This dissertation is dedicated to laser systems generating electromagnetic waves with a wavelength of approximately 3μm. Specifically, the research focuses on the design of pulsed laser systems that generate radiation in the mid-infrared range using fluoride fibers doped with dysprosium ions. To the author's knowledge, at the time of writing this dissertation, there are no existing pulsed fiber laser systems doped with dysprosium using gain modulation to generate radiation with a wavelength of around 3μm. The existing systems with Q-switching modulation significantly differ in parameters from sources utilizing erbium-doped fibers. Dysprosium-doped fiber lasers have numerous potential applications, including in spectroscopy, medicine, industry, and telecommunications. Therefore, one of the research objectives is to analyze the reasons for this state of affairs and to design and construct pulsed laser systems using dysprosium-doped fluoride fibers with gain modulation and Q-switching modulation.

This work presents the results of both theoretical and experimental studies focused on laser systems realized using fluoride fibers doped with erbium and dysprosium ions. In particular, an analysis of basic continuous-wave laser systems was conducted, and technical issues related to the construction of laser systems generating radiation with a wavelength of ~3μm were discussed. Through this analysis and the implementation of innovative technical solutions, pulsed laser systems with significantly improved parameters compared to the results available in the literature were constructed. The results of the experiments confirm the hypotheses, particularly the possibility of constructing cost-effective and relatively simple pulsed laser systems generating mid-infrared electromagnetic radiation using dysprosium-doped fluoride fibers with both gain modulation and Q-switching modulation.

The most valuable research results have been published in scientific journals: Journal of Lightwave Technology, Journal of Physics-Photonics, and Photonics Letters of Poland.