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The physics of plasmonic vapor-gas bubbles in a gassy liquid YUHANG ZHANG, Johns Hopkins University, ANDREA PROSPERETTI, University of Houston — When illuminated by resonant irradiation of a continuous-wave laser, gold nanoparticles deposited on a surface immersed in a liquid generate huge amount of heat in a very short period of time, leading to the nucleation of vapor bubbles referred to as plasmonic bubbles. In this work, a spherically symmetric mathematical model is proposed to describe the various physical processes that affect the dynamics of these bubbles: growth, condensation, the diffusion of dissolved gas into and out of the bubble and the attendant mass and heat transfer. The model is solved by transforming the partial differential equations into a system of ordinary differential equations using a collocation method. The different phases of the bubble behavior on short (microseconds) and longer (milliseconds to seconds) time scales found in experiments are reproduced by the numerical simulations. The effects of the degree of dissolved gas saturation in the liquid are discussed.

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