Infrared Imaging and Laser Sensing

www.attolloengineering.com

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Starting a company – our path

- Gov’t funding is a pathway to getting funding without dilution of equity
  - Offered through DOE, NSF, DoD, NOAA, etc.
  - Small Business Innovative Research (SBIR)
    - Phase I - ~$150K for 6-9 months => fast sprint to show feasibility
    - Phase II - ~ $1M for 2 years => more methodical, develop product
  - Phase III - > $3M
    - Much harder to obtain these, but you get the same rights as earlier SBIRs
    - Allow you to bring a product through manufacturing
  - Straight government programs
    - Higher dollars, but very strict on deliverables
    - Compete against large companies, must have an inside track
Company Details and Heritage

- Attollo was founded in 2012 in Camarillo with the purpose of developing IR technologies and sensors primarily for emitting and imaging.
- Principals previously founded and led Aerius Photonics in Ventura (sold to FLIR in 2011), where they built the company into a leading supplier of several IR technologies.
- Company growth – located in the infrared corridor:
  - 21,000 square foot facility
  - 2500 square feet of clean room
  - 28 employees – expected to hire an additional 5 in the next year
- AS9100 Certified Manufacturer – March 2019
Infrared Spectrum

- MWIR and LWIR are considered thermal bands
Attollo Vision

Focus on technologies at the intersection of IR imaging and lasers

Product Emphasis

- IR Imagers
  - SWIR
  - MWIR IDCA
  - CoreCam
  - IR Imagery

- Laser Sensing
  - WASP LRF
  - LIDAR Transmitter
Material Systems for Detectors

- Optical band and substrates determine the desired material
- We focus on III-V epitaxially-grown materials
Tunable III-V Material: SLS
Strained Layer Superlattice

- InAs limited to band edge at 3.5 um
- Superlattice is a repeating crystalline superstructure used to create new band effects (i.e. like QWs)
- Generally grown using MBE

10/10/2019
Tunable band structure

- Just like QWs, we can adjust the wavelength by changing the thickness of the constituent layers.
- Staggered band give us more flexibility.

<table>
<thead>
<tr>
<th>Superlattice Characteristic</th>
<th>Advantage</th>
<th>Tangible Benefit to FPAs</th>
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</thead>
<tbody>
<tr>
<td>Band structure engineering</td>
<td>Suppress Auger related dark current</td>
<td>Higher operating temperature</td>
</tr>
<tr>
<td>Large electron effective mass</td>
<td>Smaller leakage currents</td>
<td>Higher detectivity</td>
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<tr>
<td>Interband transitions</td>
<td>Normal incidence absorption</td>
<td>High quantum efficiency (fast arrays)</td>
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<tr>
<td>Adjustable bandgap</td>
<td>Tunable cutoff from 3 to 20μm</td>
<td>Multicolor capability</td>
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<tr>
<td>III-V semiconductor based</td>
<td>Highly uniform</td>
<td>Cheap, robust, uniform</td>
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Laser Sensing and LIDAR

- Time of flight sensing – to understand distance precisely in real time
  - Drones as an altimeter or to map to 1 cm resolution or <10cm accuracy
  - Collision avoidance on airborne or land vehicles

1 ft = 1 ns
Laser Rangefinders

- Applications include:
  - Drone/UAV height sensing
  - Precise mapping and treatment at the plant level
LIDAR Systems

- Automotive – driverless car or driver assist with three dimensional awareness using LIDAR – our Attollo designed and manufactured InGaAs detectors
- Currently working as a tier two provider of components
- High signal to noise detectors
Laser Arrays for LIDAR

- 64 beams to get wide swath
- Can rotate or dither beams to view other axis

LIDAR System

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Product Offerings

• IR Imagers
  o SWIR, MWIR, and LWIR sensors
  o Packaged sensors
  o IR Cameras

• Laser Sensing
  o Laser rangefinder (Wasp 200)
  o Laser warning system
  o LADAR receivers (High SNR detectors)

• Integrated
  o Laser triggered, SWIR Imagers
The Team Responsible for this
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