

Miniaturizing Big Science with Plasma Acceleration

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Abstract

Particle accelerators are among the most productive instruments in the history of modern experimental science, powering discoveries ranging from the frontiers of high energy physics to new possibilities in imaging atomic and molecular systems at their natural length and time scales: Angstroms and femtoseconds. These fields are firmly classified by now as "big science" as the accelerators involved require billions of dollars of investment. Recently, there has been a strong rejection of the paradigm of enormous and expensive accelerators, and a new field has been born - advanced acceleration using very high fields. For the past three decades, this push has concentrated on the use of large amplitude plasma waves, to extend the acceleration rate from <100 MeV/m to nearly 1 TeV/m, an acceleration rate that would permit LHC energies to be obtained in the length of a large car. At the beginning, this goal seemed like a far-off dream. Now, we are seeing the birth of the first useful accelerators based on plasmas.

In this talk, I recount the story of how this scientific revolution took place – with UCLA taking center stage - and what is in store in this rich, promising new research field.