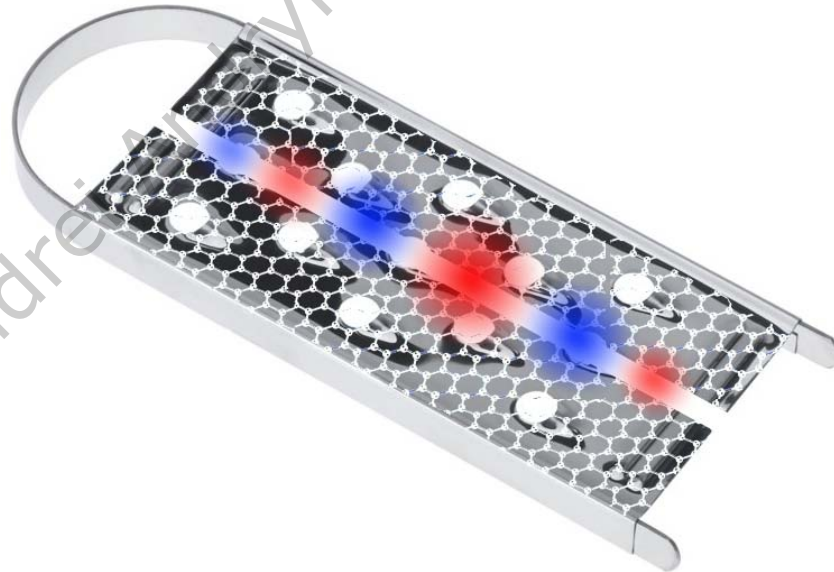


Graphene Based Terahertz Waveguide and Modulator (GraTer)

Andrei Andryieuski, Metamaterials @ Fotonik

GraTer



Outline

- Official information
- Motivation
- Project steps
- Possible applications
- Collaboration

Andrei Andryieuski @ DTU Fotonik

Official information

- FTP personal postdoc grant
- 2.95 mio. DKK
- 3 years (2012-2014)

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Project goal

□ Goal:

- Simulate and design
- Fabricate
- Characterize

Graphene

- Waveguide
- Modulator
- Antenna

For THz radiation (0.1-10 THz)

Motivation

□ Why THz:

- Security
- Spectroscopy and food control
- Biomedical apps
- Wireless communication
- Information processing

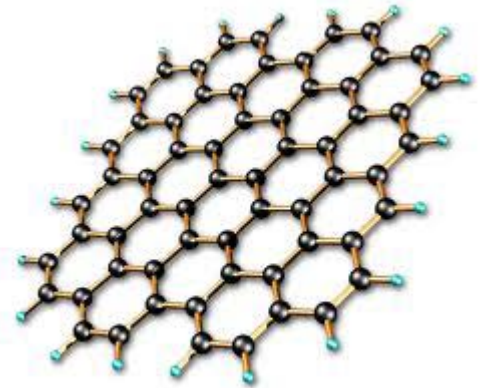
□ Needed

- Waveguides
- Modulators
- Antennas
- Sources, detectors etc.

Motivation

□ Why graphene:

- Ultrathin (1 atom)
- Quickly tunable properties (up to 100 GHz?)
- THz plasmons:
 - Strong confinement
 - Effective index $n=10-100$
 - Reasonable propagation length

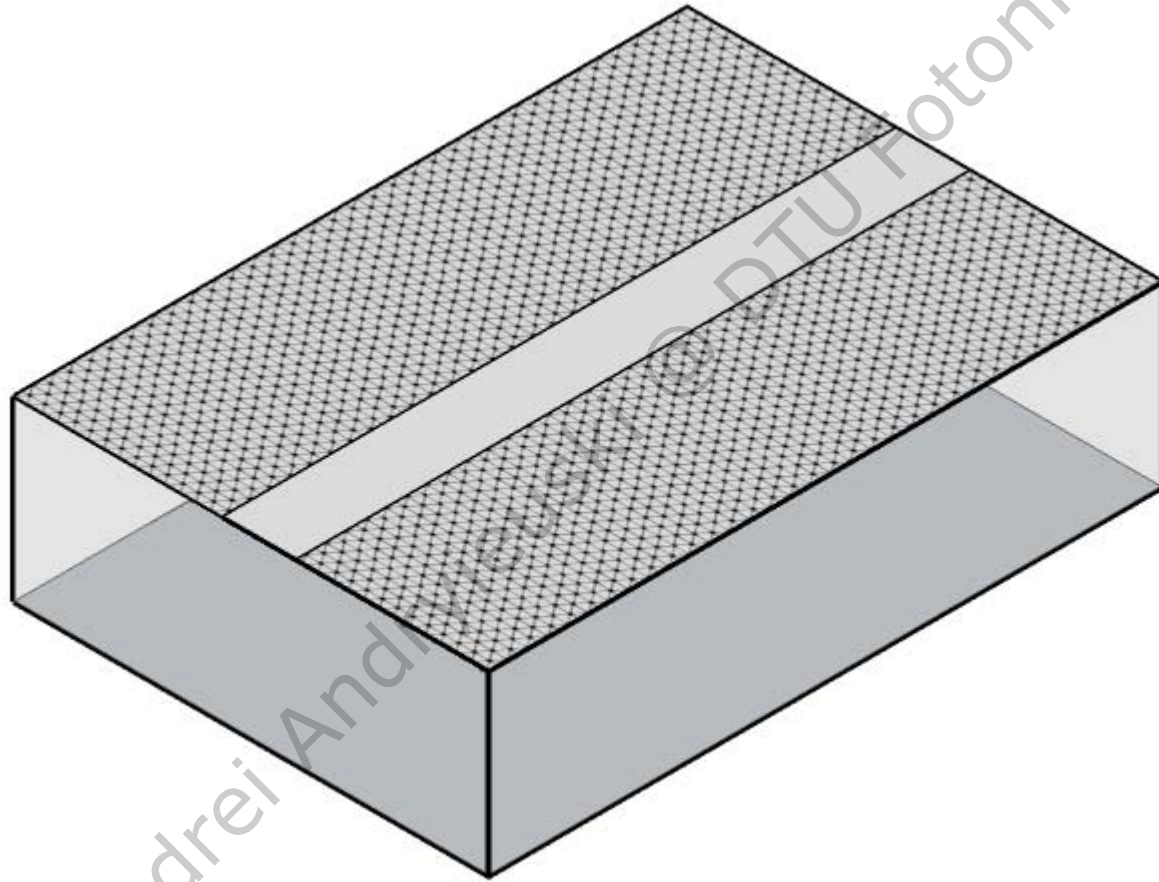


Research steps

- 1. Waveguide
- 2. Modulator
- 3. Antenna

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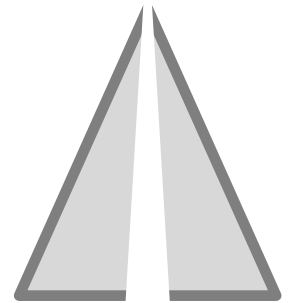
1. Waveguide



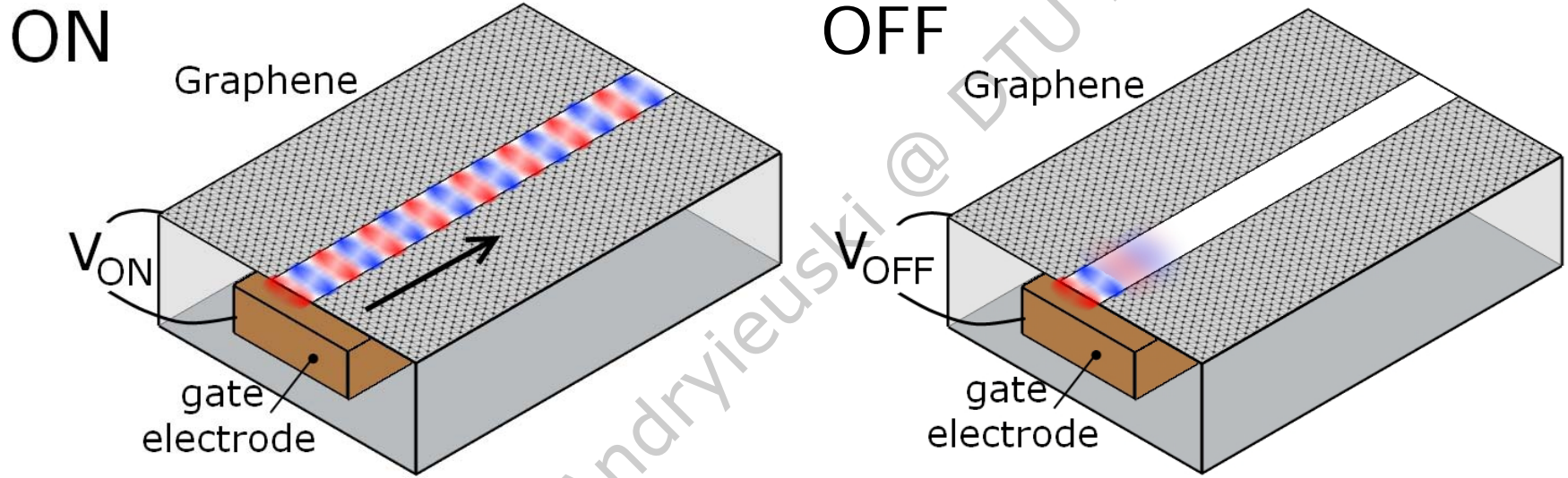
1. Waveguide

Plasmonic slot waveguide

- Analyse different types of waveguides
 - CST, ComSol
- Fabricate on SOI, SiO₂ wafers
 - Patterning?
- Characterize
 - Tapered parallel plate waveguide?
- Fabricate on polymer substrate
- Characterize



2. Modulator



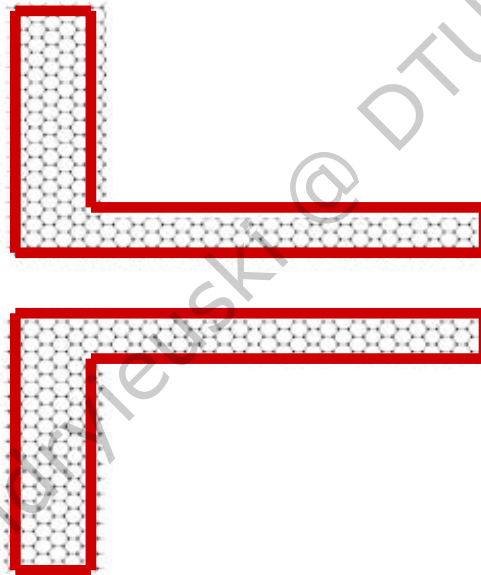
2. Modulator

Add gate electrode to the waveguide

- Design
- Fabricate
 - Gate?
- Characterize

Andrei Andryieuski @ DTU Photonics

3. Antenna



3. Antenna

Antennas

- Design
- Fabricate
- Characterize
 - Wireless transmission

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Possible applications

- Waveguide
 - THz endoscope
- Waveguide + Modulator
 - THz photonic circuit
- Waveguide + Modulator + Antenna
 - THz wireless communication system

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Collaboration

□ Simulation

- Metamaterials and SEM @ Fotonik
- D. Chigrin @ Uni Wuppertal
- K. Thygesen's group @ Fysik

□ Graphene fabrication

- @ Danchip
- P. Bøggild's group @ Nanotech
- A. Grigorenko @ Uni Manchester

□ Raman characterization

- A. Boisen's group @ Nanotech

Collaboration

- THz measurements
 - P.U. Jepsen's group @ Fotonik
- Modulator characterization
 - L.K. Oxenløwe's group @ Fotonik
- Antenna design
 - O. Breinbjerg's group @ Elektro
- Antenna characterization
 - I.T. Monroy's group @ Fotonik

Thank you for your attention and
hope for fruitful collaboration!

GraTer

