



**2D-OMA V**

The 2D-OMA V:320 from Princeton Instruments/Acton is the world's first, scientific grade 2D InGaAs camera, specifically designed for low-light IR imaging applications. The detector uses a 320 x 256 format focal plane array with 30- $\mu\text{m}$  x 30- $\mu\text{m}$  pixels and is cryogenically cooled to -100°C to reduce the thermally generated dark noise.

**2D-OMA V sets the new standard for low light level NIR imaging (<1.7  $\mu\text{m}$ ):**

- Low dark current and extended integration times.
- The camera produces 53 full frames per second by using 5 MHz readout.
- Software controlled high and low gain modes for high sensitivity or high dynamic range operation.
- On-line flat field (non-uniformity) and background correction.
- Single sapphire window in the optical path for high throughput.

| Features   | Benefits   |
|--|--|
| 320 x 256 InGaAs array   | Ideal for Imaging in NIR region  |
| 30 x 30- $\mu\text{m}$ pixels  | Good spatial resolution  |
| Response from 0.8 to 1.7 $\mu\text{m}$ with >80% peak quantum efficiency | Excellent NIR sensitivity for demanding imaging applications   |
| Cryogenic cooling  | Minimizes dark noise and allows extended integration times<br>Special "cold shield" limits the ambient background for improved contrast    |
| Software-selectable amplifiers   | Provides choice of superior sensitivity or dynamic range   |
| Electronic shutter   | Provides integration times from 1 $\mu\text{sec}$ to many minutes  |
| High frame rate  | Provides 53 frames/second with 5-MHz digitization  |
| C-mount or F-mount   | Standard lens interface compatible with numerous lenses and microscopes.<br>(Spectroscopy mount available)                                 |
| Sapphire window  | Single sapphire window in the optical path for high light throughput   |
| PCI interface  | Industry standard for fast data transfer over long distances   |
| WinView and WinSpec  | Offers powerful, easy-to-use set of Windows® GUI controls<br>Automates data acquisition, background and flat field corrections and display |
| SITK™ for National Instruments' LabVIEW™                                 | Easy integration into complex experimental setup   |
| PVCAM® Interface   | Renowned camera interface for powerful custom programming  |

Applications



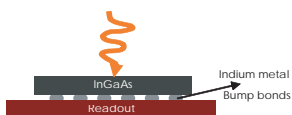
2D-OMA V

Infrared (IR) imaging is growing in its popularity due to several advantages it offers over more traditional imaging in UV-VIS region. Infrared light penetrates many materials that may absorb visible light making it a useful analytical tool. By using fluorephores that emit in NIR region (< 1.7-μm), researchers are able to achieve better contrast by suppressing the auto-fluorescence (background) in biological and chemical samples. For example, NIR emission from single walled nano tubes (SWNTs) is being studied for their potential as fluorescent tags.

Applications: Nanotube fluorescence, emission, absorption, non-destructive testing and singlet oxygen detection

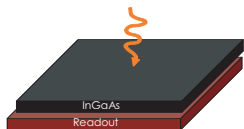
InGaAs technology for NIR detection

InGaAs material is ideally suited to NIR detection as it requires very low photon energy to produce signal (i.e., it has low band gap energy). The typical detector consists of a "slab" of InGaAs wafer bump bonded to an "external" readout circuit. The generated signal is read out via an array of row and column multiplexers (MUX). Indium simply acts as



electrical contact between the InGaAs and the

readout. Important to note is that each pixel (aka diode) has its own preamplifier which converts charge (electrons) to voltage. With 100% fill factor, InGaAs detectors are capable of >80% quantum efficiency.



Dark Current

Due to the low band gap energy, however, the dark current in InGaAs detectors is higher compared to Silicon based CCD detectors. So, it is necessary to cool the InGaAs detectors to reduce the dark current. Cooling allows extended integration times required for low light level detection. Another added advantage is that by cooling, it is possible to reduce the detector's sensitivity to unnecessary background in the far IR region, and thus use it for temperature "tuning".

Data Corrections

Since the InGaAs FPAs use separate preamplifiers for each pixel, it exhibits fixed pattern noise (FPN) commonly not found in the CCD detectors. FPN is also reduced with cooling. By employing background and flat

field corrections, this can be eliminated for quantitative measurements.

The Future of NIR Imaging

As mentioned earlier, NIR imaging has several advantages over the imaging in UV-visible region. As a result researchers around the world are using NIR imaging techniques to study biological and chemical phenomenon.

