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## Energy transfer in a proton-driven wakefield accelerator

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Plasma-based accelerators support large field gradients, but reaching high energies requires that these gradients be sustained over long distances. The high energy of currently available proton sources offers the potential to accelerate a witness bunch to the energy frontier, avoiding the need to couple sequential plasma stages.

However, a proton driver presents its own unique challenges. The large proton mass means that the limiting factor at low energies is longitudinal dispersion of the driver, while the asymmetric plasma response arising from the mass difference between ions and electrons introduces additional constraints on the transformer ratio due to the positive driver charge. In this work, we investigate the efficiency with which energy can be transferred from a proton driver to a trailing witness, the scaling with driver energy, and the influence of the driver profile.

**Primary author:** FARMER, John (Max Planck Institute for Physics)

**Co-authors:** PUKHOV, Alexander (uni duesseldorf); CALDWELL, Allen (Max Planck Institute for Physics); WILSON, Thomas (Heinrich Heine Universität)

**Presenter:** PUKHOV, Alexander (uni duesseldorf)

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