NUCLEAR EMULSION IN LOW ENERGY STUDIES

Zarubin P.I.
Joint Institute for Nuclear Research (JINR), Dubna, Russia
E-mail: zarubin@lhe.jinr.ru

An overview of recent results obtained using the nuclear track emulsion (NTE in low energy applications is given. Developed half a century ago it remains a universal and cost-efficient detector [1]. With an unsurpassed spatial resolution of about 0.5 μm this technique provides observations from fission fragment up to relativistic particles tracks. NTE deserves further applications in fundamental and applied researches at modern accelerators and reactors as well as with radioactivity sources including natural ones. The application of NTE is grounded in experiments where tracks of nuclear particles cannot be reconstructed using electronic detectors.

The possibility of α spectrometry was verified and the ^{8}He atom drift effect was established in measurement of decays of ^{8}He nuclei implanted in NTE (Fig.). Correlations of α particle trios in ^{12}C nucleus splitting by 14.1 MeV neutrons as well as ^{7}Li and ^{4}He nuclei produced in ^{10}B breakups by thermal neutrons in boron-enriched NTE were studied. In this series of experiments, the NTE resolution proved to be perfect as expected physical effects in invariant mass distributions of reaction product ensembles were clearly observed. NTE samples are calibrated using 1.2 and 3 A MeV Kr and Xe ions. NTE surface exposures to a ^{252}Cf source allowed finding and measuring events containing fragment pairs and long range α particles, as well as fragment triples (Fig.). Implantation of uranium compounds into NTE performed recently allows one to expand experimental means of nuclear fission studies. The ^{8}Be accompanied channel of the ternary fission can become the "Golden key" for experimental verification of hypothesis of the collinear cluster tri-partition.

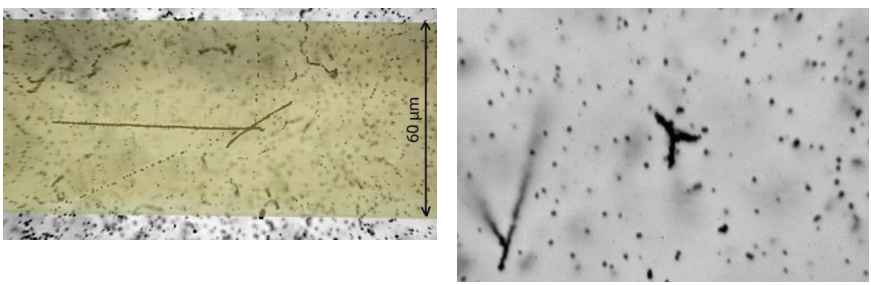

Fig. Macro photographs of hammer-like decay of the ^{8}He nucleus stopped in the nuclear track emulsion (left; superposed on a macro photograph of a human hair 60 μm thick) and Cf ternary fission (right).

1. P.I.Zarubin // Phys. At. Nucl. 2016 V.79 P.1525; arXiv:1902.04407.