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Evaluation of the sensitivity of DarkSide-50 experiment to double K-capture on Ar-36.

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The search for neutrinoless double β-decay, in particular double K-capture, is of great importance. Confirmation of its existence would mean that the neutrino is Majorana particle. The investigation of this process provides one of the best opportunities to study physics beyond the Standard Model. The double electron capture process 2EC2ν was experimentally discovered only once in the XENON1T experiment, and the search for 2EC0ν has so far been unsuccessful. These processes are very difficult to register. There are 34 candidate isotopes in which the 2EC2ν process is possible; 12 nuclei can experience only two-neutrino 2e-capture. Previously, the search for these processes was carried out on ^{78}Kr and ^{124}Xe, since the lower theoretical predictions of their half-lives lie in the experimentally achievable region is $\sim 10^{22}$ years, and they are relatively accessible isotopes of inert gases. The purpose of this work is to evaluate the sensitivity of the DarkSide-50 experiment to two-neutrino double electron capture on the ^{36}Ar isotope. To achieve the goal of the study, the following tasks were performed:
–development of a software module for constructing the energy spectrum of double electron capture (2EC2ν) on ^{36}Ar;
–application of the detector response function due to this effect for the DarkSide-50 detector;
–statistical analysis of data using a model spectrum;
–obtaining a lower limit for the half-life of ^{36}Ar.
The novelty of this work is in the fact that such processes have not previously been studied on the argon isotope ^{36}Ar. The analysis performed in this work will remain relevant in the future.

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