

Halo – like structure of unbound ${}^7\text{He}$

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${}^7\text{He}$, a particle unstable nucleus is lying in the line of neutron – rich Helium isotopes between ${}^6\text{He}$ with a neutron halo and ${}^8\text{He}$ having a neutron skin [1]. Normally it is taken for granted that the notion “halo” could not be applied to unstable nuclei. However, if the time of life T of a particular nucleus is much larger than the characteristic time τ of flight of the escaping neutron, there is no difference between stable and unstable nuclei. As for ${}^7\text{He}$ the ratio $T/\tau \approx 7$ we looked for data which could provide some information on the halo – like structure of ${}^7\text{He}$. We applied the Modified diffraction model MDM [2-4] to the charge – exchange reactions ${}^6\text{Li}(t, {}^3\text{He}){}^6\text{He}$ [5] and ${}^7\text{Li}(t, {}^3\text{He}){}^7\text{He}$ [6]. According to MDM the difference of the RMS of the states under study is determined by the difference of the corresponding diffraction radii taken from the differential cross-sections under study. We found that the radius of ${}^7\text{He}$ is $R_{rms} = 2.37 \pm 0.38$ fm. This value is close to those of ${}^6\text{He}$ and ${}^8\text{He}$ 2.48 ± 0.03 fm and 2.52 ± 0.03 fm [1]. The result supports suggestion that neutrons outside ${}^4\text{He}$ occupy the same orbitals and indicates to smooth transition between halo and skin. The phase distributions of the fragments emitted in the reactions with stopped pions on ${}^9\text{Be}$ and ${}^{11}\text{B}$ [7, 8] showed that the main ${}^7\text{He}$ decay configurations are ${}^6\text{He}_{gr,st} + n$ and ${}^6\text{He}^* + n$ confirming the complicated halo – like of ${}^7\text{He}$.

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