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Optical Coupling mechanisms in Quantum Well Infrared Photodetectors

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Abstract:

Development of hand-held long wavelength infrared (LWIR) camera at Jet l'repulsion Laboratory demonstrates the. potential of Quantum well infrared photodetector (QWIP) technology for simplifying the design and construction of a highly sensitive infrared imaging systems. This camera utilizes 256x256 focal plane may based on optimized GaAs/AlGa As multi quantum well structure coupled with random grating reflector, Alternate light coupling system, such as grating is required because QW11'C1O not respond to normal incident light due to the quant um mechanical selection rules associated with intersubband transitions. Random reflectors have demonstrated excellent optical coupling for individual QWIPs as well as for large area focal plane arrays. However, the light coupling efficiency of the random reflector is almost independent of the wavelength due to the random nature of the reflector. Therefore, random reflect or coupled QWI P do not exhibit narrow band spectral response. Unlike random reflectors the light coupling efficiency of two dimensional (2-D) gratings strongly depend on the wavelength and thus exhibit narrow band width spectral responses. Therefore, 2-D gratings can be utilized to select narrow spectra] bands in multi color QWIP caroms. A set of 2-D grating parameters optimized forgiven spectra] band can be obtained by using the modal expansion method. The research described in Ibis paper was performed by the Center for Space. Microelect ronics Technology, Jet l'repulsion Laboratory, California Institute of Technology, and was jointly sponsored by the Ballistic Missile Defense Organization/Innovative Science and Technology Office, and the National Aeronautics and Space Administration, Office of Space Across and Technology.