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OBSERVER

Most sensitive infrared detectors developed by University researchers

By Chris Chandler

RESEARCH

Northwestern University researchers have developed a new kind of semiconductor material for infrared detectors that is far more sensitive than any made to date. The new detectors should be able to see an image of a human body in extreme detail at a distance of several miles.

The detectors are being made from a man-made material that is extremely sensitive to infrared light. The detectors are equally powerful in day or night, and one of the first applications is expected to be devices for night vision for the military.

NASA hopes to demonstrate the effectiveness of the new devices later this year by flying an infrared camera with the new devices at 3,000 feet to survey for thermal leaks from oil pipelines and power lines.

The material and the detectors were manufactured at the Center for Quantum Devices under the direction of Manijeh Razeghi, Walter P. Murphy Professor of Electrical Engineering and Computer Science.

The devices are being manufactured from a combination of materials that do not form in nature: gallium, indium, arsenic and phosphorous. Thin layers of combinations of these substances form "quantum wells" which are extremely sensitive to infrared light in two different wavelength ranges (3 to 5 micron and 8 to 12 micron) that are virtually transparent in our atmosphere. This is the first material made that is sensitive in both of these wavelengths simultaneously, making it far more sensitive and useful for imaging and night vision applications.

The new devices were described on at a meeting of the International Society for Optical Engineering by Jim Hoff, a doctoral student at the Center for Quantum Devices. The devices will also be described in a forthcoming issue of Physical Review B.

"The new detectors should exceed what we've seen so far in

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Manijeh Razeghi

Infrared

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resolution and sensitivity," said Murzy Jhabvala, Chief Engineer of the Solid State Device Development Branch at NASA's Goddard Space Flight Center in Greenbelt, Md.

Jhabvala said NASA will be cooperating with the GER Corp. of Millbrook, N.Y., to build and test an infrared camera system using these devices. They plan to do test flights at about 3,000 feet to survey for thermal leaks that might arise from industrial discharges, oil spills, pipeline leaks and underground heating systems.

The devices are called QWIPS, for Quantum Well Infrared Photodetectors. These quantum wells are made by placing extremely thin layers of Gallium Arsenide and Gallium Indium Arsenide Phosphide on top of each other in multi-layers or superlattices made up of 100 layers grown by a Metalorganic Chemical Vapor Deposition reactor capable of controlling the growth atom by atom. Each layer is only about 10 molecules thick, and because of the small size, quantum effects become pronounced, creating energy subbands within the material.

These bands can be engineered to react to signals of infrared radiation. Since all bodies at room temperature emit infrared radiation, these devices can detect infrared radiation at tremendous distances, limited only in theory by natural obstructions or the curvature of the earth.

QWIPS can create highly uniform infrared focal point arrays and therefore provide highly accurate pictures of people, cars, animals, etc. Since the radiation is in the infrared portion of the spectrum, this can be accomplished at night, in fog, or through clouds, the researchers said.