*Topic: Condensed Matter and Statistical Theory of Many-body Systems/*

**Detection and identification of impurity components by THz scattering**

**Author:** Oleg Gerasymov1

**Co-authors:** Liudmyla Sidletska 1

1 *Odesa Mechnikov National University*

**Corresponding Author:** gerasymovoleg@gmail.com

The results of experimental studies on THz radiation scattering on granular composites [1-4] have been theoretically interpreted in terms of a combined scenario of ballistic propagation and photon scattering. In this way, it turns out that at low concentrations of the impurity component that perturbs the basic matrix, the refractive index depends linearly on the concentration. This mode is proposed to be interpreted as the one in which most photons move ballistically (without scattering) in the matrix material. Further, with increasing concentration of impurity particles, we believe that multiple scattering effects begin to play a more significant role. With further increase of the impurity concentration and approaching the most densely packed states, the scattering intensity decreases. This effect can be interpreted as a return to the ballistic scenario in the dynamics of photons in the impurity material. It is proposed to consider the nonmonotonic nonlinear behavior of the scattering intensity in the vicinity of concentration values corresponding to the change of the above ballistic modes as a criterion (marker) that reveals the presence and some parameters of the impurity component and allows its identification. The latter constitutes an effective tool for using THz spectroscopy in applied problems [5-7].

1. Zeitler J. A., Shen Y.-C. Industrial applications of terahertz imaging // Springer Series in Optical Sciences. 2012. Vol. 171. P. 451–489.

2. Garet F., Hofman M., Meilhan J., Simoens F., Coutaz J. L. Evidence of Mie scattering at terahertz frequencies in powder materials // Applied Physics Letters. 2014. Vol. 105, No. 3. P. 031106

3. K. N. Murphy, M. Naftaly, A. Nordon, and D. Markl, “Polymer Pellet Fabrication for Accurate THz-TDS Measurements,” Appl. Sci. **12**(7), 3475 (2022).

4. Li S. X., Zhao J., Lu P., Xie Y. Maximum packing densities of basic 3D objects // Chinese Science Bulletin. 2010. Vol. 55, No. 2. P. 114–119.

5. Gerasymov O.I. Physics of granular materials. Monograph. Odesa: ТЕS, 2015. 264p. ISBN 978-617-7054-82-4.

6. Gerasymov, O. I. , Khudyntsev, M. M. , Klymenkov, O. A. New materials technologies in the tasks of the safety technologies: Monograph. Odesa: 2021. 78 p. ISBN 978-966-186-192-2 . URL: <http://eprints.library.odeku.edu.ua/10207>

7. Gerasymov O. Theoretical Models of Composite Materials for the Protection Technologies // E3S Web of Conferences. 2024. Vol. 477. International Conference on Smart Technologies and Applied Research (STAR'2023).