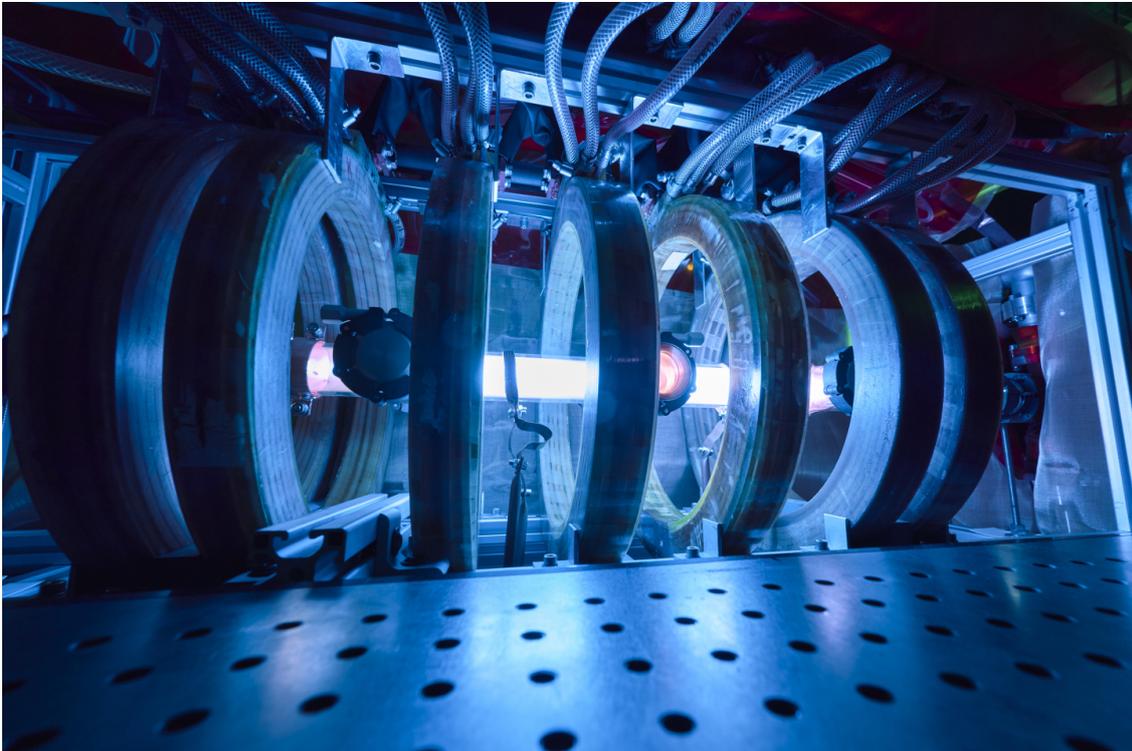


AWAKE: Accelerating Electrons to GeVs in a Proton Driven Plasma Wakefield Experiment

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Dr. Edda Gschwendtner (CERN)



Abstract:

AWAKE is an accelerator R&D experiment to demonstrate for the first time ever, plasma wakefield acceleration of electrons in wakefields driven by a proton bunch and, in the future, take advantage of the large energy store in the proton bunch to reach very high energy gain in a single plasma.

The AWAKE Run 1 experiment finished successfully its proof-of-concept program by observing the strong modulation of high-energy proton bunches in plasma; the results represent the first ever demonstration of strong plasma wakes generated by proton beams. In addition, AWAKE demonstrated for the first time the acceleration of externally injected electrons to multi-GeV energy levels in the proton driven plasma wakefields, a result published in Nature in August 2018. AWAKE Run 2 starts in 2021 and aims to achieve high-charge bunches of electrons accelerated to high energy (~10 GeV) while maintaining beam quality and showing that the process is scalable. By the end of Run 2 AWAKE should be in the position to use that scheme for first particle physics applications.

The principle of the AWAKE experiment is described. The experimental results of AWAKE Run 1 and the experimental program of AWAKE Run 2 are shown. First applications of this acceleration scheme are presented.