Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

High-Power Microwave Metamaterials for Phased-Array, anti-HPM, and Pulse Shaping Applications NADER BEHDAD, MUDAR AL-JOUMAYLY, MENG LI, University of Wisconsin-Madison — We present a class of metamaterials capable of operating under extremely high power microwave (HPM) fields. The proposed metamaterials are in the form of periodic arrangements of unit cells with sub-wavelength dimensions and periodicities. Each unit cell is composed of multiple thin impedance sheets providing non-resonant reactive surface impedances separated from each other by ultra-thin dielectric spacers. The proposed structures can be designed to operate as spatial filters with highly selective spectral responses capable of handling power density levels in the order of 1.0 MW/cm2. Such filters could ultimately be used as counter high-power-microwave devices in HPM systems. In addition to their filtering characteristics, over a certain frequency range, the unit cells of these structures could be treated as spatial phase shifters or true-time-delay units (TTDU). We will discuss how tunable versions of these TTDUs can be used to design wideband, tunable HPM lenses for phased-array applications. Finally, we will discuss the possibility of using non-linear versions of these HPM lenses for pulse shaping applications at high-power-microwave levels.

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Date submitted: 23 Jul 2010 Electronic form version 1.4