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Title:Nanoinhomogeneities in glasses and their role in optical memory phenomena and charge transfer processes
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Abstract:To explain the basic features of the response of disordered materials (glasses) to irradiation by light, a new approach based on the assumption that glasses have the so-called "medium-range" order (inhomogeneities with the characteristic scale of ~1 nm) is proposed and justified. The structure of inhomogeneities depends on the bond type: glasses with covalent directed bonds (strong glasses) at nanometer scales are similar to their crystalline ancestors. Glasses with non-directed bonds (ion and van der Waals bonds) do not form crystalline nanoinhomogeneities, though the existence of a certain medium-range order is typical for them. Using the concept of an inhomogeneous structure of glasses at nanometer scales, it is possible to explain the physical properties demonstrated by these materials: structural factor, specific features of the density of vibrational states in the terahertz range, mean free paths at frequencies below the boson peak frequency, optical memory phenomenon, and specific features of charge transfer. The proposed approach is an alternative for the widely used approach that involves construction of specific defects understood as violations of coordination of individual atoms, as quasi-molecular complexes, or as two-level states with no particular information about them. This approach reflects the specific features of the vitreous state, is universal, and is not based on a particular chemical nature of the material.
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