Calculation of some important parameters in the muon catalyzed fusion by Monte-Carlo simulation

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It is determined , how we can take into account the contribution of the nonthermalyzed $t\mu$ atoms [1] in the kinetics of muon catalyzed fusion in the steady-state condition. For this purpose we should determine the probability of the $dt\mu$ molecular formation by the epithermal $t\mu$ atoms during thermalization processes (η parameter). We determine the η parameter by the Monte-Carlo simulation [2]. However, to calculate the important parameters in μCF such as fusion yield per muon and cycling rate, solving the kinetics of μCF in the steady-state condition [2, 3] is not completely accurate method. In the present work, the μCF cycle is totally simulated by the Monte-Carlo method. We can approach to the actual situation in the μCF cycle by this method. We have prepared a computer code for this purpose. The simulation starts since a muon enters into the D/T mixture. The collision partner, kinetic energy and spin state of the muonic atom are determined, then we follow the trajectories of the muonic atoms in the collisional processes by using their cross-sections [4]. During the collisions of the $t\mu$ atoms, the molecular formation may also take place. We have calculated the fusion yield per muon in the different concentration of hydrogen isotopes. These results are compared with the results due to solve the kinetic equations of μCF cycle[2, 3]. In addition, we can calculate some other useful quantities which increase our knowledge about the processes in the μCF cycle. For example, the average number of any collisional processes of the muonic atoms such as elastic scattering, muon transfer and spin flip are calculated. Furthermore, the time evolution of energy and hyperfine spin states of $t\mu$ atoms are also determined.

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References

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