

SCHOOL OF PHYSICS

UNIVERSITY OF NEW SOUTH WALES



COLLOQUIUM

4-5 p.m., Thursday, 19 November, 2009

School of Physics Common Room
Room 64, Old Main Building

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“Quantum Structures for Infrared Detection”

There are many applications that require long wavelength, large, uniform, reproducible, low cost, stable, and radiation-hard infrared (IR) focal plane arrays (FPAs). For example, the absorption lines of many gas molecules, such as ozone, water, carbon monoxide, carbon dioxide, and nitrous oxide occur in the wavelength region from 3 to 15 microns. Thus, IR imaging systems that operate in the long wavelength IR (LWIR) region (8 - 15 microns) are required in many space borne applications such as monitoring the global atmospheric temperature profiles, relative humidity profiles, cloud characteristics, and the distribution of minor constituents in the atmosphere which are being planned for future NASA Earth and planetary remote sensing systems. Due to higher radiation hardness, lower 1/f noise, and larger array size, the GaAs based Quantum Well Infrared Photodetector (QWIP) FPAs are very attractive for such space borne applications. Furthermore, we have exploited the artificial atomlike properties of epitaxially self-assembled quantum dots for the development of high operating temperature IR FPAs. Quantum dots are nanometer-scale islands that form spontaneously on a semiconductor substrate due to lattice mismatch. We have used molecular beam epitaxy technology to grow multi-layer dot-in-a-well (DWELL) devices by embedding InAs quantum dots in a InGaAs/GaAs QWIP structure. This hybrid quantum dot/quantum well device offers additional control in wavelength tuning via control of dot-size and/or quantum well size. In this presentation I will discuss the optimization of the detector design, material growth and processing that has culminated in realization of large format QWIP and QDIP FPAs, multi-band QWIP FPAs, portable and miniature LWIR cameras, holding forth great promise for myriad applications in 3-15 micron wavelength range in science, medicine, and industry.

The audience is invited to meet the speaker beforehand at 3.45 p.m. over coffee and biscuits in the Common Room.

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