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Wakefield regeneration in a plasma accelerator

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Plasma wakefields can offer high acceleration gradients, orders of magnitude larger than conventional RF accelerators. However, the maximum charge which can be accelerated in a single bunch is limited by beam loading of the wakefields, which reduces the gradient and can lead to a broad energy spread. In this work, we show that a train of drive bunches, such as that used in AWAKE, can be harnessed to regenerate the wakefield behind a witness bunch. This allows a train of witness bunches to be accelerated, potentially increasing the achievable luminosity.