A 64-pixel WSi superconducting nanowire camera for real-time single-photon imaging

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We have demonstrated a superconducting nanowire camera based on amorphous WSi consisting of 64 individual SNSPD (superconducting nanowire single-photon detector) pixels. Each pixel has an active area of 30 µm x 30 µm, and the 8 x 8 array of pixels are spaced on a 60 µm pitch yielding a fill factor of ~0.25. The camera is biased and read out using a novel row-column readout scheme. Each of the 8 rows is individually biased, and each row and column is individually read out with a chain of room-temperature amplifiers. Output pulses from these amplifier chains are fed into a 16-channel time-tagging unit and to real-time histogramming and coincidence software. Simultaneous voltage pulses on row i and column j indicate that pixel (i,j) has detected a photon.
To test the device, light from a 1550 nm laser is free-space coupled through optical windows to the camera, which is held at a temperature of 800 mK in a closed-cycle cryostat. Because WSi SNSPDs are sensitive to blackbody photons from room temperature, we use two cold bandpass filters inside the cryostat to block most of this background. A computer-controllable image is encoded onto the laser beam with a digital micromirror device, and read out with the superconducting nanowire camera. We have shown that every one of the 64 pixels is sensitive to light, and that the coincidence software can sustain real-time, video-rate imaging with several thousand detected photons per second on each pixel.