LONGITUDINAL COHERENCE PRESERVATION AND CHIRP EVOLUTION IN A HIGH GAIN LASER SEEDED FREE ELECTRON LASER AMPLIFIER

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Abstract

We examine the start|-|up of a high gain free electron laser in which a frequency chirped coherent seed laser pulse interacts with a relativistic electron beam. A Green function formalism is used to evaluate the initial value problem. We have fully characterized the startup and evolution through the exponential growth regime. We obtain explicit expressions for the pulse duration, bandwidth and chirp of the amplifed light and show that the FEL light remains fully longitudinally coherent. We introduce an ABCD matrix formalism to characterize the FEL amplification process and to propagate the pulse length and chirp through the FEL.

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