CORPUSCULAR–WAVE EMISSIOn FROM A MICROCLUSTER TARGET IRRADIATED BY ULTRA-SHORT LASER PULSES [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2022.49.1.092

1Gozhev D.A., 1,2Bochkarev S.G., 1,2Brantov A.V., 1,2Bychenkov V.Yu.

1P.N. Lebedev Physics Institute, Russian Academy of Sciences, Moscow, Russia,
 bochkarevsg@lebedev.ru
2All-Russia Research Institute of Automatics, ROSATOM, Moscow, Russia

To date, it has been shown that a dense microstructured medium irradiated with powerful laser radiation is a unique source of charged particles (electrons and ions), as well as neutrons and secondary electromagnetic radiation [1, 2]. Microstructured targets absorb laser radiation more efficiently than solid targets such as foils. This effect is achieved due to the finite small size of the microstructures, which, as a rule, is less than or of the order of the wavelength of the incident radiation. An example of such targets used in experiments and in theoretical models are media consisting of spherical clusters and droplets, including CO2 clusters [3], micro-clusters of heavy atoms, such as xenon [4], ultra-fine dust media (for example, from gold dust grains) [5], microdroplets of heavy water [6], etc. For targeted experiments, it is necessary to fully understand what characteristics of the target, and in particular the size of micro-structures, can provide the most effective interaction with a laser pulse which is still not well understood.

In this work, using three-dimensional numerical simulation by the “particle in a cell” method, we present the results of optimization calculations to find the parameters of the irradiated medium that provide its best heating by a relativistically intense ultrashort laser pulse. Optimization includes finding the parameters at which the maximum yield of hot electrons is achieved upon irradiation of microclusters of heavy atoms, and an increased yield of synchrotron radiation from electrons recirculating around clusters and wandering between them. The work also determined the maximum yield of fast deuterons initiating DD reactions under laser irradiation of heavy water droplets. Estimates of the yield of thermonuclear neutrons are given.

This work was supported by the Russian Science Foundation, project No. 17-12-01283.

References

1. Faenov A. Ya., Pikuz T. A., Y. Fukuda, et al., Contrib. Plasma Phys. 2013, **53**, 148.
2. Purvis M.A., et al., Nature Photon. 2013, 7, 796.
3. Bochkarev S.G., Faenov A., Pikuz T., Brantov A.V., et al., Scientific reports 2018, **8**, 9404.
4. Fukuda Y., Yamakawa K., Y. Akahane, et al., JETP Letters 2003, **78**, 115.
5. Gozhev D.A., Bochkarev S.G. and Bychenkov V.Yu., JETP Letters 2021, **114**, 200.
6. Ter-Avetisyan S., Schnurer M., Hilscher, et al., Phys. Plasmas 2005, **12**, 012702.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/It/ru/DD-Gozhev.docx) [↑](#footnote-ref-1)