SPATIAL DISTRIBUTION OF THE STORED LIGHT SUM OF FEMTOSECOND LASER RADIATION IN LIF:MG,TI

Prepared

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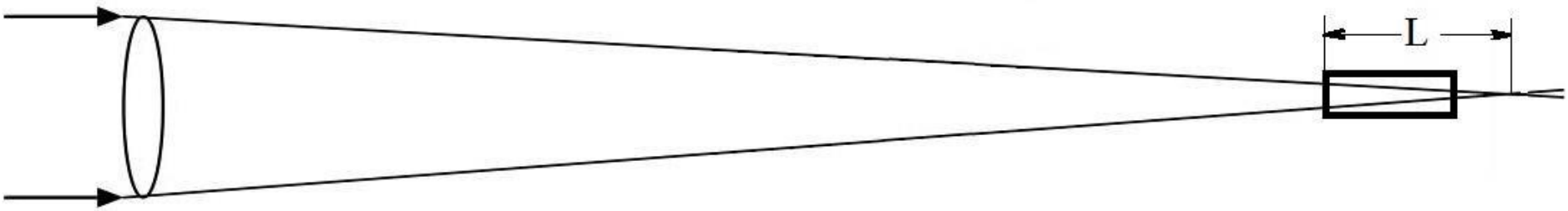
Topicality

- *The object of our research was dosimetric single crystals of LiF: Mg (100 ppm), Ti (10 ppm) widely used in γ-dosimetry. The aim of this work was to study the mechanism of light sum storage in LiF: Mg, Ti crystals under the action of intense femtosecond radiation of a titanium-sapphire laser in the near-IR region - 950 nm.*

Schematic of a setup for irradiating crystals with femtosecond laser radiation

- *Implemented a low-aperture focusing mode. The setup includes a titanium-sapphire laser generating 50 fs pulses with an energy of 6 mJ with a maximum emission spectrum at a wavelength of 950 nm. The radiation was focused by a lens with a focal length of 425 mm*.



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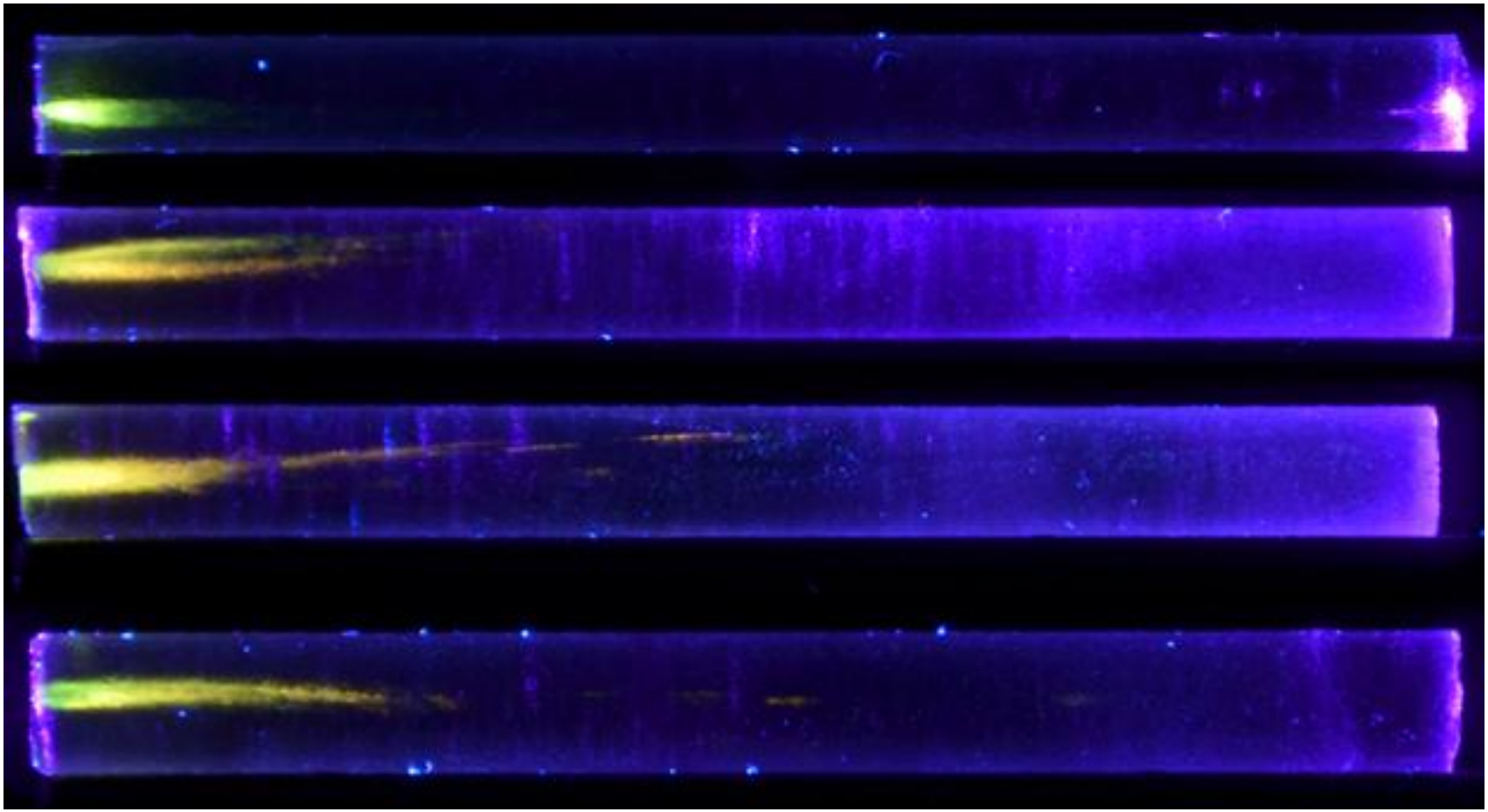
Photographs of the spatial distribution of luminescence of crystals irradiated with a series of 5, 125, 625, and 3125 pulses, respectively (from top to bottom)



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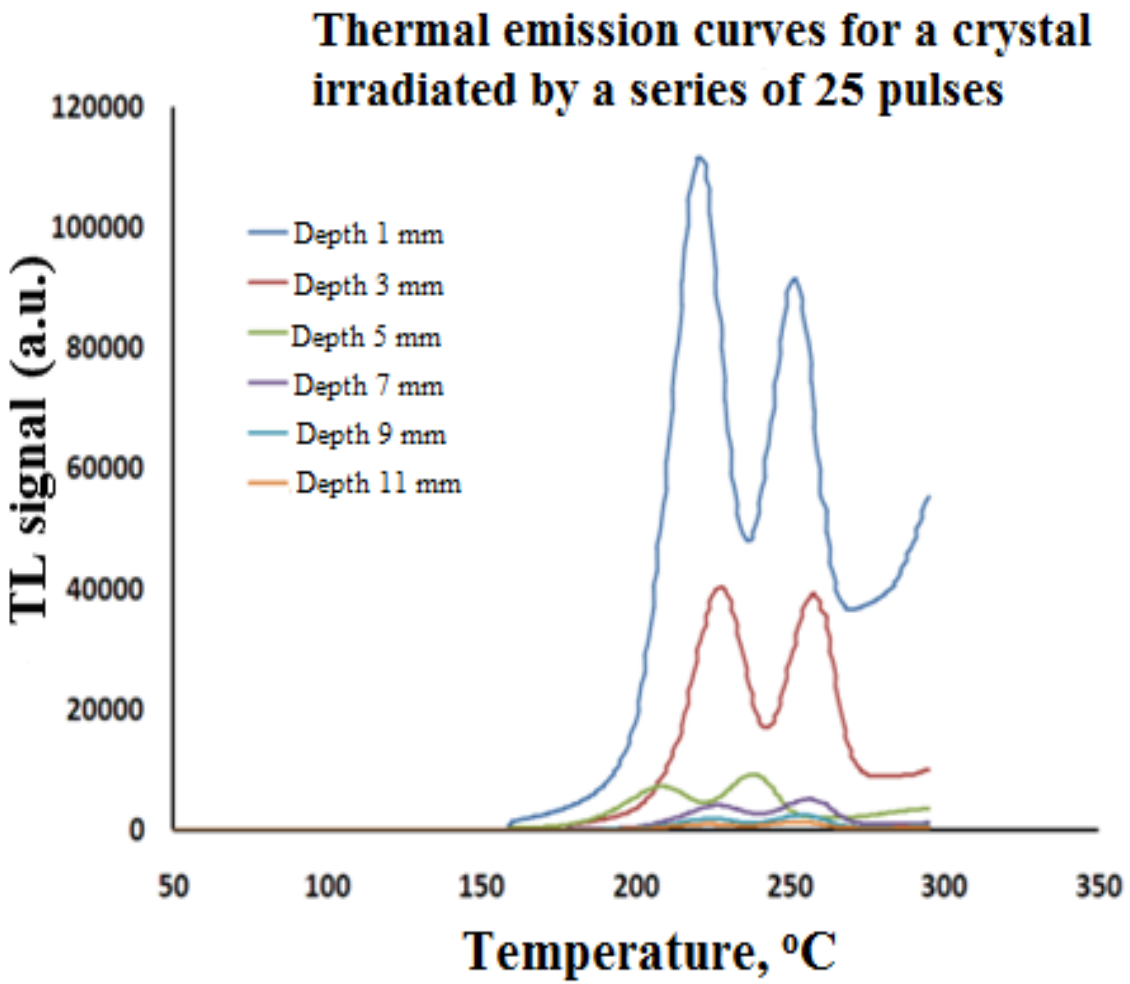
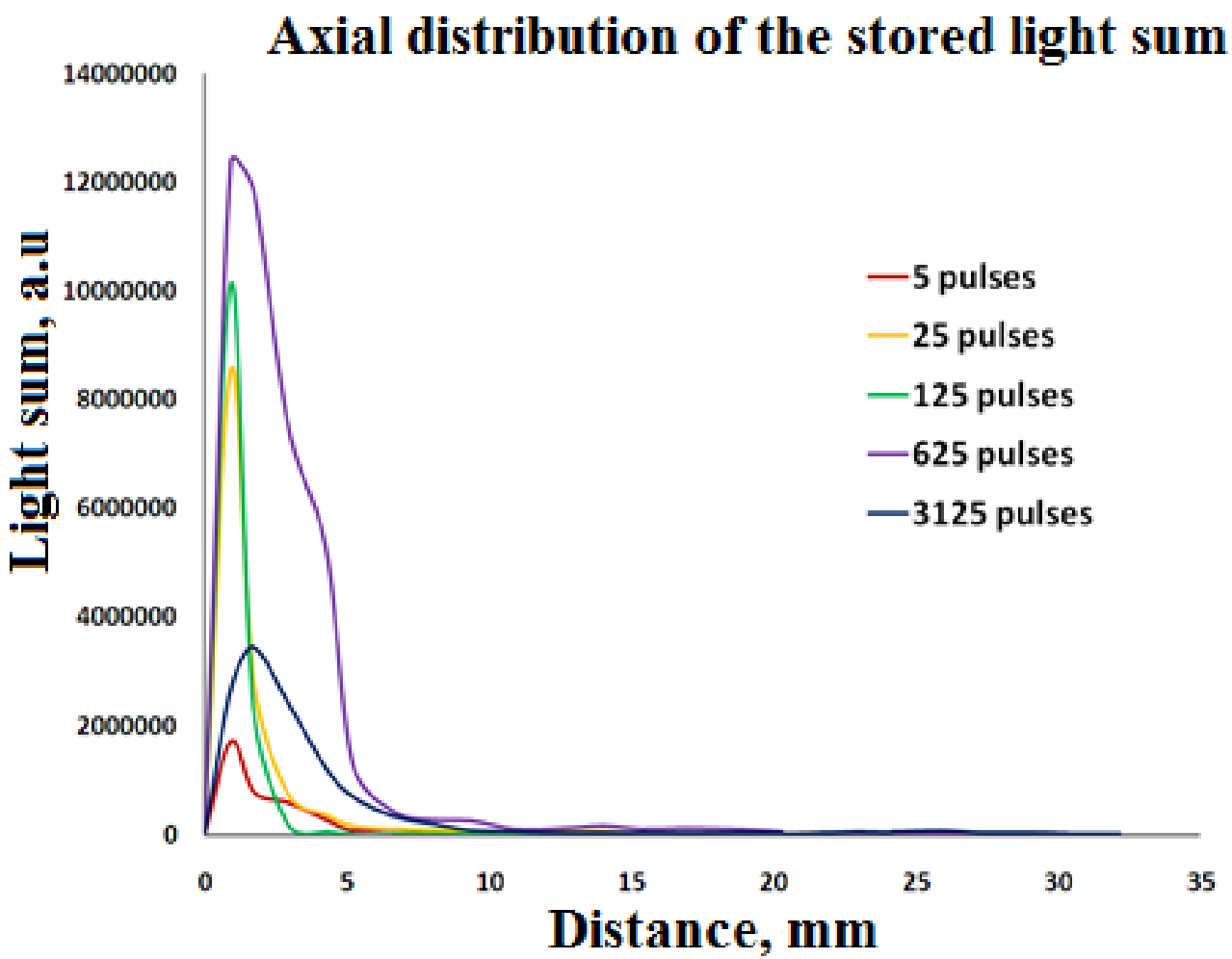
TSL studies were carried out on a specialized installation in the temperature range from 295 K to 573 K with a constant heating rate of 1 Ks^{-1}.



The axial dependence of the energy accumulated by the crystal under the action of single femtosecond pulses of laser radiation or their series has a "ragged", non-monotonic character.



Conclusion

- *The value of the light sum of thermally stimulated luminescence emitted by irradiated crystals, with an increase in the number of laser pulses, first increases superlinearly, then reaches a maximum, and then decreases. The effect of saturation of the accumulated light sum is due to the fact that the concentration, degree of aggregation, and the nomenclature of color centers in the central axial part of the holes are greater than in the peripheral part.*
- *The results of thermoluminescence studies show that under femtosecond irradiation, along with the main dosimetric peak of TSL with a maximum of 485 K, the thermoluminescence curve exhibits peaks due to annealing of* F_2 *and* F_3^+ *color centers.*

Conclusion

- *Compared to X-ray and β-irradiation, high-temperature peaks are recorded more efficiently. We associate more efficient guidance of high-temperature peaks under the action of laser radiation with a higher excitation density of the substance. The excitation density of a crystal under the action of laser radiation is approximately 10^7 times higher than under the action of X-ray radiation. Also, it is about 10^4 times higher than the excitation density provided by the beta source we used. It is known from the literature that high-temperature peaks in TL detectors based on LiF: Mg, Ti are more efficiently induced in tracks of heavy particles, where the excitation density is much higher than with X-ray or beta irradiation.*