Supercontinuum generators in condensed and liquefied gas media and creation on their basis of parametric amplifiers in the mid-IR range pumped by Cr: forsterite laser

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The development of laser physics, especially the physics of ultrashort laser pulses, causes interest in a number of nonlinear optical effects. Compact sources of radiation in the middle infrared range are of great interest for solving problems in a wide variety of scientific and applied fields:

• Generation of ultrashort pulses and high harmonics

• Spectroscopy. Absorption in the infrared range

• Laser chemistry, control over the course of chemical reactions, investigation of intramolecular interactions

• Detection of low concentrations of substances, remote sensing of the atmosphere

Generation of the supercontinuum represents the emission of spectrally continuous light, which occurs when a narrow-band pulse passes through a nonlinear medium and the resultant spectrum has a much larger width than the pulse-sitting spectrum.

The purpose of this thesis is to study the extreme broadening of the laser radiation spectrum in atomic and condensed media in the middle infrared range and the construction of a parametric amplifier based on the supercontinuum generator.

The reason for choosing xenon is the possibility of adjusting macroparameters (pressure, temperature) over a wide range, which allows controlling the nonlinear properties of the medium. Because the spectrum of the supercontinuum depends on the gas level, xenon is of considerable interest as a controlled source of ultra-wide optical radiation.

Tasks:

• Investigation of the spectral properties of supercontinuum in liquefied xenon

• Investigation of supercontinuum generation parameters in liquefied carbon dioxide gas

• Experimental realization of parametric amplification during pumping of chromium-forsterite laser radiation and injection of supercontinuum radiation and injection of supercontinuum radiation