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Two-Colored FEL Generation Using Phase Shifters at Undulator

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Phase shifters at undulator line are usually used for optimizing FEL intensity by setting 'in-phase' by matching the FEL pulse and electrons phases. π-offset so called 'out-phase'may suppress FEL intensity at the resonant frequency, therefore the 'out-phase' condition is an unwanted state. However, this 'out-phase' setting can arise side band spectrums. This phenomena can be explained by the theory of the spontaneous radiation or low-gain FEL, and it expects that these side band spectrums have two main spectrums with the spectrum difference determined by the number of undulator period. This poster shows amplification of the two-colored spectrum seeded by the spontaneous spectrum feature. Results of two colored FEL is studied by simulations and experiments are performed at PAL-XFEL showing it's intensity grows exponentially along the number of undulator segments and reaches the saturation resulting in hundreds μJ energy.

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