SPONTANEOUS FISSION OF Am^{241}

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A gas scintillation counter filled with xenon was used to measure the spontaneous-fission half-period of Am^{241}. A value of $(2.3 \pm 0.8) \times 10^{14}$ years was found, in contrast to the previously accepted value of 1.4×10^{13} years.

RESULTS of experiments for verifying the half-period of the spontaneous fission of Am^{241} were reported earlier.[1] However, the considerable background counting rate of the setup did not permit us to find the real value of the decay constant. Nevertheless, it followed from the experiment that the limit of the decay period as found by Segrè[2] was underestimated. In the meantime, we have continued our efforts to find and remove the sources of the background, and to check on the operation of the gas scintillation counter, in order to obtain a more exact value of the lifetime of Am^{241}.

The main sources of the background in our experiment may be induced fission of nuclei in the scintillation chamber, electromagnetic pickup in the electronic circuits, and instability of power supplies.

In the first series of experiments, a sample of U^{235} placed in the chamber for the calibration of the counter remained open during the experiments with Am^{241}. In spite of the fact that the counter was surrounded by cadmium and paraffin, it was impossible to exclude completely the possibility of the fission of U^{235} by thermal neutrons. In order to remove this sort of background, a magnetic shutter was placed into the chamber, which enabled us to close the U^{235} sample after carrying out check measurements. This arrangement achieved a marked decrease in the background.

The results of the measurements can be also distorted by electromagnetic pickup and instability of the power supplies. In particular, the pickup due to atmospheric discharges was dangerous, since the measurements were carried out during the summer. In order to remove this source of background, a "storm monitor" (a sensitive amplifier with an antenna at its input) was used. The pulses from the photomultipliers and from the storm monitor were simultaneously recorded on a pen recorder incorporated into the system.

After this refinement of the apparatus, the experiments on the spontaneous fission of Am^{241} were carried out. During the measurements, 12 pulses were recorded on the pen recorder. Two of these coincided with pulses from the storm monitor, and were therefore considered as background pulses.

In order to check the operation of the whole array, control experiments on the spontaneous fission of a sample of Pu^{240} were carried out in the presence of the working sample of Am^{241}. The counter characteristics had a good plateau, similar to the one in the previous experiment.[1] The result obtained for Pu^{240} is in agreement with the known data for the half-period of Pu^{240} within the limits of acceptable error.[3]

Thus, during 200 hours of measurement with a 60 μg Am^{241} sample, ten spontaneous-fission events were observed, which corresponds to a half-life of $(2.3 \pm 0.8) \times 10^{14}$ years.

The experiment was carried out under the supervision of Prof. G. N. Flerov.

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[1] Mikheev, Skobelev, Druin, and Flerov, JETP **37**, 859 (1959), Soviet Phys. JETP **10**, 612 (1960).

[2] E. Segrè, Phys. Rev. **86**, 21 (1952).

[3] Chamberlain, Farwell, and Segrè, Phys. Rev. **94**, 156 (1954).

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