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Growth and phase velocity of self-modulated beam-driven plasma waves¹ CARL SCHROEDER, CARLO BENEDETTI, ERIC ESAREY, WIM LEE-MANS, Lawrence Berkeley National Laboratory, FLORIAN GRUENER, University of Hamburg — A long, relativistic charged particle beam propagating in a plasma is subject to the self-modulation instability. This instability is analyzed and the growth rates are calculated, including the phase relations. The phase velocity of the accelerating field is shown to be significantly less than the drive beam velocity. These results indicate that the energy gain of a plasma accelerator driven by a self-modulated beam will be limited by dephasing. In the long-beam, strongly-coupled regime, dephasing is reached in less than four e-foldings, independent of beam-plasma parameters.

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