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Many-channel cluster microscopic theory of resonance states and scattering in ⁹Be and ⁹B

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We applied a many-configurational microscopic cluster model to study the nature of high-energy resonance states in ${}^9\mathrm{Be}$ and ${}^9\mathrm{B}$ near ${}^7\mathrm{Li}+d$ and ${}^7\mathrm{Be}+d$ decay thresholds and to reveal the influence of the states on the astrophysical S-factors of the reactions ${}^7\mathrm{Li}(d,n)\,\alpha\alpha$ and ${}^7\mathrm{Be}(d,p)\,\alpha\alpha$ related to the cosmological lithium problem. Parameters of the above-mentioned resonance states in ${}^9\mathrm{Be}$ and ${}^9\mathrm{B}$ were established. The dominant decay channels were determined for each resonance state.

Two coupled three-cluster configurations $\alpha + \alpha + n$ and $\alpha + d + ^3\mathrm{H}$ in $^9\mathrm{B}$ e and $\alpha + \alpha + p$ and $\alpha + d + ^3\mathrm{He}$ in $^9\mathrm{B}$ were considered to invoke dominant binary channels in $^9\mathrm{Be}$ and $^9\mathrm{B}$, respectively. The model is an extension of the three-cluster model, formulated in [1], which uses Gaussian and Oscillator basis to describe the internal structure of the binary systems and their asymptotic behavior. The model suggests a realistic description of energy spectrum of $^9\mathrm{Be}$ and $^9\mathrm{B}$ in a wide range of energy, where many decay channels of the nuclei are open.

[1] V.S. Vasilevsky, F. Arickx, J. Broeckhove, and T.P. Kovalenko, Nucl. Phys. A, vol. 824, p.37, 2009.

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