

UCLA Department of Physics & Astronomy

COLLOQUIUM

Thursday, June 6th, 2024 at 4 p.m.

PAB 1-434

Recollections of nearly a half-century of research on plasma based acceleration and particle-in-cell simulations at UCLA

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UCLA is the birthplace of plasma based acceleration, a field that has grown from a handful of researchers in the early 1980s to roughly 2000 today. UCLA has also been a breeding ground for plasma simulation using the particle-in-cell method for half a century. In plasma-based acceleration, a short and intense laser pulse or particle beam creates a plasma wave wakefield as it propagates through a tenuous plasma. The acceleration gradients of these wakefields can approach 100 of GeV/m. Properly placed electrons or positrons can then be accelerated to high energies in relatively short distances. In the particle-in-cell simulation method plasma particles move within a grid. Their currents and charge densities are then deposited onto grid points which are used as source terms to advance the electric and magnetic fields forward in time based on Maxwell's equations. The fields are then interpolated back onto the particles to push them to new positions and momentum. This process is then repeated for the desired number of time steps.

I will provide personal recollections and noteworthy results from over forty years of research on plasma based acceleration and the particle-in-cell simulation method, including on how progress in plasma based acceleration research has been profoundly impacted through particle-in-cell simulations. As in most research, the road traveled was not straight, but included bumps, lane changes, and sharp turns. And the fun part is that one never knows when or where the road will end and who will join the journey for short excursions. I will look backward on the road traveled as well as conjecture on what milestones one might expect in the not so distant future.

Refreshments at 3:30 p.m. PAB Patio.

Undergraduates Welcome!