

a photonic band gap, not related to the Bragg resonance, for both positive and negative refractive indices. We also consider optical pulses' dynamics and demonstrate such effects as diffraction-induced pulse splitting and chirped pulse compression or decompression in Borrmann and anti-Borrmann modes respectively. In negative-index PCs the latter effect is reversed in respect of the chirp sign.

### **Solitary waves in DNA and their excitation by terahertz radiation**

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Several types of soliton-like excitations in DNA are considered on the basis of extended helicoidal nonlinear dynamical model. They include transverse and longitudinal vibrational excitations and proton tunneling motions within DNA base pairs. On the basis of theoretical modelling it is demonstrated that terahertz radiation can influence both vibrational excitations in DNA and proton motion in hydrogen bonds. The thermally pre-generated low-amplitude soliton-like excitations can grow and develop into localized metastable conformational domains of DNA under terahertz irradiation.

### **The control of pulses parameters under Bragg diffraction in linear and nonlinear photonic crystals**

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A theory for effect of the diffraction-induced pulse splitting (DIPS) under dynamical Bragg diffraction in photonic crystals (PC) in the Laue geometry has been developed. In this effect incident short laser pulse splits into two ones with different dispersion laws and spatial field distribution within the structure. In linear PC we demonstrated the way to control output pulses intensity and duration by changing a phase modulation of the incident signal. In PC with thin layers of cubically nonlinear impurities we predicted the possibility of the dispersion spreading compensation by nonlinear interaction and formation of soliton-like pulse with constant parameters.