TEXAS
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Novel III-V materials for optoelectronic devices

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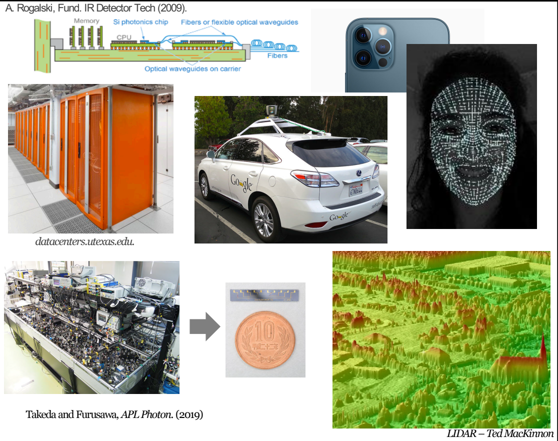
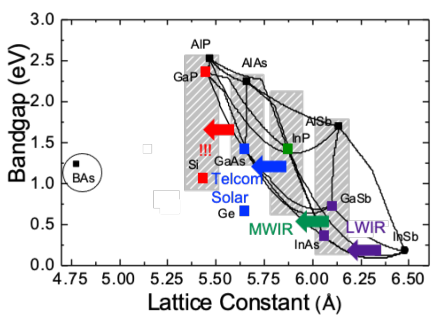
LASE
Laboratory for Advanced Semiconductor Epitaxy

Motivation



Monolithic integration of direct bandgap III-V on Si limited by large lattice-mismatch

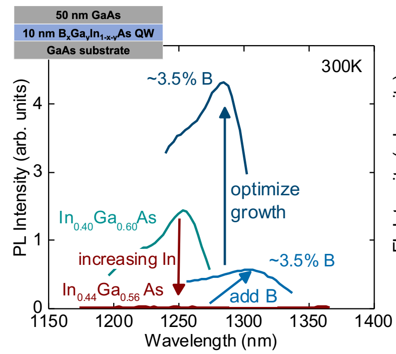
- B-III-V alloys underexplored, challenging synthesis

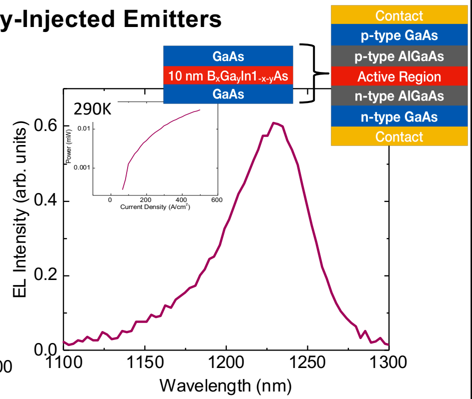


- B-III-V alloys increase substrate-choice flexibility for a wide-range of applications

B-III-V Optoelectronic Devices

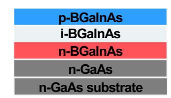
Electrically-Injected Emitters





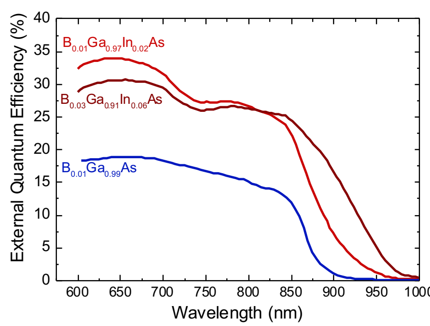
- Boron reduces strain → improved optical quality and wavelength extension
- Increase PL intensity of BGaInAs QW by 10x with optimized MBE growth

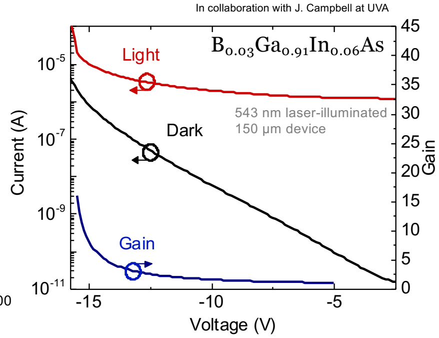
Photodiodes



- Near-infrared active regions lattice-matched to GaAs
- Potential for all-BGaInAs avalanche photodiodes (APD)

In collaboration with J. Campbell at UVA

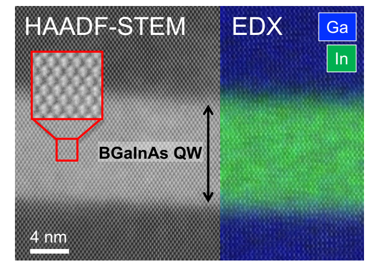




Future Work

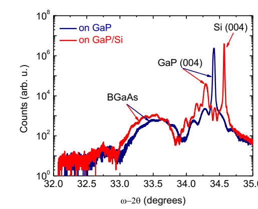
Demonstrate telecom-range B-III-V active-region lasers and photodetectors on Si, GaAs for LIDAR & quantum info processing

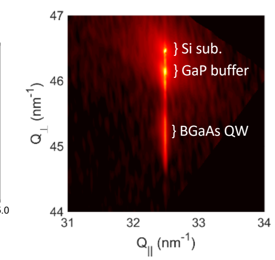
- Growth is more challenging as alloy becomes highly-mismatched



In collaboration with M.L. Lee at UIUC

- Addition of In to BGaAs QWs increases available bandgaps on Si





McNicholas *UT Austin Thesis* (2019)

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