

# Novel nanostructure fabrication for high quality III-V semiconductor epitaxy

## Background & Motivation

The performance of optoelectronic devices—such as light-emitting diodes, laser diodes, and photodetectors—critically depends on the structural quality of the III-V semiconductor materials used in their active layers. High crystalline perfection is essential to achieve superior electrical and optical performance. One promising approach to achieve such high crystal quality is through coalescence overgrowth on nanostructures. These nanostructured surfaces can effectively relieve strain and enable the epitaxial growth of III-V materials with minimized dislocations.

## Objective

This project aims to develop and optimize nanostructure fabrication on GaN substrates to support high-quality epitaxial growth of III-V semiconductors. The work will focus both the fabrication of nanostructure with controlled dimension and their morphological characterization.

## Methodology

The project will involve the design and implementation of nanostructure fabrication processes including:

- Metal deposition and thermal annealing for self-assembled nanostructure formation
- Plasma etching and wet chemical etching for structuring
- Surface morphology characterization using scanning electron microscopy
- Image analysis through Python-based tools

## Expected Outcomes

- Development of reproducible processes for nanostructure fabrication on GaN substrate
- Achieving controlled nanostructure sizes and morphologies suitable for III-V epitaxial growth

## Student's Role and Responsibilities

- Nanostructure design and fabrication
- Structural characterization by scanning electron microscope
- Data analysis and planning of experiments
- Master thesis writing

## Skills & Requirements

- Background in materials science, physics, or a related field.
- Experience with nanostructure processing and device fabrication is advantageous

## Opportunities and Benefits

- Modern laboratories with a wide range of experimental techniques
- International and culturally diverse community
- Supportive environment with experts for various scientific sub-fields
- Financial support

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For further details or clarification, please feel free to contact us. Lab tours are available for interested applicants.