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Broadband Tunable Transparency in rf SQUID Metamaterial¹ DAIMENG ZHANG, MELISSA TREPANIER, Univ of Maryland-College Park, OLEG MUKHANOV, Hypres Inc, PHILIPP JUNG, SUSANNE BUTZ, ALEXEY USTINOV, KIT, STEVEN ANLAGE, Univ of Maryland-College Park — We demonstrate a metamaterial with broadband tunable transparency in microwave electromagnetic fields. This metamaterial is made of Radio Frequency Superconducting QUantum Interference Devices (rf SQUIDs) [1]. We show both experimentally and theoretically that the resonance of this metamaterial totally disappears when illuminated with electromagnetic waves of certain power ranges, so that waves can propagate through the metamaterial with little dissipation in a wide frequency spectrum. Unlike traditional electromagnetically induced transparency, high transmission through this metamaterial is due to the intrinsic nonlinearity of the rf SQUID. Transparency occurs when the metamaterial enters its bistability regime. We can control the metamaterial to be transparent or opaque by switching between the two states depending on the initial conditions and signal scanning directions. We also show that the degree of transparency can be tuned by temperature, power of the incident wave, and dc magnetic field and discuss analytical and numerical models that reveal how to systematically control the transparency regime. The metamaterial has potential application in fast tunable digital filter, power limiter and auto-cloaking.

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