THE CROSS-SECTIONS FOR BINARY AND TERNARY FISSION OF GOLD INDUCED BY 12.2, 14, 18 AND 23 GeV PROTONS

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ABSTRACT

The binary and ternary fission cross-sections of gold have been determined using a polycarbonate foil (makrofol) as the detector of fission fragments. The incident proton energies were 12.2, 14, 18 and 23 GeV.

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The binary and ternary fission of nuclei induced by high-energy particles is defined as a decay of the nuclei into two resp. three fragments of about the same masses[1]. High-energy fission of gold has mainly been studied using mica[2,3] and glass[4] as detectors of fission fragments.

In this work makrofol foil sandwiches sensitive to fragments with mass numbers $A \geq 16$ were used as detectors. The preparation of the sandwiches for exposure and the conditions of chemical treatment after exposure have been described earlier[5]. The thickneses of targets, vacuum-evaporated into one of the foils of sandwich, ranged from 200 Å to 500 Å and were determined with an error less than 10%.

The sandwiches were exposed to 12.2 GeV protons at Argonne National Laboratory, and to 14, 18 and 23 GeV protons at CERN. The uncertainty in determination of proton flux was less than 20%.

The detector was scanned with an optical microscope at a magnification of 20×15×1.25. Single-, two-, three- and four-prong events were found, but we have analyzed those with two and three fragments. A correction to the found number of events was made because of coincidence of events and because of loss of events due to the removal of the surface layer of detector in the course of chemical etching.

Figure 1 gives the values for binary fission found in this experiment, as well as those obtained in other experiments. It seems that the binary fission cross-section of gold

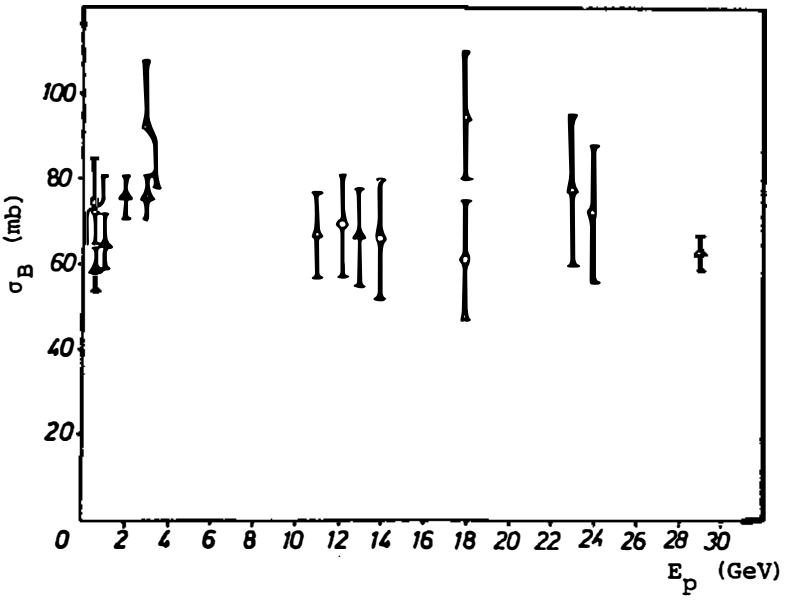

Fig. 1

The binary fission cross-section of gold as a function of incident proton energy:

glass detectors: □ (Ref. 4),
mica detectors: ▲ (Ref. 2), △ (Ref. 3);
polycarbonate detectors: o present work.

is constant within the incident proton energy range investigated.

Calculated values of the ternary fission cross-section of gold are given in Fig. 2. In the same figure the cross-section values are plotted obtained using mica as a detector sensitive to fragments with mass numbers $A \geqslant 30$. From the given values of the ternary fission cross-section it may be concluded that almost all ternary fission events involve at least one fragment of a mass within the interval $16 < A < 30$.

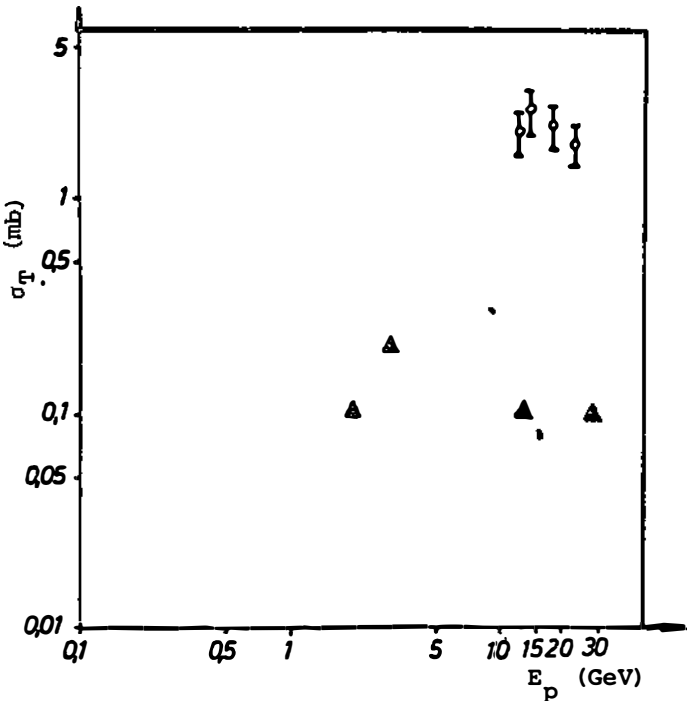

Fig. 2

The ternary fission cross-section of gold as a function of incident proton energy. The notation is the same as in Fig. 1.

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