7th European Advanced Accelerator Conference

Contribution ID: **472** Type: **Poster (participant)**

The NanoAc Collaboration: Toward a Proof-of-Principle for Laser Wakefield Acceleration in Nanostructured Solid-State Plasma

Monday, 22 September 2025 19:00 (1h 30m)

Solid-state plasma wakefield acceleration has recently garnered attention as a viable alternative for achieving unprecedented ultra-high acceleration gradients on the order of 1 TV/m or beyond. In this context, recent advancements in nanofabrication techniques have opened up the possibility of creating structured plasmas with tailored properties. For instance, the utilization of carbon nanotube (CNT) bundles holds great potential for generating stable plasmas with electron densities reaching as high as 10^{24} cm^{-3}, i.e., orders of magnitude higher than conventional gaseous plasmas. As part of a new collaborative effort called NanoAc, we have conducted Particle-In-Cell (PIC) simulations to investigate laser wakefield acceleration in nanostructured solid-state plasmas based on CNT arrays. Our results confirm the attainment of wakefields at the TV/m scale. Additionally, we observed self-injection, sub-femtosecond bunch formation, and electron acceleration in micrometre-scale targets, yielding kinetic energies of ~10 MeV. These findings open up promising possibilities to design novel ultra-compact accelerators and radiation sources. In this contribution, we present a summary of the work carried out by the NanoAc collaboration to date and discuss the preparation of future experimental tests in existing laser facilities.

Primary author: RESTA LOPEZ, Javier (ICMUV-University of Valencia)

Co-authors: BONATTO, Alexandre (Federal University fo Health Sciences of Porto Alegre); SYTOV, Alexei (Istituto Nazionale di Fisica Nucleare, Sezione di Ferrara; Korea Institute of Science and Technology Information); LEI, Bifeng (University of Liverpool); WELSCH, Carsten Peter; Dr VALAGIANNOPOULOS, Constantinos; BONTOIU, Cristian; GATTI, Giancarlo; CAVOTO, Gianluca (Istituto Nazionale di Fisica Nucleare); XIA, Guoxing (Cockcroft Institute and the University of Manchester); Dr AKSAKAL, Husnu (ICMUV-University of Valencia); Dr RAGO, Ilaria Carmela (INFN Rome1); DREBOT, Illya (Istituto Nazionale di Fisica Nucleare); ZHANG, Jiaqi (University of Manchester); Dr GINER-NAVARRO, Jorge (ICMUV-University of Valencia); Mr RODRIGUEZ-PEREZ, Juan (ICMUV-University of Valencia); BANDIERA, LAURA (Istituto Nazionale di Fisica Nucleare); MARTÍN-LUNA, Pablo

Presenter: RESTA LOPEZ, Javier (ICMUV-University of Valencia)

Session Classification: Poster Session

Track Classification: PS1: Plasma-based accelerators and ancillary components