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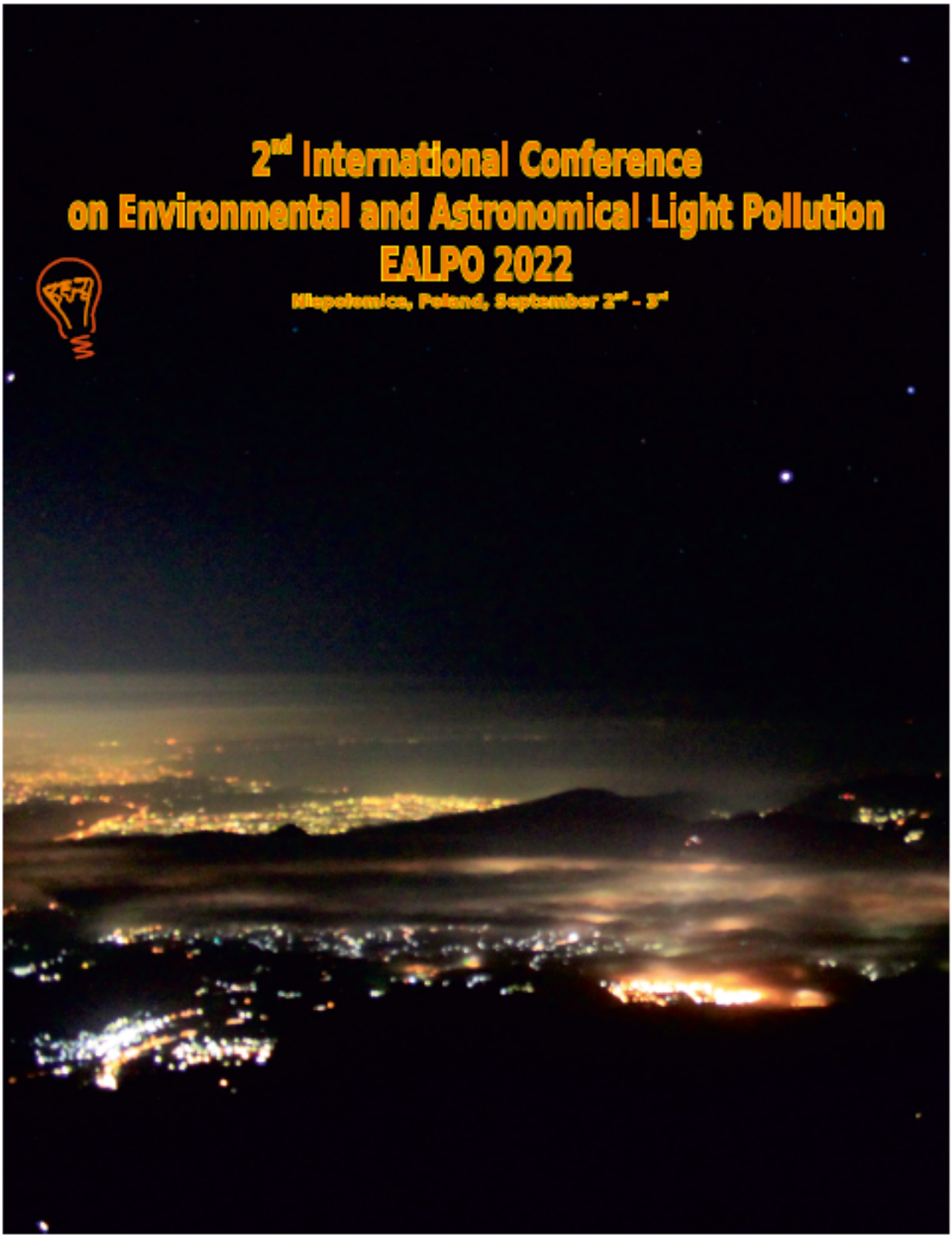

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Capturing of electromagnetic waves by decorated micro-mechanical (granular) systems formed as layered periodic structures

In this paper, we propose an approach to protection against electromagnetic radiation based on the provisions of modern photonics, in which the role of the main element is played by decorated micro-mechanical (granular) materials.

In his seminal work, Rayleigh showed that a plane wave propagating in a one-dimensional periodic unbounded structure is, for some wavelengths, completely reflected at fragment boundaries, called in modern terminology (accepted for structures such as photonic crystals) the band gap. In this case (upon the Bloch-Floquet theorem) the amplitude of the wave inside the periodic system decays exponentially. If the symmetry of the initial state of the system is violated, say, due to particular decoration, for example, due to formation of defects, the generation of exponentially growing and decaying components is possible with the formation of a mode localized in the vicinity of the defect [1, 2].

We will study the wave transport in a horizontal chain composed of isolated identical particles – granules under the condition that particles contact each other tightly, without breaks, and also experience oriented precompression configured along the chain axis, which does not violate the topological order. The system thus looks like horizontally alternating segments filled with undeformed particles and areas of their mutual overlap (so-called layered-periodic structure) [3].

We show that in such a systems with a decrease in the frequency of the corresponding defect, the corresponding components in the spectrum shift to the lower boundary of the band gap. This state does not correspond to the propagating models, and so in our model, which, however, corresponds to a real prototype (decorated granular chain), an electro-magnetic wave is “captured” by a defect, and “arrested” in some of its own vicinity.

References

[1] Gerasymov O.I., Physics of granular systems. Odessa, TES, 2015, p. 264.

[2] Gerasymov O.I., Khudyntsev N.N., Klymenkov O.A., *The latest materials and technologies in the protection of ecological systems*, Odessa, OSEU, 2021, p. 100

[3] Gerasymov O.I., Sidletska L.M., *Plane wave propagation in an inhomogeneous one-dimensional power chain: the effect of transparency*, Environmental safety and nature management, 2022, N. 41, p. 102-110, doi: 10.32347/2411-4049.2022.1.102-110