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Optical Undulators for Free Electron Lasers JAMES LAWLER, JOSEPH BISOGNANO, ROBERT BOSCH, MICHAEL GREEN, KENNETH JACOBS, DENIZ YAVUZ, Univ of Wisconsin, Madison — Free Electron Lasers (FELs) in the x-ray region are opening new research directions in AMO physics and other fields, but beam time is quite limited at these expensive facilities. There are conceptual designs for much less expensive soft x-ray FELs using sheared pulses from Table Top Terawatt (T^3) lasers as optical undulators [1]. A nearly co-propagating laser pulse can be angle tuned to yield soft x-rays, and shearing the pulse can optimize use of the laser photons. Undulator K values near unity are available from T^3 lasers, and angle tuning provides almost arbitrary effective undulator periods. A combination of these optical undulator ideas with pre-“micro-bunching” at a photocathode followed by electron beam emittance exchange [2] can reduce the energy needed from the T^3 laser. A combination of a nearly co-propagating optical undulator with a Bragg-reflection diamond mirror cavity [3] may lower the cost of an x-ray frequency comb for metrology.

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