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Quantum Tunneling in Metal-Insulator-Metal Nanoantennas¹ MALLIK MOHD RAIHAN HUSSAIN, JOSEPH HAUS, IMAD AGHA, ANDREW SARANGAN, University of Dayton, OH — The goal of this research is to experimentally examine the optical properties of nanometer-sized metal-insulator-metal (MIM) structures. A set of experiments are designed to measure the second and third-harmonic waves scattered from the nanostructured MIM antenna when illuminated with different lasers and, also, to quantify the current/voltage characteristics of carefully fabricated MIMs. The MIM sample geometry is designed so that there is a nanometer-sized gap between two metals that is filled with an insulator (dielectric) material. The prediction of higher-order optical harmonics generation related to the MIM geometry is predicated on the photon-assisted, electronic quantum tunneling process. The quantum tunneling process calculates a set of conductivities that is used in our numerical simulations to describe the electromagnetic properties of the MIM. The initial results from numerical simulations were compared to other numerically intensive methods available in the literature to validate them. For this research, we extend the validation process by performing more numerical simulations to compare with data from our optical experiments. Our research is guided by numerical calculations to find the optimal conditions for generating the optical harmonic waves.

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