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Self-Action of Pyroelectric Spatial Soliton in Undoped Lithium Niobate Samples with Pyroelectric Mechanism of Nonlinear Response

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Abstract : Compensation for the nonlinear diffraction of narrow laser beams with wavelength of 532 and the formation of photonic waveguides and waveguide circuits due to the contribution of pyroelectric effect to the nonlinear response of lithium niobate crystal have been experimentally demonstrated. Complete compensation for the linear and nonlinear diffraction broadening of light beams is obtained upon uniform heating of an undoped sample from room temperature to 55 degrees Celsius. An analysis of the light-field distribution patterns and the corresponding intensity distribution profiles allowed us to estimate the spacing for the channel waveguides. The observed behavior of bright soliton beams may be caused by their coherent interaction, which manifests itself in repulsion for anti-phase light fields and in attraction for in-phase light fields. The experimental results of this study showed a fundamental possibility of forming optically complex waveguide structures in lithium niobate crystals with pyroelectric mechanism of nonlinear response. The topology of these structures is determined by the light field distribution on the input face of crystalline sample. The optical induction of channel waveguide elements by interacting spatial solitons makes it possible to design optical systems with a more complex topology and a possibility of their dynamic reconfiguration.

Keywords : self-action, soliton, lithium niobate, piroliton, photorefractive effect, pyroelectric effect
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