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Phases Shift in Sub-wavelength Plasmonic Hole on Thin Metal Film.[1] JUN XU, HYUNGJIN MA, NICHOLAS X. FANG, University of Illinois at Urbana-Champaign — While recent study of extraordinary transmission of light through sub-wavelength plasmonic nanostructures shows promise of novel nanophotonic elements in sensing and display, the origin of such phenomena is still under hot debate. In this paper, we measured the phase delay of the squeezed light emerging from individual plasmonic holes. Near-field Scanning Optical Microscope (NSOM) has been used to measure the interference of transmitted and scattered light of an isolated sub-wavelength hole on thin metal film. Our results indicate that even with a 30nm perforated film, the observed phase shift can be as large as 300 degrees, well beyond the prediction from earlier theoretical models. Counter intuitively, the measured phase shift is sensitive to the wavelength, the film thickness but insensitive to hole diameter. Also, full scale simulation by COMSOL has been done to show the more detail features inside the metal film. Our study may provide new insight to compact and efficient optoelectronic devices.

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