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State-of-art imaging in nuclear track emulsion

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Nuclear track emulsion (NTE) remains a universal and cost-efficient detector. The application of NTE is especially well grounded where tracks of nuclear particles cannot be reconstructed using electronic detectors. At the JINR Nuclotron the BECQUEREL experiment [1] is performed a program of irradiation of NTE stacks in the beams of relativistic isotopes of beryllium, boron, carbon and nitrogen, including radioactive ones to study their cluster structure. The NTE technique allows one to observe the 3D images of few-body ensembles originated in peripheral collisions and explore the fragmentation of the relativistic nuclei down to the most peripheral interactions - nuclear “white” stars [2].

The competitive character of the novel NTE is proved in measurements of slow α particles and heavy ions (summarized in [3]). The possibility of α spectrometry was verified and the atom drift effect is established in measurement of decays of 60 MeV ^8He nuclei implanted in NTE [4]. Correlations of α particles in splitting of ^{12}C nuclei by 14.1 MeV neutrons [5] as well as ^7Li and ^4He nuclei produced in ^{10}B breakup by thermal neutrons in boron-enriched NTE [6] are studied. NTE samples were irradiated with relativistic and slow Kr and Xe ions [2,7,8]. Surface irradiations of NTE samples were performed with automatic movement of the ^{252}Cf source [9].

Classic observations of fundamental importance presented in “The Study of Elementary Particles by the Photographic Method” by C. H. Powell, P. H. Fowler and D. H. Perkins [10] can serve as a model of clarity in our time. Our research is implemented in keeping with this tradition by state-of-art means. The rich collection of videos and images of the nuclear few-body processes gathered at the Web site is presented [1]. In terms of applications they are relevant for the development of advanced systems of automatic search for nuclear interactions, as well as for university education.

1. The BECQUEREL Project WEB site: <http://becquerel.jinr.ru/>
2. <http://becquerel.jinr.ru/movies/movies.html>
3. P. I. Zarubin “Recent applications of nuclear track emulsion technique” Phys. At. Nucl., 2016, 79, 1525-1535; DOI: 10.1134/S1063778816130093.
4. <http://becquerel.jinr.ru/miscellanea/8He/8He.html>
5. <http://becquerel.jinr.ru/miscellanea/DVIN/dvin11.html>
6. <http://becquerel.jinr.ru/miscellanea/IBR-2/IBR-2.html>
7. <http://becquerel.jinr.ru/miscellanea/IC-100/IC-100.html>
8. <http://becquerel.jinr.ru/miscellanea/U400M/U400M.html>
9. <http://becquerel.jinr.ru/miscellanea/Prague-dosimetry/Prague-dosimetry.html>
10. <http://becquerel.jinr.ru/text/books/POWELL.pdf>

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