INFLUENCE OF OPTICAL FEEDBACK ON THE COHERENCE PROPERTIES OF FEL OSCILLATORS

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Abstract

When detuned, the output of a FEL oscillator is dominated by a transient amplification of the spontaneous emission noise (SE). Here, we show that FEL oscillators in this situation appear to display a strong sensitivity to optical feedback. From a Dattoli-Elleaume type modeling, we show that a very small amount of reinjected power (typically $\ll 1 \cdot 10^{-8}$ in the case of the UVSOR SR-FEL) modifies dramatically the FEL operation. In particular, we demonstrate experimentally and numerically a strong spectral narrowing, correlated with a disappearance of the laser pulse microstructures. This is also accompanied by a suppression of SR-FEL instabilities for a wide range of parameters (half of the detuning curve). These topics (strong amplification of SE noise, and control using tiny reinjection), are of course more general. We propose a theoretical approach of these questions, using in particular the concept of convective instabilities.