent |  |  |
| Magnetized (“M”): |  |  |  |

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Figure 5. Coulomb logarithm for “Fast” and “Adiabatic” types of interaction between ion and electron.

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Figure 6. Three types of interactions between ion end electron. B=100 Gs.

(left – “Meshkov”, right – “BETACOOL” approaches).

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Figure 7. Three types of interactions between ion end electron. B=600 Gs.

(left – “Meshkov”, right – “BETACOOL” approaches).

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Figure 8. Three types of interactions between ion end electron. B=3000 Gs.

(left – “Meshkov”, right – “BETACOOL” approaches).

Areas of different types of interaction between ion and electron (left – “Meshkov”, right – “BETACOOL” approaches).

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Figure 9. B=100 Gs.

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Figure 10. B=600 Gs.

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Figure 11. B=3000 Gs.

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Figure 12. Number of collisions between ion and electron during their adiabatic interaction.

Table 2. Friction force  (across the ion velocity).

|  |  |  |  |
| --- | --- | --- | --- |
| Type of interaction between ion and electron | Ion velocity | | |
| “H”: High | “L”: low | “S”: superlow |
|  |  |  |
| Fast (“F”): |  |  |  |
| Adiabatic (“A”): | This type of interaction is absent |  |  |
| Magnetized (“M”): |  |  |  |

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Figure 13. Transverse friction force for “Fast” and  for “Adiabatic” types of interaction between ion and electron (both approaches).

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Figure 14. Transverse friction force  for “Magnetized” type of interaction between ion and electron (left – “Meshkov”, right – “BETACOOL” approaches).

Values of total transverse friction force is a sum of all three types of interactions – “Fast”, “Adiabatic” and “Magnetized”:



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Figure 15. Total transverse friction force (left – “Meshkov”, right – “BETACOOL” approaches).

Table 3. Friction force  (along the ion velocity).

|  |  |  |  |
| --- | --- | --- | --- |
| Type of interaction between ion and electron | Ion velocity | | |
| “H”: High | “L”: low | “S”: superlow |
|  |  |  |
| Fast (“F”): |  |  |  |
| Adiabatic (“A”): | This type of interaction is absent |  |  |
| Magnetized (“M”): |  |  |  |

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Figure 16. Longitudinal friction force  for “Fast” and  for “Adiabatic” types of interaction between ion and electron (both approaches).

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Figure 17. Longitudinal friction force  for “Magnetized” type of interaction between ion and electron (left – “Meshkov”, right – “BETACOOL” approaches).

Values of total longitudinal friction force is a sum of all three types of interactions – “Fast”, “Adiabatic” and “Magnetized”:



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Figure 18. Total longitudinal friction force (left – “Meshkov”, right – “BETACOOL” approaches).

**Resume**

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Figure 19. Total transverse (left) and longitudinal (right) friction forces (“Meshkov” approach).

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Figure 20. Total transverse (left) and longitudinal (right) friction forces (“BETACOOL” approach).

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**Links for Figures**.

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