6.5. A check of the existence of the ternary fission of ^{235}U induced by thermal neutrons

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An investigation of the ternary fission of ^{235}U has been carried out with nuclear emulsions and solid state track detectors sensitive to particles of $A > 4$ and $A > 16$. The uranium target was homogeneously distributed throughout the emulsion, or vacuum evaporated on the two foils of the solid state detector (polycarbonate). In the solid state detector, the following three types of events have been found:

a) events with two collinear tracks (binary fission),
b) events with two tracks making an angle less than 180° and
c) events with three tracks.

Events b) and c) may be accidental (T^-), due to coincidence of binary events, and T^+, which represent cases of binary fission fragments scattering on target and detector nuclei, or ternary fission.

A computer program has been devised to calculate all elements of T^+ events and to discriminate cases of scattering from the ternary fission. On the basis of this a comparison is made of the results obtained by means of the two detectors. The yield of ternary fission relative to binary fission is determined.

6.6. Activation measurements of fast neutron radiative capture

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The existing differences in fast neutron capture cross sections obtained by the activation[1,2] and integration methods[3,4] are presently the subject of considerable interest. In principle, σ_{int} should be smaller than σ_{act}, since the former quantity measures only the decay to the bound states of the final nucleus (target + neutron), i. e. the prompt gamma spectra, while the latter includes the decays to the bound and the unbound states. However, this difference should not be too large, since the decay to the unbound states leads normally to the emission of particles and gamma rays compete favourably with particle emission only in the region just around the binding energy where the available neutron energy might be too small to overcome the centripetal barrier.

As the present experimental evidence shows (Fig. 1), the integration cross sections follow a smooth path. The activation cross sections vary considerably as a function of A, but also σ_{act} measured by different authors yield results which differ by more than a factor of two (see, e. g. the case of ^{127}I in the Table).

For all these reasons and unanswered questions our group in Zagreb started a systematic survey of 14 MeV (n, γ) reactions by the activation method. A standard Ge(Li) detector of 20 cm^3 active volume in connection with a 256-channel analyser was used. At the beginning we measured (n, γ) cross sections on ^{23}Na, ^{27}Al, ^{37}Cl, ^{55}Mn, ^{41}K and ^{127}I. For ^{37}Cl it is the first measurement of σ_{act} around 14 MeV.