SECOND HARMONIC LASING WITH STORAGE RING BASED FELS

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Abstract

The study of forbidden processes in many types of physical systems is critical for understanding the underlying symmetry breaking. The FEL second harmonic lasing of provides a unique opportunity to study the "forbidden" FEL gain mechanisms which are otherwise not allowed under normal operation conditions of an FEL. Because of its very low gain, the sole study of second harmonic lasing in the optical region was reported by the JLab using its high-gain IR FEL (PRL, 084801, 2001). This work reports the first second harmonic lasing results at Duke University with the storage ring based optical klystron and distributed optical klystron FELs. Several different mechanisms have been proposed for the second harmonic lasing, including relative misalignments between electron and optical beams, transverse field gradients, and longitudinal coupling (NIM A483, p. 527, 2002). Different gain mechanisms can also lead to preferred polarization states. In order to understand and distinguish various gain mechanisms, our work focuses on measurements of the gain and polarization of the second harmonic lasing under various optical and electron beam conditions and for a variety of FEL configurations.

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