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# Synthesis of and Emission from Nanostructures: Understanding and Control

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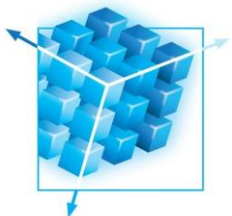


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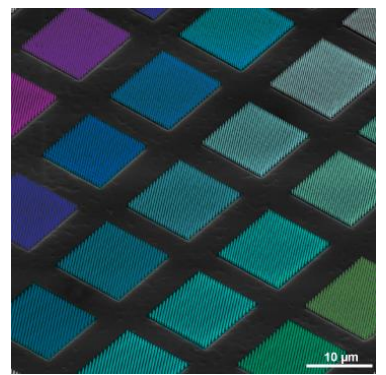
# Why nanostructured emitters?

- **Access to/control of crystal facets w/ desirable properties**
  - Facet polarities (reduced QCSE); strain-accommodation; defect reduction; In-uptake; emission efficiency; enhanced emission area
- **Control/enable new functionalities in light emission**
  - Light extraction; laser facets; polarization/index control; quantum dots; photonic crystals; collective emitters; metamaterials
- **Growth on foreign substrates**
- **InGaN family can potentially span the visible spectrum**
- **Variety of synthesis approaches available**
  - MBE; catalytic (VLS); MOCVD (selective-area growth); HVPE; pulsed growth; top-down etching; and combinations of these...

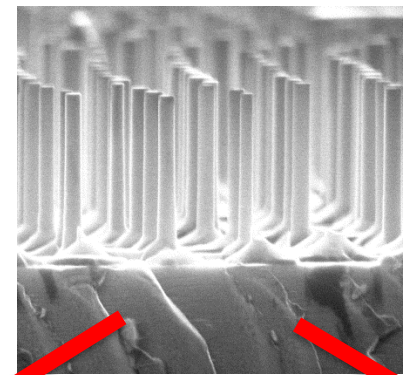


# Nanoscale syntheses enabled architectures to study unique emission processes

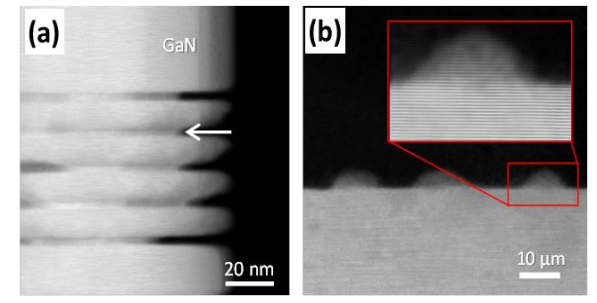
Ph-Xtal array (60nm  $\Delta\lambda$ )



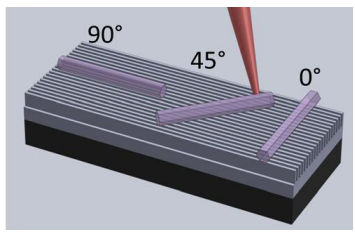
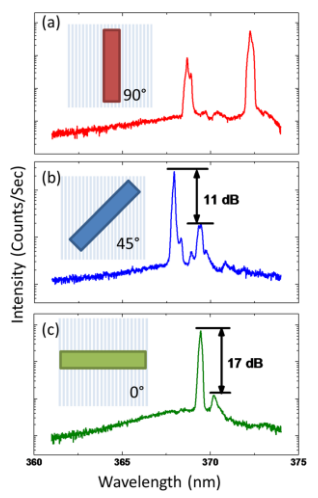
Top-down creation of uniform NW arrays



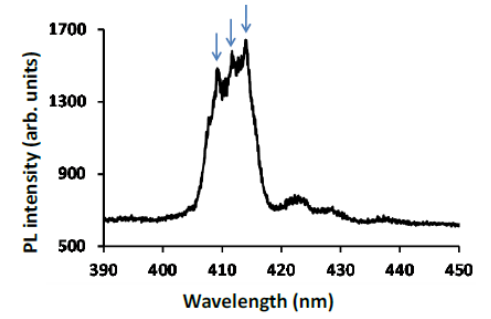
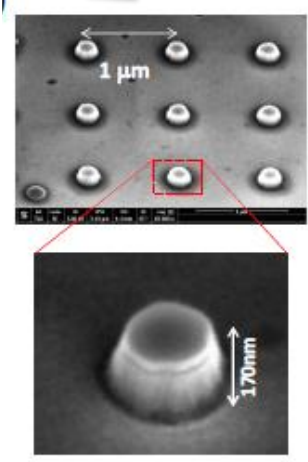
Self-limiting PEC etching (size-selective QD synthesis)



Manipulate NW-laser emission via coupling to a grating



Deterministic array of QD emitters





# Synergistic goals and approaches

- Tools and analysis with roots in basic science can provide guidance and a basis for understanding in a technology-development environment
- Rapid pace of development, precision, and massive experimental databases can provide rigorous tests of scientific understanding
- Opportunities exist for fertilization and breakthroughs across the traditional EERE and BES “boundaries”

