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Experiments on the activation of heavy nuclei by pions were performed using a slow pion beam from the Dubna synchrocyclotron /1/.

Produced isotopes were identified by means of gamma-rays emitted in the decay with a high resolution Ge(Li)-detector.

The ^{177m2}Hf isomer with $I^{\pi} = 37/2^{-}$ was observed in the ^{181}Ta(π^{-}, 4n) reaction. Earlier this isomer was obtained by Y.Chu et al. /2/ in the ^{176}Yb(α, 3n)^{177m2}Hf reaction. Fig. 1 shows a part of the gamma-ray spectrum from the decay of isotopes produced in the ^{181}Ta(π^{-}, xn) reaction. All gamma-rays related to the ^{177m2}Hf (51.4) with ^{177m1}Hf in equilibrium (1.1 sec) were identified. The half life measured by means of a 214 keV gamma-line is 51.6 min, which closely resembles the known data.

The production of metastable high spin states is observed for other nuclei also. Thus., e.g., when irradiating Pb with negative pions the isomers ^{196m}Tl(7^{+}) and ^{198m}Tl(7^{+}) have been obtained /3/ with an unusually high isomeric ratio $\xi = \sigma m / \sigma g = 5.0$.

When pions are captured oy Bi nuclei, the following metastable states are formed: ^{197m}Pb(13/2^{+}), ^{199m}Pb(13/2^{+}), ^{201m}Pb(13/2^{+}), ^{202m}Pb(9^{-}), ^{204m}Pb(9^{-}) /4/ (Fig. 2).

The high spin states in ^{190m}Ir(11^{-}) and ^{196m}Au(12^{-}) were obtained when irradiating platinum and mercury.

The fact itself of the excitation of high spin states in negative pion capture seems surprising.

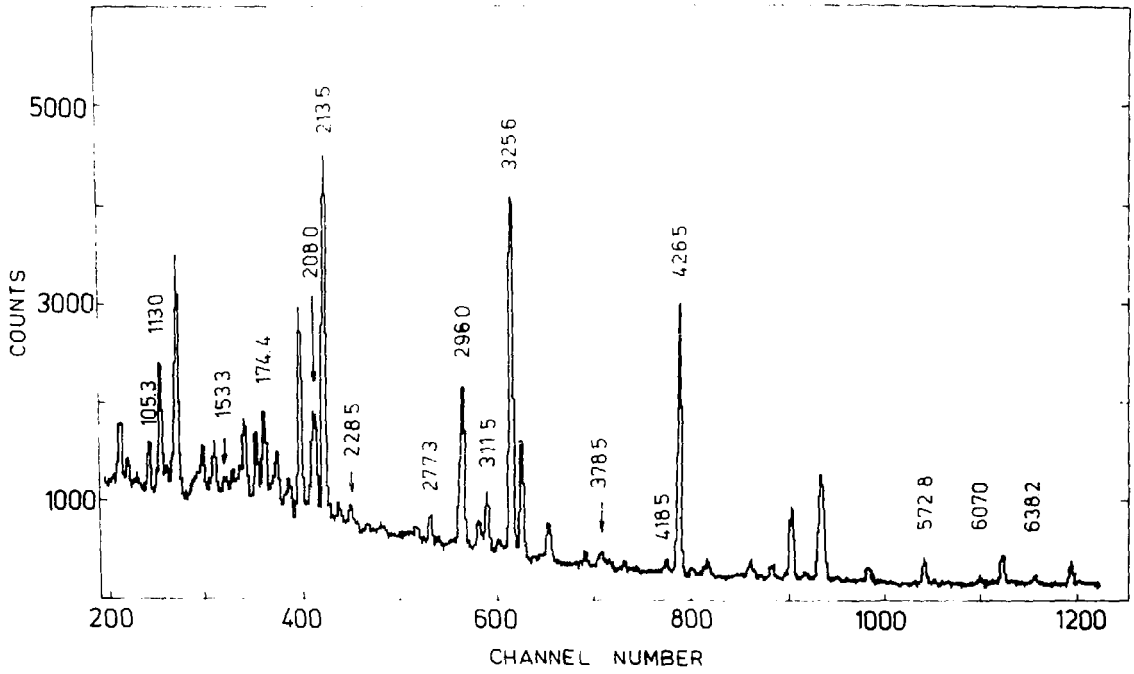

Fig. 1. The part of the gamma-ray spectrum of Hf isotopes produced in the Ta(π^-, xn) reaction. The numbers indicate the energies (keV) of gamma-lines of ^{177}Hf isomers.

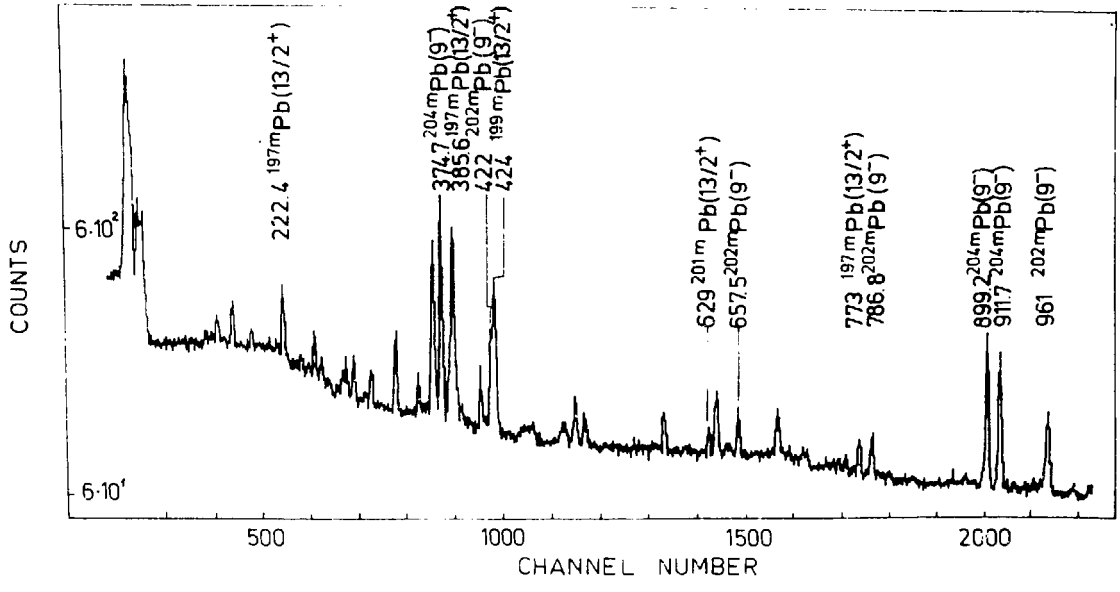

Fig. 2. The part of the gamma-ray spectrum of Pb isotopes produced in the Bi (π^-, xn) reaction.

As is known, pion capture by the nuclei of heavy elements proceeds mainly from the 4f orbit of the pionic atom. Since the pion has zero spin, only its orbital momentum $l = 3\hbar$ can be transferred to the nucleus.

It might seem that the probability of the excitation of nuclear high spin states should be small. At present there are no theoretical investigations describing the mechanism of the excitation of such states in pion capture by nuclei.

In our opinion, the observed effect might be due mainly to pion capture by nucleons having a large orbital momentum.

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