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Application of thin organic scintillator to study fragmentation of 12C nuclei under the action of relativistic muons

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The availability of muons in a wide energy range makes it possible to offer them experiments on topical problems of nuclear physics. Answering questions of a fundamental nature, they can be used in research on geology and radiation biology related to the impact of muons of cosmic origin. It is possible to use relativistic muons in the muon torch and in the secondary particle channel of the U-70 accelerator. Of primary interest is the possibility of fully detecting short-range α-particles produced in nuclear fragmentation events under the action of muons. The reaction μ + 12C ⟶ μ' + 3α is the starting point in the study of nuclear fragmentation under the action of muons. The presence of the 12C isotope in nuclear emission and organic scintillators makes it possible to use these materials as active targets. Traditionally, radioactive decay of uranium, thorium and their daughter radionuclides is indicated as a source of helium, and analysis for the presence of helium serves to search for their deposits. At the same time, the reaction μ + 12C ⟶ μ' + 3α can serve as a mechanism for generating helium in natural gas fields. Thus, it is necessary to measure the cross section for the reaction μ + 12C ⟶ μ' + 3α in the widest possible energy range on an active carbon-containing target, which combines detection of beam particles and triples of α-particles. In this regard, the following is proposed. A muon beam with an energy of 7 GeV is used, which can pass after one or two beam absorbers in the HYPERON channel. Muons are directed to a thin scintillator, which registers ionization losses, starting from the minimally ionizing particles of the beam and up to 3α stars. The background and development of this experiment are presented.

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