

Focal Plane Array of Thermo-Electric Bolometers

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Abstract— Novel concepts of the parallel and series array of Thermo-Electric Bolometers (TEB) with Superconductor-Insulator-Normal (SIN) Tunnel Junctions [1] have been proposed and realized for a distributed focal plane antenna. The arrays are developed for a pixel design based on arrays of TEBs coupled to a distributed slot antenna or dipole antenna [2] similar to array of Cold-Electron Bolometers (CEB) [3,4].

Two variants of the CEB arrays have been considered for both types of antenna on bulk substrate.

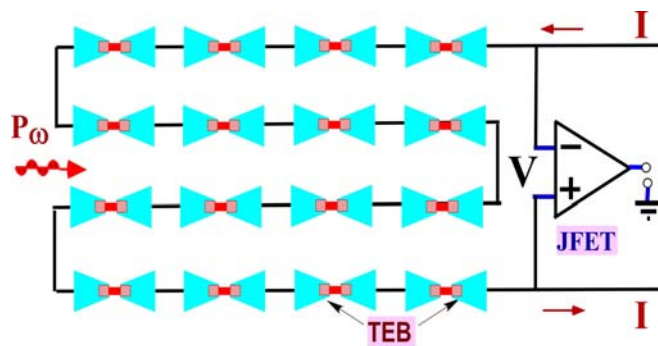


Fig 1. A distributed single polarization dipole antenna with a series array of TEBs and a JFET readout. This dipole antenna will be sensitive only to horizontal component of RF signal.

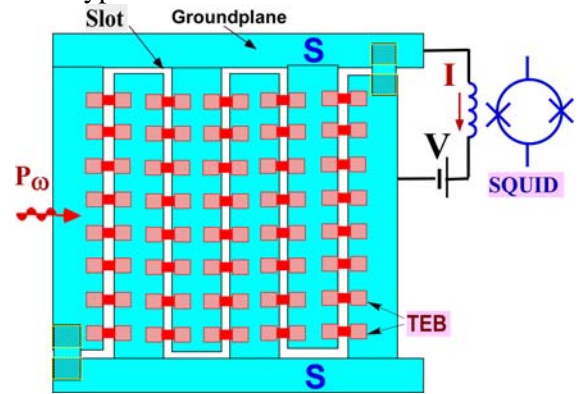


Fig 2. A distributed single polarization slot antenna with a parallel array of TEBs and a SQUID readout.

The series connection of TEBs with SIN tunnel junctions in current-biased mode [2] is optimal for dipole antennas. Estimations of the TEB noise with JFET readout have shown an opportunity to realize NEP less than photon noise for typical power load.

The parallel connection of CEBs with SIN tunnel junctions in voltage-biased mode [3] is optimal for a slot antenna. Remarkable progress in performance is expected from implementation of a new technology for fabrication of the CEB and SQUID on the same chip in one vacuum circle.

The design of 2x2 pixels for dipole and slot antennae has been realized for 350 GHz. The samples were fabricated using shadow evaporation technique on Si substrate. Results of DC and RF measurements will be reported at the conference.

1. Leonid Kuzmin, "Thermo-Electric Charge-to-Voltage Converter based on SIN Tunnel Junction", submitted to Applied Physics Letters (December 2009)
2. Peter K. Day et al., "Far-infrared imager-polarimeter using distributed antenna-coupled transition-edge sensors, 5498, pp 856-875, SPIE, 2004.
3. Leonid Kuzmin, "Array of Cold-Electron Bolometers with SIN Tunnel Junctions for Cosmology Experiments", Journal of Physics: Conference Series (JPCS), 97, 012310 (2008).
4. Leonid Kuzmin, "Distributed Antenna-Coupled Cold-Electron Bolometers for Focal Plane Antenna", Proc. of the 19th ISSTT, pp 154-158, Groningen, April 2008.