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Simulation studies on the development of an advanced electron/ion accelerator using a laser-plasma interaction in Korea University Sejong Campus

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A laser-plasma acceleration, as an innovative technology for a compact accelerator, has been developed for tumor therapy, compact light sources, an injector of a high-energy accelerator, and so on. To overcome the limitations on generating stable, high-quality beams, it is better to perform the simulations with new ideas based on expected mechanism. The accelerating mechanism and/or self-injection condition of a laser wakefield acceleration has been investigated using EPOCH and SMILEI particle-in-cell (PIC) codes for different types of plasmas, such as, a laser-ablated metal plasma and a helium gas plasma. As investigating the ionization effects of different metals, such as, aluminum, copper, and titanium, the structured metallic plasma targets, such as, titanium-layered aluminum plasma target, has been developed to improve the beam quality, for example, bunch charge or energy spread. The simulation study of laser ablation processes using FLASH computational fluid dynamics (CFD) code is underway to find the experimental condition for generating a desired plasma. A laser proton acceleration with different targets and contamination layers has been also investigated. The simulation results will be presented including the comparison between 2D and 3D simulations with EPOCH and SMILEI codes.

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