Physics Final Year Projects 2017

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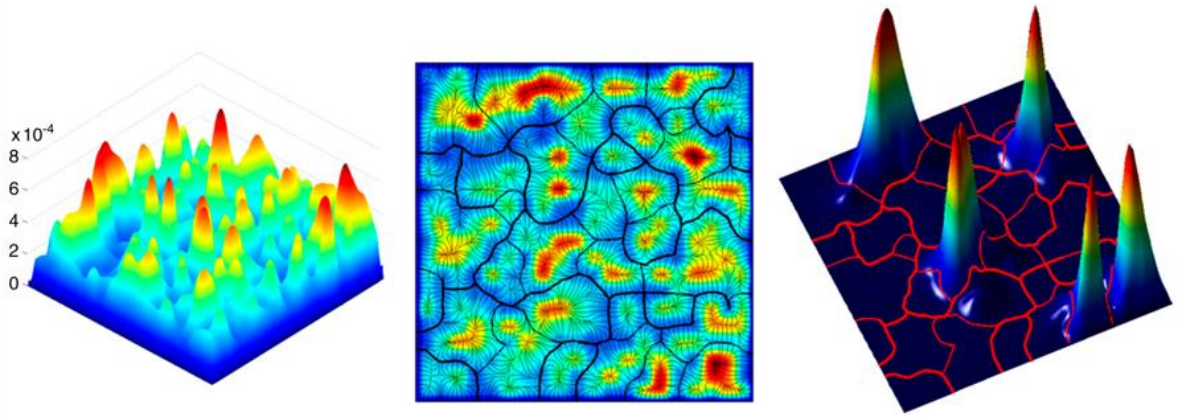
Project I: Modelling of localization effects

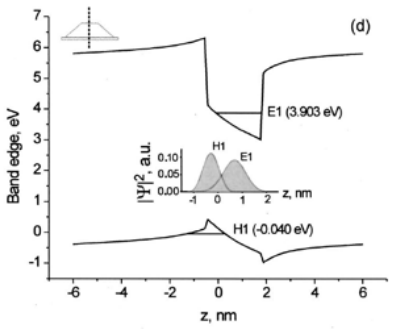


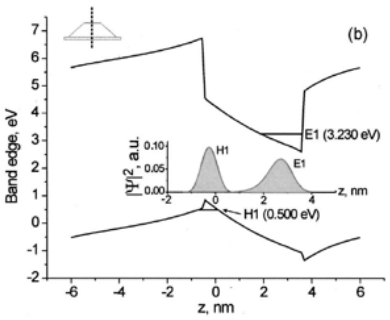
By solving **Hu = 1** with **u = 0** on boundaries (or **$H^2u = 1$**) can create an effective localization potential $W = u^{-1}$ (or $W = u^{-2}$), which correlates very well with calculated eigenstates.

- **How accurate is this approach?** **(6-week)**
- **Can it be modified to treat real systems?**
- **What does it tell us about InGaN?** **(12-week)**

Project 2: Built-in Electric Fields in GaN heterostructures

(12-week)





Problems of group-III nitrides:

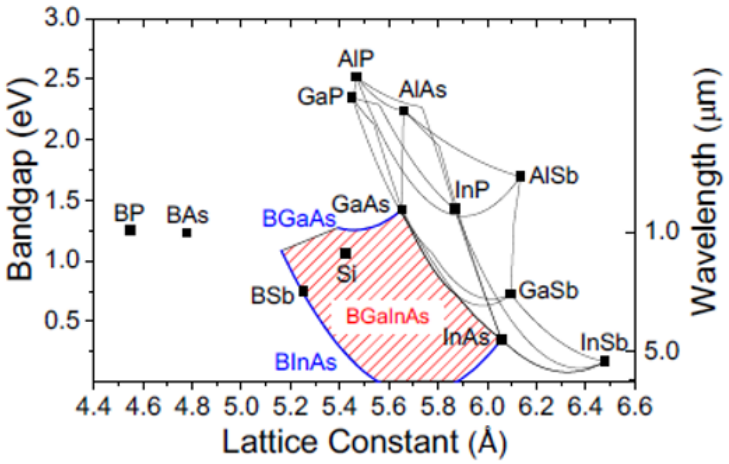
- Lack of suitable substrates
  ⇒ Defects
- Strong built-in fields
  ⇒ Enhanced radiative lifetimes

"Green gap" problem: dramatic efficiency drop at longer wavelength

- higher In composition
- wider well width

- **Control of optical properties: control of electronic structure and built-in fields required**
- **Given excellent models of 1st and 2nd order piezoelectric response, can we identify "winning" quantum well or dot structures?**

Project 3: Boron-containing Alloys



- Challenge to grow direct-gap semiconductors on Si
- Collaborators motivated by potential benefits of BGaAs and BGaP for growth of direct-gap III-V semiconductors on Si.

(12-week)

- **How does band structure of BAs and BP compare with GaAs and GaP? (DFT – density functional theory calculations)**
- **How does band structure evolve as B replaces Ga in GaAs and GaP? (DFT + other possible methods)**