

640x512 Pixel Narrow-Band, Four-Band, and Broad-Band Quantum Well Infrared Photodetector Focal Plane Arrays

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ABSTRACT

A 9 μm cutoff 640x512 pixel hand-held quantum well infrared photodetector (QWIP) camera has been demonstrated with excellent imagery. A noise equivalent differential temperature (NEDT) of 10.6 mK is expected at a 65K operating temperature with $f/2$ optics at a 300K background. This focal plane array has shown background limited performance (BLIP) at a 72K operating temperature with the same optics and background conditions. In this paper, we discuss the development of this very sensitive long wavelength infrared (LWIR) camera based on a GaAs/AlGaAs QWIP focal plane array and its performance in quantum efficiency, NEDT, uniformity, and operability. In the second section of this paper, we discuss the first demonstration of a monolithic spatially separated four-band 640x512 pixel QWIP focal plane array and its performance. The four spectral bands cover 4-5 μm , 8.5-10 μm , 10-12 μm , and 13-15.5 μm spectral regions with 640x128 pixels in each band. In the last section, we discuss the array performance of a 640x512 pixel broad-band (10 – 16 μm full-width at half-maximum) QWIP focal plane. Authors are grateful to C. P. Bankston, M. Bothwell, T. N. Krabach, and P. J. Grunthaler for encouragement and support during the development and optimization of QWIP FPAs at Jet Propulsion Laboratory for various applications. The research described in this abstract was performed by the Jet Propulsion Laboratory, California Institute of Technology, and was sponsored by the NASA Code R Micro & Nano Technology Program, and the NASA Code Y Advance Technology Initiative Program.

Key Words: Infrared Detectors, Quantum Well, QWIP, Intersubband Transitions, Focal Plane Arrays, long-wavelength Infrared, multi-color

Short Bio:

Sarath D. Gunapala received a BS in physics from the University of Colombo, Sri Lanka in 1980, MS and a PhD in physics from the University of Pittsburgh in 1986. He studied properties of thin films as a research associate at the Bell Communications Research from 1986 to 1988. From 1988 to 1991 he was a post doctoral member of technical staff at

AT&T Bell Laboratories where he participated in the development of quantum well infrared photodetectors for infrared imaging. He joined NASA's Jet Propulsion Laboratory at California Institute of Technology in 1992 where he is now a Senior Research Scientist and the Group Supervisor of Infrared Focal Planes & Photonics Technology group. He has authored over 150 publications, including several book chapters on quantum well infrared photodetectors.

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