Invariance of the transmitted pattern in a periodic structure

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Abstract

A characteristic of the localized regime in a disordered medium is the insensitivity of the transmitted speckle to the incident wave. In optics, the image on a screen of the transmitted field through an opaque disordered medium - the speckle – remains the same regardless of the lighting conditions. This remarkable phenomenon can be explained by analyzing the eigenmodes of transmission of the studied material. The localized regime is characterized by the predominance of a single mode, with the transmission of all other modes being significantly weaker. The pattern of the transmitted field is then determined by this single mode, regardless of the source. A similar phenomenon is possible in an ordered, periodic medium, when the wave propagated in the medium is mainly carried by a single Bloch mode. The wave propagated in the periodic medium is then gradually "frozen", presenting the same pattern, regardless of the source that generated it. The presented work aims to characterize and to observe experimentally this phenomenon in the case of propagation in a periodic waveguide. It also aims to characterize this phenomenon in the case of transmission through a diffraction grating.

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