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Particle acceleration on a chip: A laser-driven micro-accelerator for research and industry[1] R.B. YODER, Goucher College, G. TRAVISH, UCLA
— Particle accelerators are conventionally built from radio-frequency metal cavities, but this technology limits the maximum energy available and prevents miniaturization. In the past decade, laser-powered acceleration has been intensively studied as an alternative technology promising much higher accelerating fields in a smaller footprint and taking advantage of recent advances in photonics. Among the more promising approaches are those based on dielectric field-shaping structures. These "dielectric laser accelerators" (DLAs) scale with the laser wavelength employed and can be many orders of magnitude smaller than conventional accelerators; DLAs may enable the production of high-intensity, ultra-short relativistic electron bunches in a chip-scale device. When combined with a high-Z target or an optical-period undulator, these systems could produce high-brilliance x-rays from a breadbox-sized device having multiple applications in imaging, medicine, and homeland security. In our research program we have developed one such DLA, the Micro-Accelerator Platform (MAP). We describe the fundamental physics, our fabrication and testing program, and experimental results to date, along with future prospects for MAP-based light-sources and some remaining challenges.

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