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Analytical and numerical characterization of a one and two-dimensional plasma photonic crystal with a sine series density perturbation[1] W R THOMAS, U SHUMLAK, University of Washington — Plasma photonic crystals (PPCs) have the potential to significantly expand the capabilities of current microwave filtering and switching technologies by providing high speed (μs) control of energy band-gap/pass characteristics in the GHz through low THz range. While photonic crystals consisting of dielectric, semiconductor, and metallic matrices have seen thousands of articles published over the last several decades, plasma-based photonic crystals remain a relatively unexplored field. The majority of numerical and theoretical investigations into PPCs make the simplifying assumption of uniform density plasmas. In practice, most methods of generating repeatable, controllable plasmas have density gradients arising either from diffusion or wall effects. In this investigation we use analytical and numerical techniques on a plasmas perturbed with 1) a single sine wave, and 2) a finite Fourier series approximation of a square wave. These one and two dimensional PPCs will be studied to characterize their transmission properties and associated plasma dynamics, and establish relationships between dimensionless parameters (a lattice normalized plasma frequency, density perturbation ratio, density gradient) and band-gap frequency and width.

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