Electron-ion energy partition for alpha particle moving in fusion DT Plasmas mixed with hot Au

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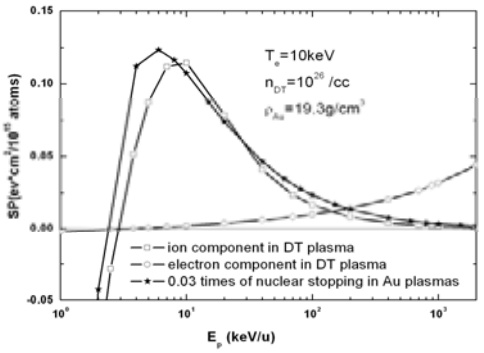
The heating of DT ion by alpha particle is crucial to the realization of the nuclear fusion and it has been studied for many years. Besides DT material, some other materials such as Be and Au are often used in the design of fusion targets [1] or fusion device of fast ignition driven by ions. During the implosion process these materials would mix with DT fuel inevitably. How the mixed material influence the heating of DT ion is still unknown to us, which is the motivation of the present work, where the case for Au mixture is considered.

For this problem the electron-ion energy partition for alpha particle in DT Plasmas should be studied first. The related investigation has been made with the mechanism for the excitation of the ionic acoustic wave to discuss the problem in ICF dense plasma [2]. In recent time this problem was discussed in BPS model [3] in a complex form when both the coulomb binary collision and the ionic acoustic wave excitation were considered. In the first part of the present work the mechanism of the field fluctuation [4] is introduced to discuss the problem in DT plasmas. It is naturally found that the heating of the plasma is stopped when the projectile energy is slowed down to the plasma temperature T_e, which is more reasonable than the models mentioned above. Based on this the electron-ion energy partition in DT plasmas is obtained, which is compared with different models with their differences explained.

Au ion is almost in fully ionized state for $T_e \geq 5$keV according to the average atom model [5]. Near the end of alpha particle range the energy exchange between alpha particle and the Au ion becomes important, which will influence the heating of DT ion in the mixed plasmas due to the highly charged state of Au ion. Reasonable result of the problem is obtained by us according to the binary collision mechanism with the Au ion potential obtained from the average atom model. It is found that the well-known binary collision model with constant Coulomb logarithm [6] as well as the revised model by Ferrariis and Arista [7] is not suitable in this case although they work well in DT plasmas. The reason for this is found and how to improve this in Coulomb potential is obtained, which is useful for rapid and reliable calculation.

Basing on the above work electron-ion energy partition for alpha particle in the mixed DT+Au plasmas is studied in the case of solid Au density with a huge range of plasma temperature and DT density for different percentage of Au. The preliminary results show that the heating of DT ion will be strongly affected by the mixed highly charged Au ion for the temperature beyond 10keV and the percentage of Au beyond 5%. The following figure presents the related components of stopping power for DT, electron and Au ion in a specific case. The relevant results will be presented in detail in the conference.



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