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## Seeding with an electron bunch the self-modulation of a long, relativistic particle bunch in a plasma

*Wednesday, September 18, 2019 7:00 PM (1 hour)*

Seeding of the drive bunch self-modulation (SM) process is essential when using a long particle bunch ( $\sigma_z \gg \lambda_{pe}$ ) to drive wakefields in plasma. Seeding in principle leads to a SM phase reproducible from event-to-event, allowing for deterministic injection of an electron witness bunch to be accelerated.

Since external injection requires generation of an electron bunch in an RF-gun or LWFA, we explore opportunities and challenges related to also using an electron bunch for seeding of the SM process in AWAKE. Seeding with an electron bunch has a number of possible advantages over seeding with a relativistic ionization front: no high-power laser needed, use of a source with pre-formed plasma (helicon, discharge, etc.), effective use of the entire drive bunch to drive wakefields, etc. It may also have some difficulties: implementation of a plasma density step, evolution of the seed bunch if not matched to the plasma focusing force, energy loss and dephasing of the seed bunch, etc.

**Primary authors:** MUGGLI, Patric (Max-Planck-Institut für Physik); BACHMANN, Anna-Maria (CERN); HÜTHER, Mathias (Max-Planck-Institut für Physik); MOREIRA, Mariana (IST, CERN); VIEIRA, Jorge (Instituto Superior Tecnico)

**Presenter:** MUGGLI, Patric (Max-Planck-Institut für Physik)

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