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Pyroelectric accelerator with quasimonoenergetic electron production: current status and challenges

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Pyroelectric effect in some single crystals exposed to temperature variations under vacuum provides a simple route for producing and accelerating electron beams. In particular, lithium tantalate ($LiTaO_3$) crystals can generate electric field strong enough to accelerate electrons to energies exceeding 100 keV. This principle forms the basis of pyroelectric accelerators—compact systems that operate without conventional external high-voltage supplies or hazardous materials and have potential applications in electron, ion, neutron, and X-ray generation, as well as for calibrations detectors in large facilities. We report our recent achievements in development of pyroelectric accelerators. The quasi-continuous X-ray generation from a $LiTaO_3$-based pyroelectric accelerator driven by periodic temperature variations is demonstrated [1]. This way allows to overcome the unpredictable nature of conventional pyroelectric X-ray sources. Stable X-ray emission (as electron quasimonoenergetic production) was achieved over repeated heating–cooling cycles, highlighting the potential of this approach for compact and continuous radiation sources. Nowadays, the way to control the energy of generated electron flow in a pyroelectric accelerator is proposed and developed

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[1]. Karataev, P., Ali, M., Fedorov, K. et al. Quasi-continuous X-ray generation in LiTaO3-based pyroelectric accelerator driven by periodically varying temperature. Sci Rep 15, 31209 (2025).

Primary author(s) : OLEINIK, Andrei (Belgorod State Unversity); KISHIN, ivan (Federal State Autonomous Educational Institution of Higher Education «Belgorod National Research University»); KLENIN, Artemiy (Belgorod National Research University); SHAPOVALOV, Pavel (National Research Nuclear University "MEPhI"); Ms. BEREZHNAYA, Maria (Belgorod National Research State Univeristy); Mr. PODOYNITSYN, Andrey (Belgorod National Research State University); Mr. SHABLOV, Iurii (Shubnikov Institute of Crystallography of the Kurchatov Research Center); Dr. SOTNIKOVA, Valentina (Belgorod National Research State University)

Presenter(s) : OLEINIK, Andrei (Belgorod State Unversity)

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