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Radiative neutron capture on 6-8Li isotopes in the cluster model

In the consistent approach, total cross-sections and reaction rates of radiative neutron capture on lithium isotopes ${}^{6-8}\text{Li}$ in the temperature range from 0.01 to $10 T_9$ within the framework of the modified potential cluster model (MPCM) with forbidden states are considered [1-3]. These reactions are of significant astrophysical interest as a part of the chain of primordial nucleosynthesis processes of the Universe [4,5].

Estimation of reaction ${}^6\text{Li}(n, \gamma_{0+1}){}^7\text{Li}$ has been done in our work [1] in the context of comparison with the isobar-analog reaction ${}^6\text{Li}(p, \gamma){}^7\text{Be}$ [6]. The role of ${}^7\text{Li}(n, \gamma_{0+1}){}^8\text{Li}$ reaction in BBN is examined in [2].

Our first calculation of reaction ${}^8\text{Li}(n, \gamma_{0+1}){}^9\text{Li}$ is considered in [3]. Now we re-estimate this process for reaction ${}^8\text{Li}(n, \gamma_{0+1}){}^9\text{Li}$ with renewed characteristics. The effect of the value of the asymptotic constant on the behavior of the total capture cross-sections is studied. Compared with our previous results, the total cross sections for radiative capture at energies in the range from 0.01 eV to 5 MeV are obtained, which generally agree with the results of experimental measurements. Furthermore, an approximation of the obtained capture rate by a simple analytical expression is executed.

The comparison of the obtained reaction rates of the ${}^{6-8}\text{Li}(n, \gamma)$ processes is performed. These results are directly related to the discussion of the lithium problem ${}^6\text{Li}/{}^7\text{Li}$ ratio.

References

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