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Design of Tunable Superconducting Metamaterials[1] MELISSA TREPANIER, DAIMENG ZHANG, STEVEN ANLAGE, University of Maryland — Our goal is to create a superconducting metamaterial utilizing deep sub-wavelength meta-atoms with a quickly-tunable index of refraction. To accomplish this we will combine two different materials: an array of rf SQUIDs (with tunable effective permeability) and an array of thin wires interrupted by Josephson junctions (with tunable effective permittivity). These materials have been designed to maximize tunablility in the range easily measured via X-band, Ku-band, and K-band waveguides. Various sizes of rf SQUIDs were designed to be non-hysteretic, be sufficiently insensitive to noise, and to have resonant frequencies ranging from 6.5 - 22 GHz. The wire array was designed so that the inductance of the Josephson junctions can completely cancel the geometric and kinetic inductance of the wires, giving rise to strong tunability. We will present the design considerations and simulation results for this new class of metamaterials.

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