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Assembling Three-Dimensional Optical Stereo-Nanocircuits JINWEI SHI, Dept. of Phys., Beijing Normal University, SARAH ELIAS, Dept. of Phys. and Center for CQS, The University of Texas at Austin, FRANCESCO MONTICONE, Dept. of Electrical and Computer Engineering, The University of Texas at Austin, YANWEN WU, DANIEL RATCHFORD, XIAOQIN LI, Dept. of Phys. and Center for CQS, The University of Texas at Austin, ANDREA ALU, Dept. of Electrical and Computer Engineering, The University of Texas at Austin — The development level of integration of photonic devices is lagging behind compared with microelectronics, due to diffraction limit and the difficulty of realizing basic functionalities with lumped photonic circuit elements at the nanoscale and achieving versatile operations by combining these elements in large circuits. Here we demonstrate the design, assembly and characterization of various 3D photonic nanocircuits with increasing complexity by accurately positioning a number of metallic and dielectric nanoparticles (NPs) in a reconfigurable way with atomic force microscope (AFM) manipulation, in analogy to what an electrical engineer does when putting together an electronic circuit. The NP clusters are shown to produce the designed spectral response, qualitatively predicted by simple circuit rules, with fixed optical lumped impedance value of each NP for different nanocircuit configurations. Additionally, such nanophotonic circuits exhibit stereo-functionality, i.e., a response that can be controlled by the polarization of impinging light. Our work represents an important step toward transplanting and extending the powerful design tools of electronic circuits to nanophotonic systems.

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