Project name, IRN	**AP09057911** – Experimental studies of the mechanisms of luminescence of KI, RbI and CsI crystals at the activation by cations-homologues and low temperature deformation
Completion date	01.02.2021-31.12.2023
Project supervisor	Myasnikova Lyudmila, c.ph.-m.s., associated professor
Report	The project will study the spectra of X-ray luminescence, photoluminescence, tunneling and thermostimulated luminescence in KI, RbI and CsI crystals with decreasing lattice symmetry of local deformation by homologous cations and elastic low-temperature deformation (ε=1%) in the mode of counting photons in a wide range of the spectrum (from 140 nm to 1000 nm) and temperatures (100-400 K) at spectroscopic experimental facilities that have no analogues in the Republic of Kazakhstan. The idea of the project is to experimentally establish the effect of increasing the luminescence intensity of KI, RbI and CsI crystals by effectively forming self-trapped excitons or electron-hole pairs under direct strain action on the radiative relaxation of electronic excitations
Relevance	Trends in the development of scintillation materials consist in the fact that when the symmetry of the lattice is lowered by an impurity, a significant part of the excitation energy is transferred to the center of the glow. Therefore, it is necessary to create conditions under which scintillators based on AHCs will have the highest possible quantum yield of luminescence. One of these conditions is the effect of uniaxial deformation, which significantly reduces the free path of excitons. The uniqueness of using the uniaxial deformation method is that there is no transfer of electronic excitation energy to the impurities. By lowering the lattice symmetry, it is possible to modify the properties of KI, RbI and CsI crystals in such a way that increasing the luminescence output allows creating scintillation detectors based on them, and increasing the efficiency of radiation defect formation can be used to obtain dosimetric materials.
Purpose	Identify the mechanisms of formation of electronic excitations in the field of homologous cations and elastic deformation by registering the spectra of X-ray luminescence, photoluminescence, tunneling, thermostimulated luminescence in alkali-metal iodides under the influence of X-ray, ultraviolet radiation, which allow us to develop a scientific-basis for creating modern scintillation detectors
Expected results	• based on digital technology, experimental installations of luminescent and thermal activation spectroscopy will be upgraded for automatic registration of X-ray luminescence, photoluminescence, tunneling and thermostimulated luminescence of KI, RbI and CsI crystals. • the spectra of X-ray luminescence, photoluminescence, tunneling and thermostimulated luminescence in KI, RbI and CsI crystals will be experimentally studied by activation by homologous cations and exposure to low-temperature deformation (100 K); • the main mechanisms of formation of luminescence of electronic excitations (excitons, electron-hole pairs) under local

	deformation with the participation of homologous cations and elastic deformation in KI, RbI and CsI crystals will be revealed.
Research group	Supervisor – Main researcher: Myasnikova Lyudmila, c.ph.-m.s., associated professor, H index=5 (Author ID в Scopus – 16481268100; Researcher ID - O-9697-2017; ORCID - 0000-0003-3326-7206). https://www.scopus.com/authid/detail.uri?authorId=16481268100 Sergeyev Daulet, c.ph.-m.s., professor, H index=8 (Author ID в Scopus – 55237792800; Researcher ID - O-3783-2017; ORCID - 0000-0001-7426-3039). https://www.scopus.com/authid/detail.uri?authorId=55237792800 Zhanturina Nurgul, PhD, associated professor, H index = 6 (Author ID in Scopus – 55588115900; ORCID - 0000-0001-9540-6334). https://www.scopus.com/authid/detail.uri?authorId=55588115900 Aimaganbetova Zukhra, PhD, H index=5 (Author ID in Scopus – 56305678700). https://www.scopus.com/authid/detail.uri?authorId=56305678700 Maratova Aida, PhD student (ORCID - 0000-0002-0083-3219) https://www.scopus.com/authid/detail.uri?authorId=57220785727 Istlyaup Assel – master, H index = 1 (Author ID в Scopus – 57211115630; ORCID - 0000-0003-3423-5126). https://www.scopus.com/authid/detail.uri?authorId=57211115630 Duisenova Ainur – PhD student (ORCID 0000-0003-4868-1944) https://www.scopus.com/authid/detail.uri?authorId=57221375049
Publications in scientific publications	1. Myasnikova L.N., Istlyaup A.S. Моделирование зонной структуры и плотности состояния нанокристалла KI // Zhanstvena misel journal. – 2021. – Vol. 58. – C. 37-41. 2. Maratova A.G., Myasnikova L.N., Shunkeyev K.Sh. Модернизация экспериментальной установки для автоматической регистрации спектров фотолюминесценции и рентгенолюминесценции иодидов щелочных металлов // Инновационные научные исследования. - 2021. - №10-3(2). - P. 6-13. Magazine recommended by CCSES: 3. Myasnikova L.N., Maratova A.G., Shunkeyev K.Sh. The features of deformation-stimulated RbI luminescence // Eurasian Journal of Physical and Functional Materials. ¬ 2021. ¬ Vol. 5, N. 4. ¬ accepted for publication.