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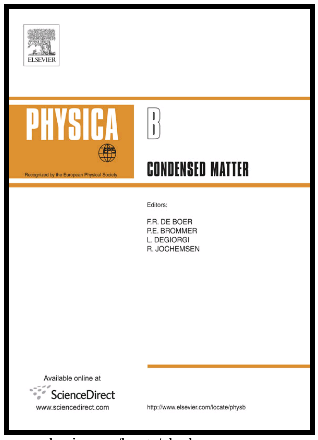

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Chittaranjan Nayak, Alireza Aghajamali, Tannaz Alamfard, Ardhendu Saha

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Tunable photonic band gaps in an extrinsic Octonacci magnetized cold plasma quasicrystal

Chittaranjan Nayak[1], Alireza Aghajamali[2,3], Tannaz Alamfard[2], and Ardhendu Saha[1,*]

[1]Department of Electrical Engineering, National Institute of Technology, Agartala, 799046, India.
[2]Department of Physics, Marvdasht Branch, Islamic Azad University, Marvdasht, Iran.
[3]Department of Physics and Astronomy, Curtin University, Perth, WA 6102, Australia.

Abstract: In this paper, the characteristics matrix method is employed to theoretically investigate the propagation of electromagnetic waves through one-dimensional extrinsic Octonacci magnetized cold plasma (MCP) quasicrystal. Compared with the periodic structure, the results show that such type of structure has more numbers of photonic band gaps (PBGs) within the selected computational range. These PBGs can be easily manipulated by tuning the external magnetic field ($\boldsymbol{B}$), electron density (n_e) and the thickness ratio (ρ). When considering the case of $\boldsymbol{B}$ and n_e, the analysis of the results shows that the pattern of change in the transmittance spectrum is opposite to each other. Moreover, the influence of the structural configuration of parameter ρ on PBGs is noteworthy and quite different from $\boldsymbol{B}$ and n_e. The observed results are of technical use in the design of a multichannel microwave reflector.

Keywords: Magnetized cold plasma; Extrinsic Octonacci quasicrystal; Structure-property relationship.

1. Introduction

In 2004, Hojo and Mase [1] first-ever jointly predicted the existence of photonic band gap (PBG) in a plasma photonic crystal. Their theoretical studies indicated that the resultant PBG is a function of plasma density as well as layer thickness, and it would become wider with the increase in these parameters. In the meantime, theoretical and practical studies have been conducted on one-dimensional magnetized and non-magnetized plasma photonic crystal [2-5]. A magnetized plasma [6] is one in which the applied static magnetic field, $\boldsymbol{B}$, is strong enough to modulate the dielectric function extensively. Such functional aspect of the dielectric constant of magnetized plasma ensues from the Larmor gyration [7], which is informative in the study of various magneto-optic applications. In recent years, MCP photonic crystal (PC) has achieved prominence due to having more particular characteristics than the conventional PCs, and therefore, the relevant research activities have been increasing day by day [8-11]. In addition, it is of particular interest in the field of optical engineering to design several devices within the microwave and terahertz frequency regions.

[*]Corresponding author: *Email address*: arsagtwave@gmail.com