

Investigation of magnetized plasma created in snail targets at the PALS facility

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Magnetized plasma studies are necessary for many applied studies including laser-driven inertial fusion, modeling astrophysical relevant phenomena, as well as innovative industrial and medical applications. One of the main issues met in this research is generation of strong magnetic fields. A particularly interesting alternative to classic pulse magnetic field generators offers the application of spiral-shaped cavity (snail-like) targets, in which the magnetized plasma streams are generated. This research continues previous PALS experiments, which principally confirmed the idea of forming the magnetized plasma in snail targets irradiated by moderate intensity laser beams [1]. In the reported extended research, snail targets of various diameters illuminated by ~500 J, 1 ω , linearly or circularly polarized radiation of the PALS iodine laser, were used. As the main diagnostic, a 3-frame complex interferometry measured the temporal changes in the distribution of the magnetic fields and electron density in the formed structures of the magnetized plasma. Complementary studies of the electron emission parameters were carried out using 2D imaging of the Cu-K α line emission and a multi-channel electron spectrometer. A 4-frame X-ray camera was used to visualize the plasma formation process in the X-ray range. The results obtained within this investigation clearly demonstrate the influence of the target size and the laser beam polarization on the structure of the formed magnetized plasma and the emission of electrons and ions. Irradiation of the targets with the linearly polarized laser beam significantly affects the parameters of the electron emission, especially the hot electrons, which reveals in their increased production, temperature and energy deposited along the snail target surface, according to 2D imaging of K α -Cu emission and to angular measurements of the electron spectra with the multi-channel magnetic electron spectrometer.

- [1] T. Pisarczyk, S.Yu Gus'kov, A. Zaras-Szydłowska, R. Dudzak, O. Renner, T. Chodukowski, J. Dostal, Z. Rusiniak, T. Burian, N. Borisenko, M. Rosinski, M. Krupka, P. Parys, D. Klir, J. Cikhart, K. Rezac, J. Krasa, Y.J. Rhee, P. Kubes, S. Singh, S. Borodziuk, M. Krus, L. Juha, K. Jungwirth, J. Hrebicek, T. Medrik, J. Golasowski, M. Pfeifer, J. Skala, P. Pisarczyk, Ph. Korneev. Magnetized plasma implosion in a snail target driven by a moderate intensity laser pulse. *Scientific Report*, **8**:17895, 2018.