

Micro Cryogenic Coolers for Terahertz Imagers Utilizing Superconducting Hot Electron Bolometers

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Objective: To develop a micro cryogenic cooler for targeted cooling of superconducting hot electron bolometer for THz imaging with the following features:

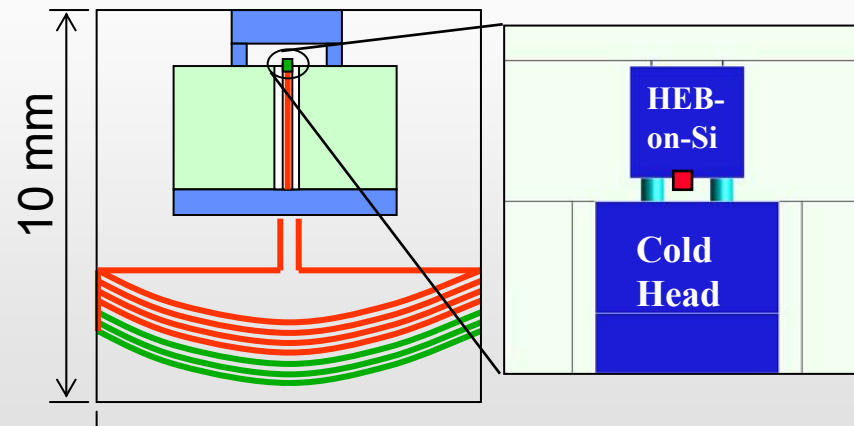
- Micro heat exchanger for micro Joule-Thompson cryocoolers.
- THz/RF couplings for thermal isolation.
- Optimum gas mixture for J-T cryocoolers
- MEMS-based compact compressor.

Expected Impact :

- Reduce device heat loads 48X from 120 to 2.5 mWatt by targeted cooling.
- Reduce total system power 40X from 7,700 to 200 mWatt.
- Achieve a system size less than 4 c.c. including control electronics.
- Demonstrate novel components for micro-scale energy systems.

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Technology: 16-atm gas mixture compressed by MEMS is delivered to 77K cold head through micro heat exchanger.



Deliverables:

- YBCO-based superconducting hot electron bolometer operating at 77K for THz imaging.
- Targeted cooling technology with only 2.5 mW heat loads to the device at 77K.
- Joule-Thompson micro cryogenic cooler with net refrigeration of 3 mWatt.
- MEMS-based compressor for cryocoolers.
- Optimum gas mixture for micro-scale Joule-Thompson cryocoolers.

