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Random Dielectric Photonic Structures for Accelerating Particles C.A. BAUER, Univ. of Colorado, J.R. CARY, Univ. of Colorado; Tech-X Corp., G.R. WERNER, Univ. of Colorado — We investigate the applicability of random dielectric photonic structures to particle acceleration. Electromagnetic waves trapped within photonic crystal cavities can be used to accelerate charged particles. Whereas metallic cavities support higher harmonics, cavities in dielectric photonic crystals limit trapped oscillations to a frequency range within the bandgap of the surrounding crystal. This allows the cavity to contain only one frequency mode, and a resulting simplified field distribution within the cavity. In two dimensions, certain periodic arrangements of cylindrical rods (square and triangular lattices, for example) provide well-defined bandgaps, and are relatively easy to fabricate. Their 3D counterparts, however, pose an experimental challenge on the sub-micrometer scale. A recent simulation shows that an arrangement of randomly placed dielectric rods that are required to lie a minimum distance from any other rod, will also have a well-defined bandgap in two dimensions. If an analogous three dimensional structure exists, an improved accelerating cavity is feasible and may be easier to fabricate than regular 3D photonic crystals. Using FDTD simulation methods, we investigate the electromagnetic fields trapped in cavities inside 1D and 2D realizations of this random dielectric photonic structure toward particle acceleration applications and insights into a three dimensional counterpart. This work was supported by the U.S.DOE grant DE-FG02-04ER41317.

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