**Abstract to Bachelor's paper**

# THE HIGH-POWER ULTRASHORT PULSES FROM CR:FORSTERITE LASER RESONATOR

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In this work a comprehensive study of the generation of ultrashort pulses of the maximum peak power in a long resonator of a cr:forsterite laser operating in a soliton regime was carried out. In experimental part of research, the increase of peak power of pulses inside the resonator from 2 to 4 MW was shown when cooling the surface of crystal from 20 to 4 °C. Maximum pulse peak power is limited by the fundamental critical pulse power, at which soliton blows up in two. That power, according to calculations, in experiments varies from 10 to 15 MW and its value is determined by modulation instability of soliton because of periodic perturbations in the resonator. Using the phase matching conditions of quasi-soliton and dispersion waves and positions of sidebands from experimental spectra, the dispersion coefficients of resonator were obtained. These coefficients agree well with the values from theoretical model of resonator dispersion. Also, theoretical analysis of laser pulse dynamics was performed using ABCD matrices model, that takes into account kerr-lens mode locking, thermal lensing and pulse waist geometry. It has been shown that the laser resonator is stable at a focal lenght of the kerr lens less than 3.3 mm. The inversion of laser level populations was studied using differential equations for an effective two-level system. It is shown that with the temperature reduction of the crystal by 7.5%, kerr lens leads to an increase in the mode area by 60%, that combined with the effect of shifting the waist position from the crystal center and the increase of the lifespan of the upper level $^2E$ from 1.4 ms to 2.4 ms allows to increase the peak power of generated pulses by 1.9 times.