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Microbunching of Relativistic Electron Beams

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One of the fundamental facets of microbunching in relativistic electron beams is the potential for generation of coherent radiation at the wavelengths that characterize that periodic longitudinal modulation. This microbunching is an inherent process in the free-electron laser (FEL) mechanism for both single-pass and oscillator configurations. Besides the FEL output, diagnostics of these microbunched electron beams can be performed using coherent optical transition radiation (COTR) and imaging techniques in the former case. In these cases, the COTR from the microbunched portion of the beam in 6-D space generally dominates the images. Other mechanisms include the longitudinal-space-charge-induced microbunching in ultra-bright beams and laser-induced microbunching such as observed in laser wakefield accelerator beams. More recently, we consider the diagnostics of the TESSA** FEL concepts where a seed laser co-propagating with the electron beam through a short modulator and chicane may result in bunching fractions of >10 % leading to COTR enhancements of >22 million. Examples of these past, present, and future investigations will be discussed.

**Tapering Enhanced Super-radiant Stimulated Amplification (TESSA)

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