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Novel Radiation Sources Based on Ultra-High-Power Lasers: New Capabilities for Radiology and Radiotherapy[1]

DONALD UMSTADTER, University of Nebraska, Lincoln

As the maximum power level of compact lasers steadily increases, new opportunities are enabled for their use in bio-medicine and medicine. For instance, the Diocles laser at the University of Nebraska, Lincoln, now produces a peak power of 150-terawatts (1.5×10^{14} W) from a table-top-size system. When light at this power level is focused, it can accelerate electrons, and produce quasi-monoenergetic beams of x-rays, similar to those produced by much larger synchrotron light sources. Such MeV-energy beams create new opportunities in biomedicine, radiology and radiography. Examples to be discussed include structural analysis of bio-molecules, diffraction-enhanced imaging for computed tomography, and radio-sensitization-enhanced radiotherapy. This talk will describe the current status of laser-based x-ray technology, as well as the potential advantages and prospects for their use in medicine.

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