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Development of a far-infrared image sensor with Si-supported Ge BIB detector and FD-SOI cryo-CMOS ROIC hybritized by nano-particle deposition Au-bump

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Far-infrared (FIR) wavelength (30-200 μm) is an important tool to study the formation of planets, stars and galaxies. Gallium doped germanium (Ge:Ga) extrinsic photo-conductors (PCs) and cryo-PMOS readout integrated circuits (ROICs) were used in the previous space infrared astronomical observatories such as AKARI and Spizer.
Development of FIR large format image sensor is, however,difficult because of the following reasons:
1) Stress mechanism is required to extend the cut-off wavelength from that of Ge:Ga PC (120 μm) to 200 μm.
2) Large power consumption of the PMOS ROIC limits the number of pixel.
3) Thermal expansion mismatch between Ge detector and Si ROIC damages the In bump interconnection between them.
In order to overcome these problems, we are developing a large format FIR image sensor by the following key technologies:
1) Ge:Ga blocked impurity band (BIB) detector,
2) fully-depleted silicon-on-insulator (FD-SOI) cryo-CMOS ROIC,
3) a thick Si support for a thin Ge detector,
and hybridization by nano-particle deposition (NpD) Au-bump. A demonstration astronomical observation by a balloon experiment is also planned.
Here we report the overview and the latest status of our project. The details of the Si-supported Ge BIB detector, the cryogenic FD-SOI CMOS ROIC, and the balloon observation with the detector will be shown by the other authors in this workshop.

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