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Advanced Proton Driven Plasma Wake-field Acceleration Experiment at CERN: AWAKE Collaboration

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by Mikhail Martyanov (CERN) on behalf of AWAKE Collaboration

The AWAKE Collaboration has been formed in order to demonstrate proton-driven plasma wake-field acceleration of electrons for the first time ever. This technology could lead to future colliders of high energy of electrons but of a much reduced length compared to proposed future linear accelerators. The 400 GeV/c SPS proton beam will be extracted towards the AWAKE facility and injected into a 10 meters Rubidium plasma cell where the long proton bunches will be modulated into significantly shorter micro-bunches. The seeding of a micro-bunching instability of relatively long SPS proton bunch will be done by co-propagating ionization front induced by a powerful fs-laser pulse in Rubidium vapour. Proton micro-bunches will then initiate a strong wake-field in the plasma with peak fields above 1 GV/m that will be capable to accelerate a bunch of electrons from about 20 MeV up to the GeV scale within a few meters. The experimental program is based on detailed numerical simulations of proton / electron beams and plasma interactions. First protons to the experiment are expected at the end of 2016 and this will be followed by an initial 3–4 year experimental program. The AWAKE project at CERN has been already started at 2013 and it is an accelerator R&D experiment which is a prerequisite for the future larger-scale facilities of proton-driven plasma wake-field acceleration and applications to high energy colliders.

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