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Passive THz Imaging with Superconducting NbN microbolometer Arrays[1]

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Passive THz imaging applications indoors require temperature difference resolution well below 1 K and integration times down to 0.1 ms. Recently we have shown that such resolution, approaching the photon noise limit, can be achieved using an antenna-coupled superconducting microwire bolometer with about 10 K transition temperature. The bolometer signal is read out with a low-noise room-temperature amplifier, thus eliminating the need for SQUID amplifiers. The readout method utilizes electro-thermal feedback at the $I-V$ curve minimum of a voltage-biased bolometer. At this working point, the very high power gain of the bolometer makes noise matching of the readout to the detector straightforward. The readout amplifier can be used with transition bolometers and calorimeters operating even at mK temperatures. We are presently developing a video-rate THz imager for concealed weapon detection, utilizing conical scanning and a 128-pixel NbN bolometer array, cooled down to 4 K with a pulse-tube cryocooler. We will characterize the bolometer arrays and the readout electrically and compare the results with the theory. We will also present the design of the system and results of preliminary imaging experiments. The work is done in collaboration between VTT, Millilab and NIST.

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