Abstract Submitted
for the 4CS20 Meeting of
The American Physical Society

Optical Response of Arrays of Nanoparticles with Periodic Vacancies LAUREN ZUNDEL, ASHER MAY, ALEJANDRO MANJAVACAS, University of New Mexico — Periodic arrays of metallic nanoparticles are an ideal platform for a wide range of applications, from ultrasensitive sensors to nanolasers, due to their ability to support collective modes known as lattice resonances. These excitations, which occur at wavelengths commensurate with the periodicity of the array, give rise to strong and spectrally narrow optical responses that can be controlled by changing the geometrical properties of the array. Recently, there has been a significant effort dedicated to understanding the optical response of periodic arrays of nanoparticles with complex unit cells that contain more than one particle. These systems exhibit much richer optical responses than those with single-particle unit cells. Inspired by this, here, we provide a comprehensive analysis of the optical response of arrays of nanoparticles with a unit cell built from the periodic removal of particles from a square single-particle array. We find that the introduction of these vacancies can give rise to lattice resonances not present in the pristine system. The results of our work therefore serve to advance the fundamental understanding of the optical response of periodic arrays of metallic nanoparticles and provide an alternative method to control it.

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Date submitted: 29 Sep 2020 Electronic form version 1.4