

A new type of vacancy-induced localized states in multilayer graphene

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(Acknowledgments: F. Guinea, A. Cortijo, and J.M.B. Lopes dos Santos)

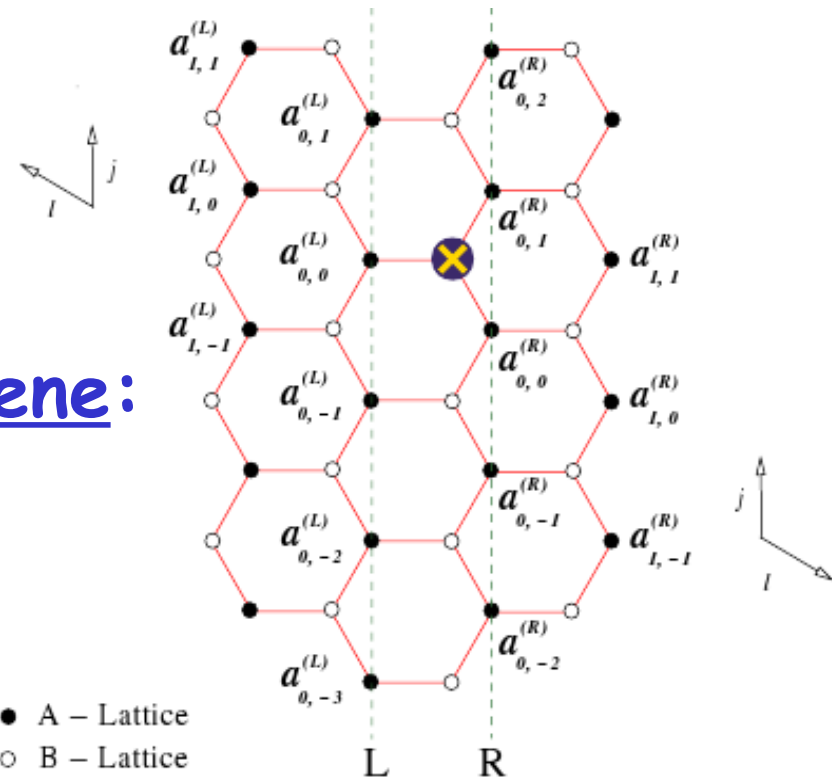
Motivation:

- Vacancies \rightarrow midgap states
- True in *1-layer* graphene
- What about *n-layer* graphene?

Vacancies in monolayer graphene:

Pereira *et al.*, PRL **96**, 036801 (2006)

- Zero-energy states
- Quasi-localized ($\sim 1/r$ decay)



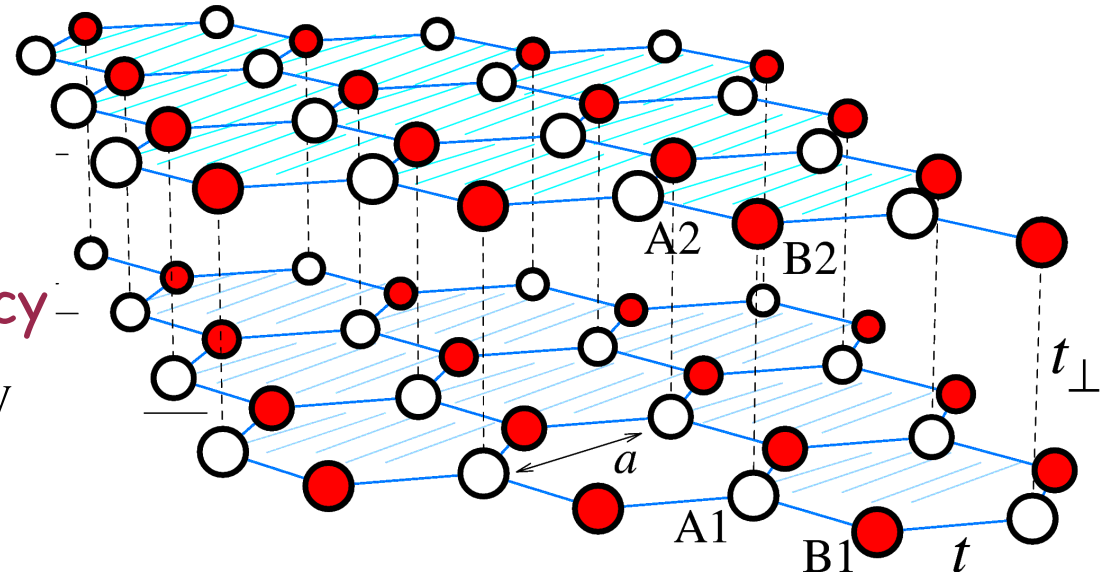
Vacancies in bilayer graphene

A1 / B2 vacancies:

- Zero-energy mode
- Lives in **layer with vacancy**
- **Quasi-localized**: $1/r$ decay

B1 / A2 vacancies:

- Zero-energy mode
- Lives in **both layers**
- **Delocalized state**
 - *Quasi-localized in layer with vacancy*
 - *Completely delocalized in opposite layer*

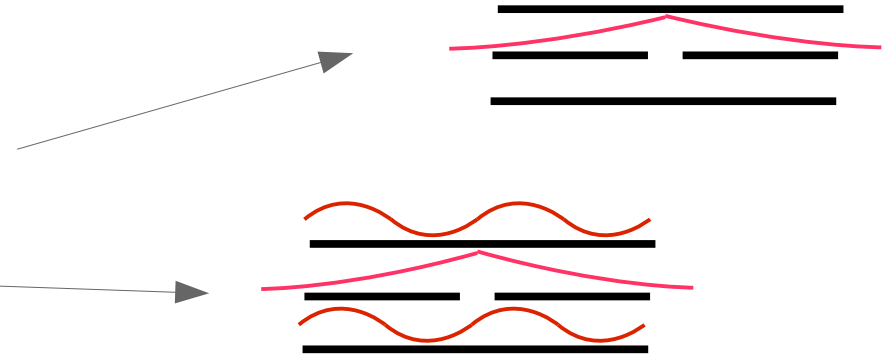


(minimal model)

Extensions

Multilayer:

- A1 / B2 → Quasi-localized ($1/r$)
- B1 / A2 → Delocalized



Finite γ_3 :

- Solution is robust

Biased (gapped) bilayer:

- A1 / B2 (Quasi-localized) → Delocalized
- B1 / A2 (Delocalized) → Truly localized

