**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 like “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 the 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” = [15]: (1.32) |  | | |
| “m” = [15]: (1.32) |  | | |
| “b” = [26]: (3.12) |  | | |
| Like “Debye”:  “b” = [26]: (3.13) |  | | |
| “m” = [15]: (1.34) |  | | |
| “m” = [15]: (1.34) |  | | |
| “m” = [15]: (1.34) |  | | |
| “b” = [26]: (3.34) |  | | |
|  |  | | |
| “m” = [15]: (1.33) |  | | |
| “m” = [15]: (1.35) |  |  |  |

maximal impact parameter ([15]: (1.33)).

 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” Interactions between Ion and Electron.

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Figure 6. Three Types of Interaction between Ion and Electron. B=100 Gs.

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

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Figure 7. Three Types of Interaction between Ion and Electron. B=600 Gs.

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

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Figure 8. Three Types of Interaction between Ion and Electron. B=3000 Gs.

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

Areas for 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. Transverse 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 “Adiabatic” Types of interactions 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).

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Figure 15. Total Transverse Friction Force

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

Table3. Longitudinal 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 “Adiabatic” Types of interactions 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).

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Figure 18. Total Longitudinal Friction Force (left – “Meshkov”, right – “BETACOOL” approaches).

**Resume**

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Description generated with high confidence Figure 19. Total Transverse (left) and Longitudinal Friction Force

(“Meshkov” approach).

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Figure 20. Total Transverse (left) and Longitudinal Friction Force

(“BETACOOL” approach).

**References** (in random order).

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**Links of Figures.**

1. rD\_rE\_rPass-m\_ff2-fig209.jpg, rD\_rE\_rPass-b\_ff2-fig2091.jpg
2. rMax-m\_ff2-fig215.jpg, rMax-b\_ff2-fig2151.jpg
3. rMin-m\_ff2-fig307.jpg, rMin-b\_ff2-fig3071.jpg
4. rFast\_rCrit-m\_ff2-fig305.jpg
5. fastCL-lin\_ff2-fig351.jpg, adiaCL-lin\_ff2-fig331.jpg
6. CL\_100Gs-m\_ff2-fig360.jpg, CL\_100Gs-b\_ff2-fig3601.jpg
7. CL\_600Gs-m\_ff2-fig362.jpg, CL\_600Gs-b\_ff2-fig3621.jpg
8. CL\_3000Gs-m\_ff2-fig361.jpg, CL\_3000Gs-b\_ff2-fig3611.jpg
9. impctPar\_100Gs-m-types\_ff2-fig378.jpg, impctPar\_100Gs-b-types\_ff2-fig3781.jpg
10. impctPar\_600Gs-m-types\_ff2-fig374.jpg, impctPar\_600Gs-b-types\_ff2-fig3741.jpg
11. impctPar\_3000Gs-m-types\_ff2-fig371.jpg, impctPar\_3000Gs-b-types\_ff2-fig3711.jpg
12. larmNs\_larmNl\_ff2-fig340.jpg
13. trnsvFF\_fast-m\_ff2-fig415.jpg, trnsvFF\_adia\_ff2-fig405.jpg
14. trnsvFF\_magn-m\_ff2-fig395.jpg, trnsvFF\_magn-b\_ff2-fig3951.jpg
15. trnsvFF\_total-m\_ff2-fig430.jpg, trnsvFF\_total-b\_ff2-fig4301.jpg
16. longFF\_fast-m\_ff2-fig515.jpg, longFF\_adia\_ff2-fig505.jpg
17. longFF\_magn-m\_ff2-fig495.jpg, longFF\_magn-b\_ff2-fig4951.jpg
18. total-m\_ff2-fig530.jpg, longFF\_total-b\_ff2-fig5301.jpg
19. trnsvFF\_total-m\_ff2-fig430.jpg, total-m\_ff2-fig530.jpg
20. trnsvFF\_total-b\_ff2-fig4301.jpg, longFF\_total-b\_ff2-fig5301.jpg