THE INVERSE β-DECAY OF ^{197}Au

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The inverse β-decay ($\tilde{\beta}$) of the stable nucleus $^{A}_{Z}X$ is the electron-capture-like process of the type:

$$e^- + {}^{A}_{Z}X \xrightarrow{\tilde{\beta}} {}^{A}_{Z-1}Y + \nu$$
$$\downarrow \beta^-$$
$${}^{A}_{Z}X + e^- + \tilde{\nu}$$

We estimated the cross section for such a process in ^{197}Au to be smaller than 10^{-36} cm^2 (E_e=1.5 MeV, i_e=0.1 μA, Au purity 99.999%, an intrinsic Ge detector used for detection of the 77 keV gamma-ray from the β-decay of ^{197}Pt, which is supposed to form in the ground state). The result is consistent with the weak character of the process. However, the spectra of the Au target after irradiation showed the X-rays of platinum, superimposed on the fluorescent X-rays of gold (Fig.1). The activity responsible for these lines decreased with a half-life of some ten days. The origin of Pt X-rays is very difficult to contemplate and the only possibility, though a very odd one, is that in the reaction some unknown isomer states of ^{197}Pt are formed, which do not get excited otherwise, and which do not decay via the 77 keV state in gold. This conclusion still needs justification, especially because in an attempt to reproduce the experiment we failed to observe the Pt X-rays completely!

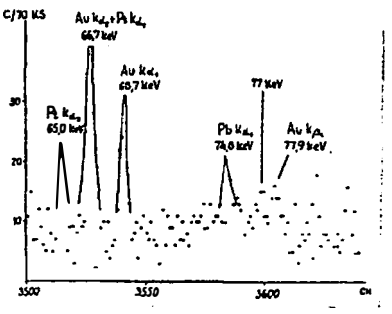

Fig.1. The relevant part of the low-energy γ-ray spectrum of ^{197}Au irradiated with 1.5 MeV electrons.

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