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Observation of the Hosing Instability in AWAKE

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The AWAKE Experiment at CERN relies on the Seeded Self-Modulation (SSM) process, which transversely modulates the charge density of the SPS proton bunch and turns it into a train of micro-bunches. While the SSM process is axi-symmetric, the hosing instability (HI) is non-axi-symmetric and can grow from bunch or plasma axial asymmetries. As the growth rates of the Self-Modulation Instability (SMI) and the HI are similar, the hosing growth starting from noise can overcome the SMI growth. In this case, the transverse centroid of the bunch slices starts wiggling around the beam axis, which drastically reduces the useful acceleration length for a plasma wakefield accelerator. Even though the HI is not a limitation for the AWAKE experiment as it mainly appears at much lower plasma densities than those useful for acceleration, a better understanding of the physical processes is desired. We will introduce the experimental conditions where Hosing is observed, show results on the bunch centroid modulation and its frequency and a comparison to PIC-simulations in OSIRIS.

Primary author: HÜTHER, Mathias (Max-Planck-Institut für Physik)

Co-author: AWAKE, Collaboration

Presenter: HÜTHER, Mathias (Max-Planck-Institut für Physik)

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