

Outline of the Short Course on High Performance Visible and Infrared Focal Plane Arrays

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Part 1:

- The Value of Imaging in Different Wavelengths
- General Explanation of Imaging Systems
- Photon Wavelengths, Passbands, and Energies
- The Six Steps of Optical / Infrared Light Detection
 1. Getting light into the detector
 - Anti-reflection coatings
 - Indices of refraction of silicon, hafnium dioxide, and HgCdTe
 - Linear variable anti-reflection coatings
 2. Charge Generation
 - Crystal lattices
 - Silicon, HgCdTe, InGaAs, InSb, Type 2 Superlattices
 - HgCdTe cutoff wavelength
 - Absorption Depth of Light in HgCdTe and Silicon
 - Ways to grow HgCdTe crystal lattices
 - Hybrid CMOS architecture and manufacturing process
 - HgCdTe substrate removal
 - Thermal radiation
 - Detector dark current as function of temperature
 3. Charge collection
 - p-n junctions to collect photocharge in pixels

Part 2:

4. Charge Transfer (for CCDs) / Voltage transfer (for CMOS)
 5. Charge-to-voltage conversion
 - MOSFET principles
 - Noise reduction by “sampling-up-the-ramp”
 - Hybrid pixel amplifier types
 6. Digitization
- General architecture of CMOS-based image sensors
 - Focal-plane arrays for a space environment
 - Space radiation
 - Packaging of infrared FPAs
 - Teledyne’s Infrared FPA Products - Applications
 - HxRG FPA Family
 - IR astrophysics missions (JWST, Euclid, RST, NEO Surveyor, SPHEREx)
 - ESO Extremely Large Telescope
 - GeoSnap-18
 - GeoSnap-10
 - CHROMA-A
 - Digital scanners
 - HyViSI (Hybrid Visible Silicon Imager)