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AWAKE: A Proton-Driven Plasma Wakefield Experiment at CERN

Tuesday, 4 June 2013 11:40 (30 minutes)

Short, high-energy proton (p+) bunches can drive GV/m accelerating fields over long distances (»10m) in low-density plasmas (1e15-1e15/cc) . Long p+ bunches subject to the self-modulation instability (SMI) form a train of micro-bunches that can resonantly drive accelerating fields of comparable amplitude over similar distances. The AWAKE experiment proposed at CERN aims to study the development of the SMI of p+ bunches in plasmas and to test the acceleration of externally injected electrons. AWAKE will use the ~12cm-long bunches of the SPS in the CERN CNGS facility. The SMI will be seeded using a laser pulse ionization front co-propagating within the p+ bunch. Numerical simulations show that seeding drives the SMI to saturation in ~4m of plasma and determine the final phase of the wakefields. Low energy electrons can either be injected from the side in a long, continuous plasma source, or on axis with two plasma sources. They are accelerated to a few GeVs in the remaining ~6m of plasma. The AWAKE current experimental plan and goals will be presented. Other SMI experiments at Brookhaven and SLAC relevant to AWAKE will also be briefly mentioned.

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