Selected Topics in Advanced Optics

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Week 1 – part 1

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Selected Topics in Advanced Optics – Overview

- Objectives:
  - Selected topics in modern photonics
  - Polish the basics and emphasize some of the fundamental concepts.
- Course book: B.E.A. Saleh and M.C. Teich, Fundamental of photonics, 2nd Ed. (Wiley, Hoboken, 2007); can be read on-line via Moodle or the 1st edition downloaded via Moodle.
- Exercises:
  - Numerical experiments
  - Jupyter notebooks in python
  - Correction available in the notebooks
  - Interact with the teaching assistant
  - Bonus question for the exam!

Selected Topics in Advanced Optics – Overview

9 Sept.	Introduction	
& 16 Sept.	Ray optics, wave optics	Chapter 1, 2
	Electromagnetic optics	Chapter 5
	Polarization optics	Chapter 6
23 Sept.	Material properties and optical constants	
30 Sept.	Light scattering	
7 Oct.	Optics of metals & plasmonics	
14 Oct.	Optics of metals & plasmonics	
21 Oct.	Holiday!	
28 Oct.	Optics of metals & plasmonics	
4 Nov.	Gratings, stratified media & photonic crystals	
11 Nov.	Gratings, stratified media & photonic crystals	
18 Nov.	Gratings, stratified media & photonic crystals	
25 Nov.	Metamaterials and metasurfaces	
2 Dec.	Metamaterials and metasurfaces	
9 Dec.	Metamaterials and metasurfaces	
16 Dec.	Lab tour	

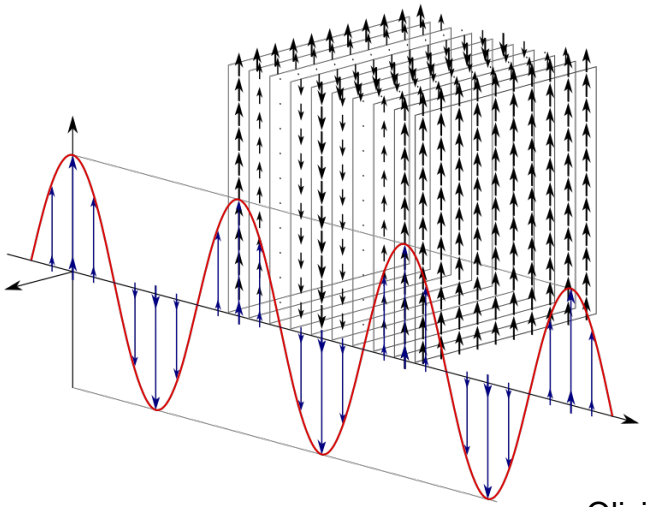
Selected Topics in Advanced Optics – Overview

- Best way to succeed:
  - Interact as much as you can during the class… or on Ed Discussion
  - Take notes
  - Make the exercises and discuss with the teaching assistant
- Videos are available on Moodle, they correspond to a large extent to the current class
- Examination:
  - Oral examination (20min preparation, 20min examination)
  - One of the course topics chosen at random
  - All material available for the preparation time.

Selected Topics in Advanced Optics – Content

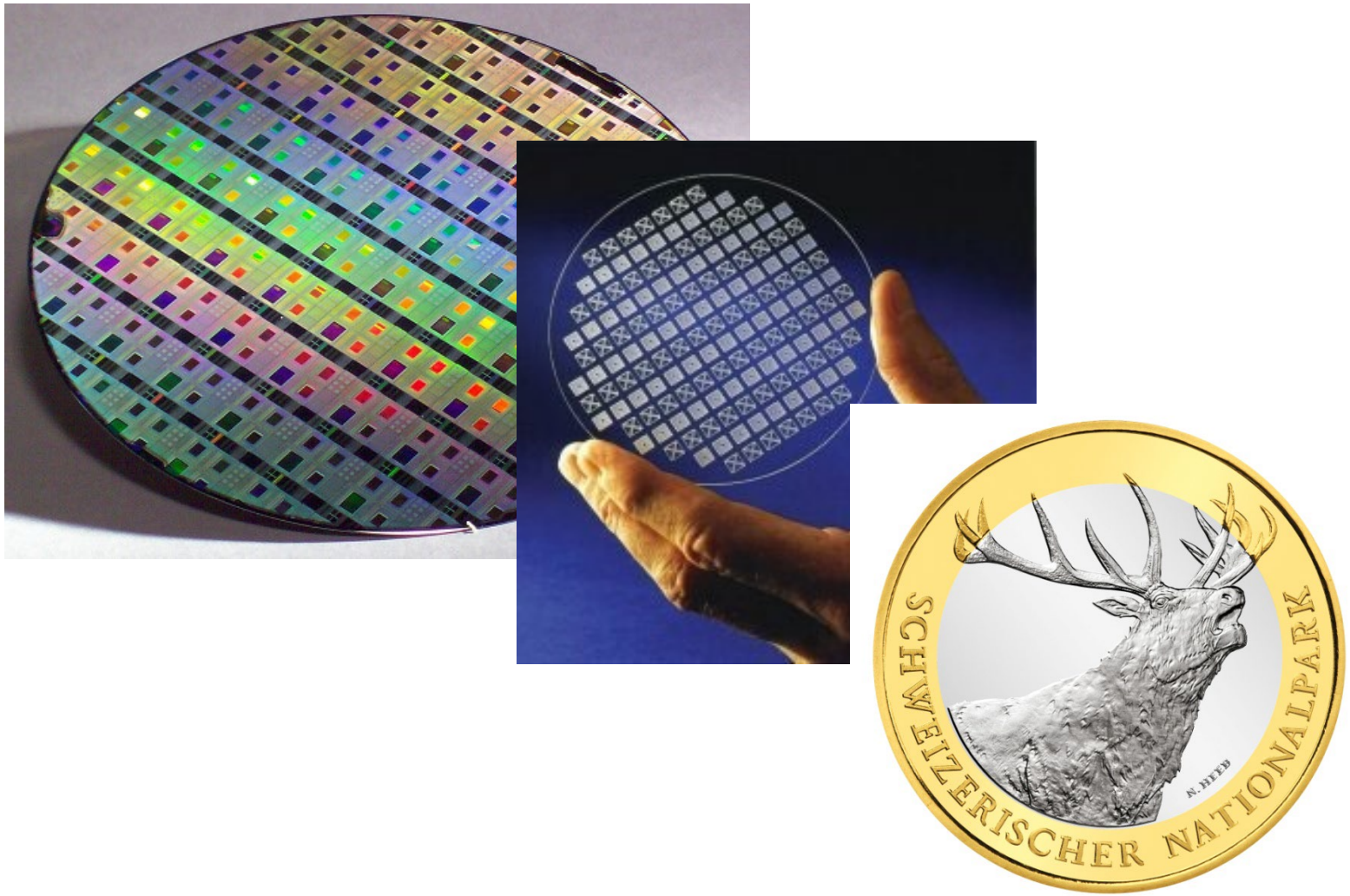
- Introduction – All what we should know about basic optics

James Clerk Maxwell
(1831-1879)



Selected Topics in Advanced Optics – Content

- Material properties and optical constants

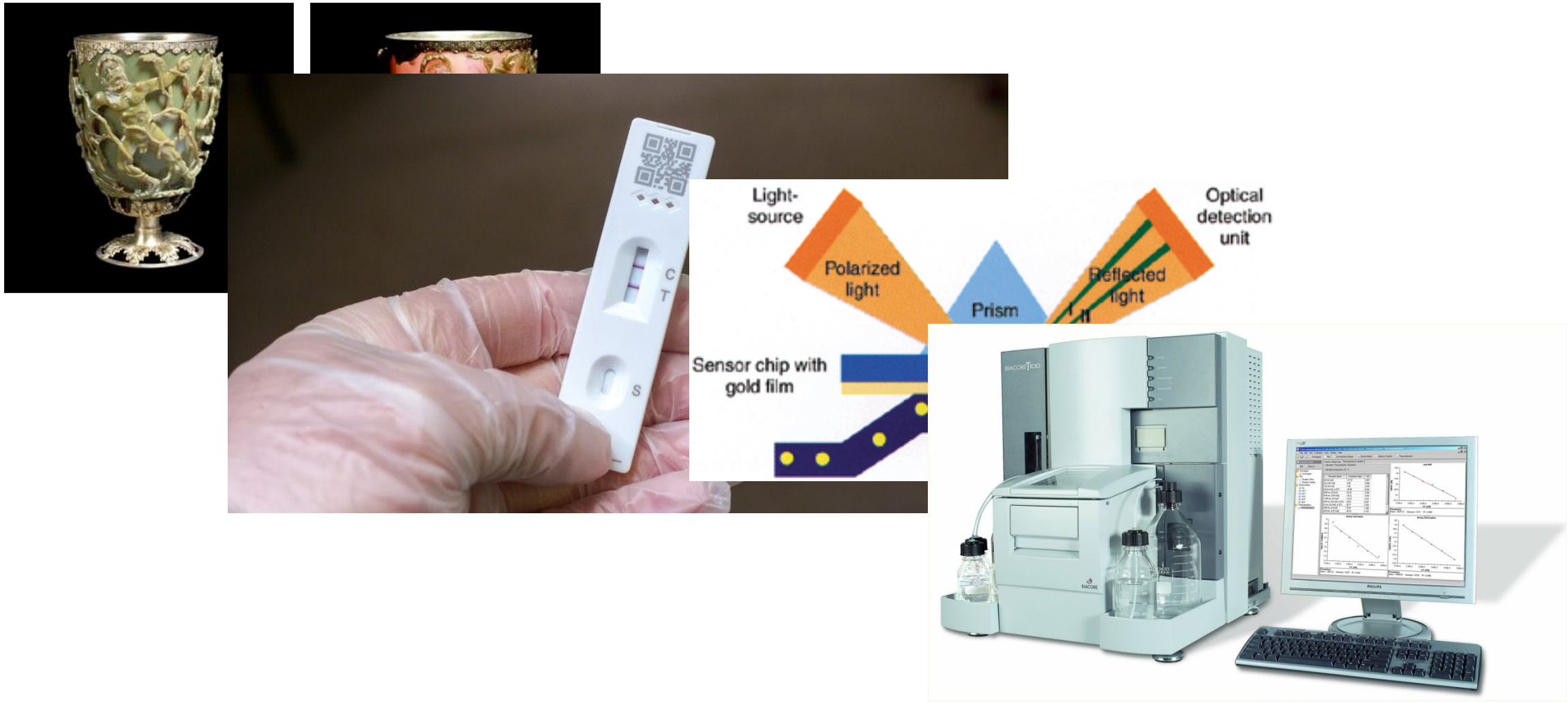


Selected Topics in Advanced Optics – Content

- Light scattering

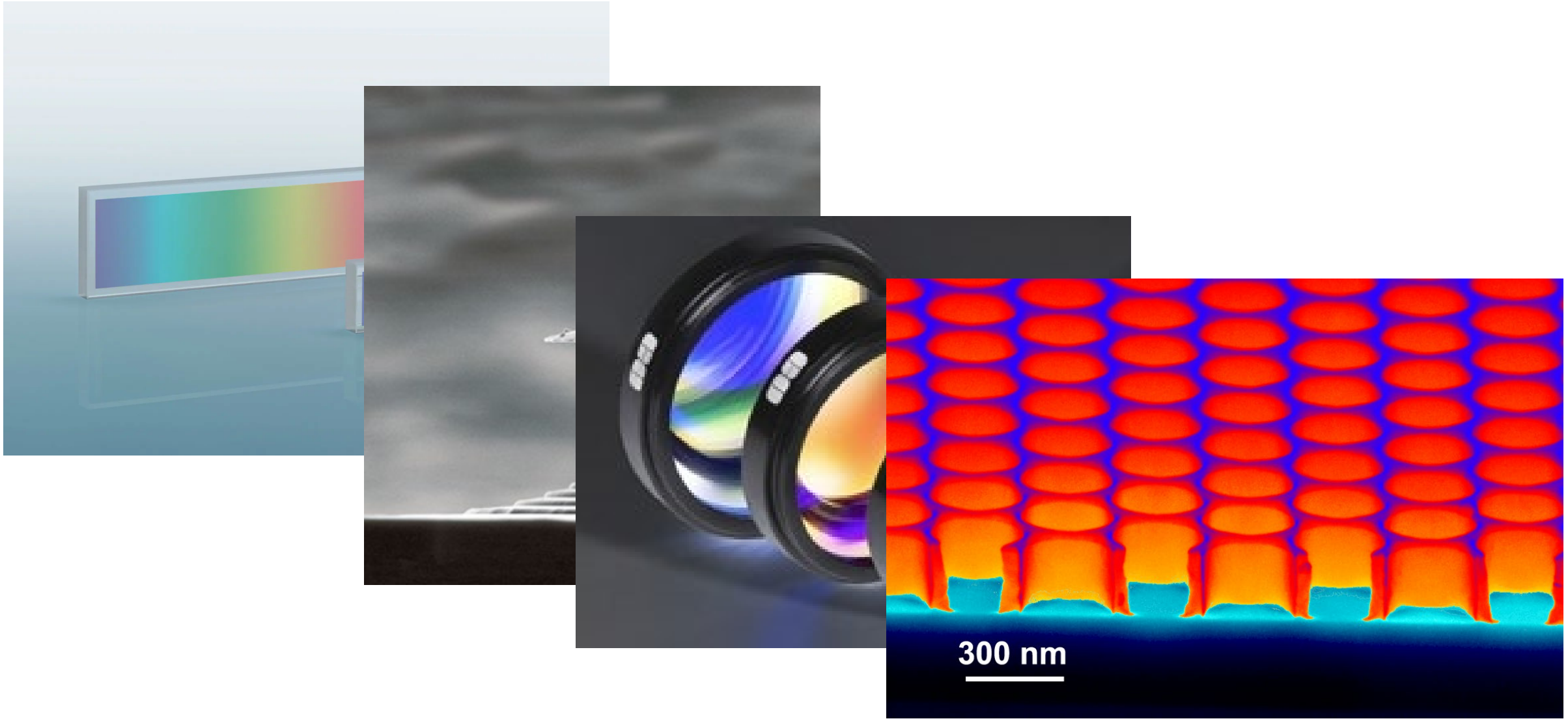
Selected Topics in Advanced Optics – Content

- Optics of metals, plasmonics



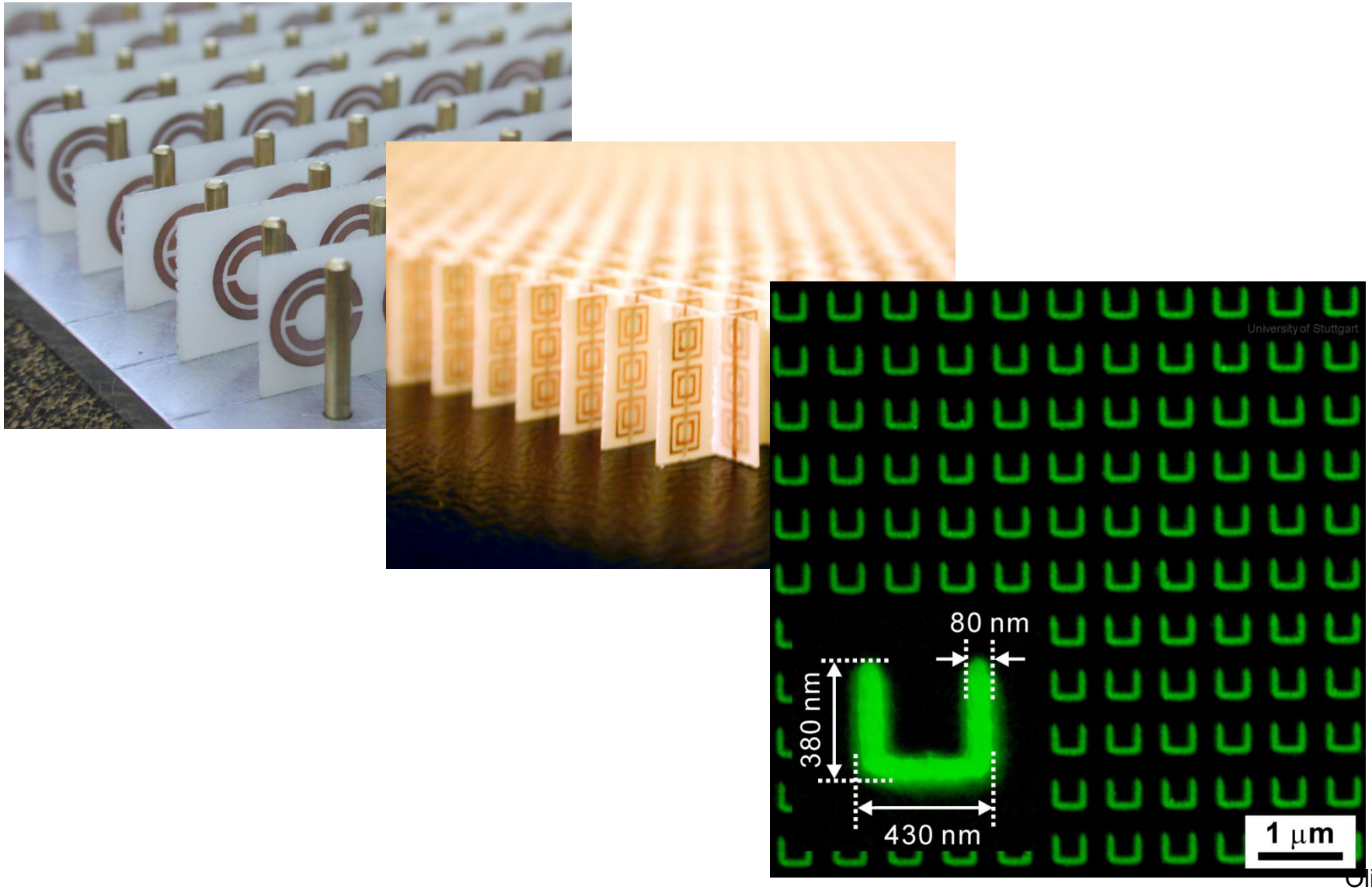
Advanced Optics – Content

- Gratings, stratified media & photonic crystals



Selected Topics in Advanced Optics – Content

- Metamaterials and metasurfaces



Selected Topics in Advanced Optics – Content

- Metamaterials and metasurfaces

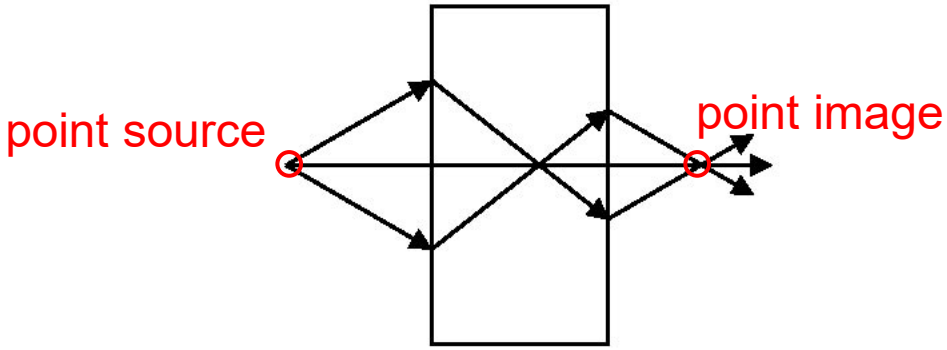
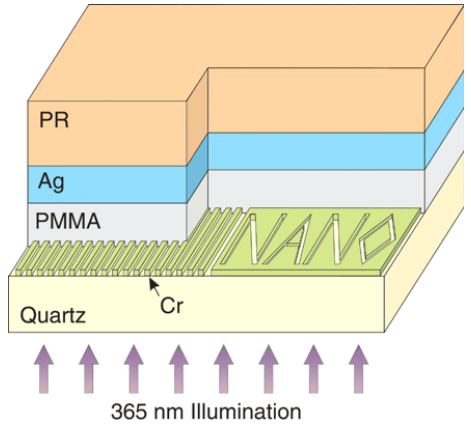
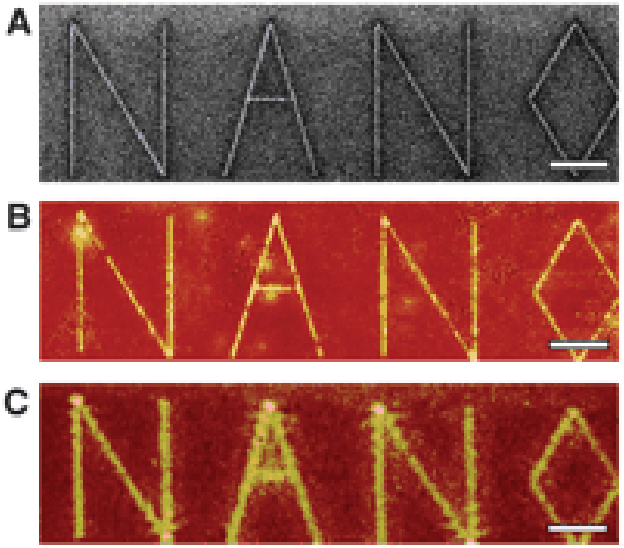
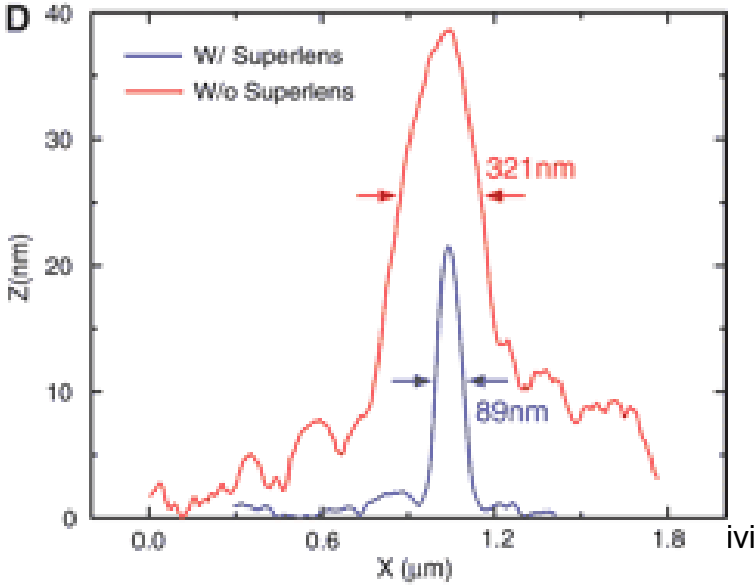


FIG. 1. A negative refractive index medium bends light to a negative angle with the surface normal. Light formerly diverging from a point source is set in reverse and converges back to a point. Released from the medium the light reaches a focus for a second time.







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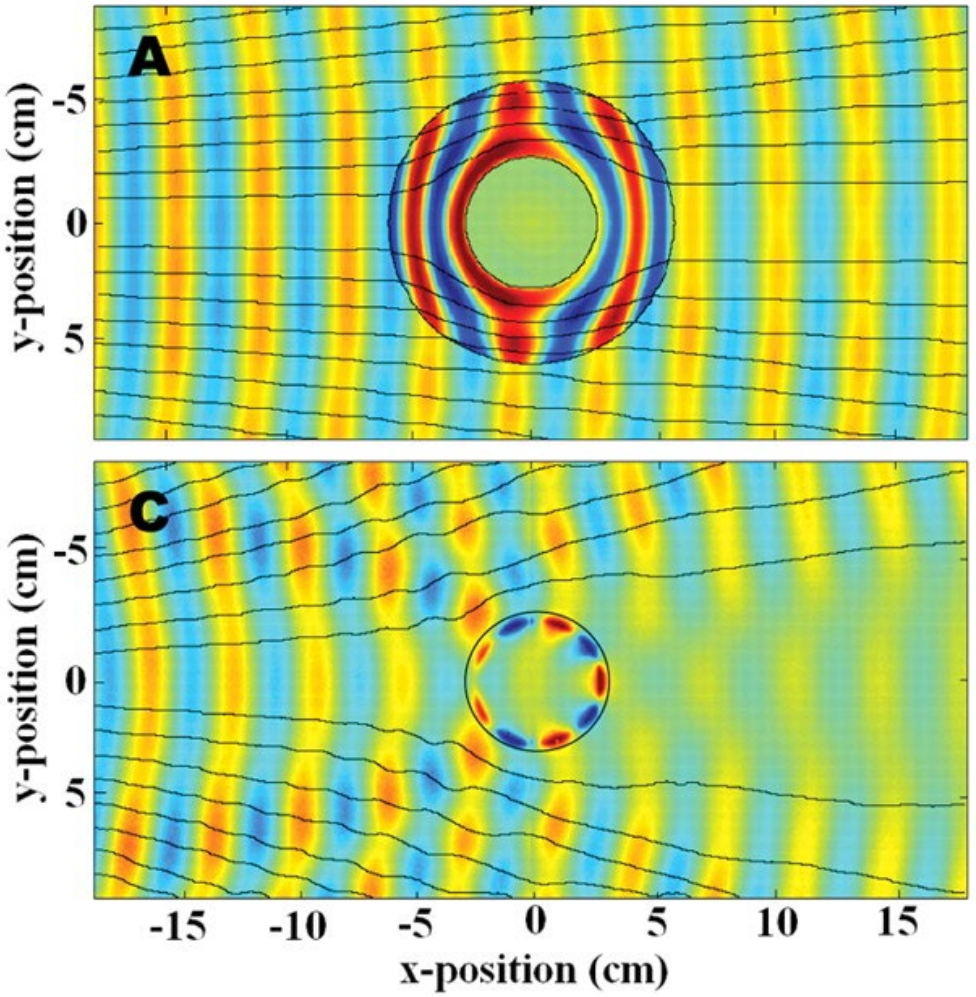
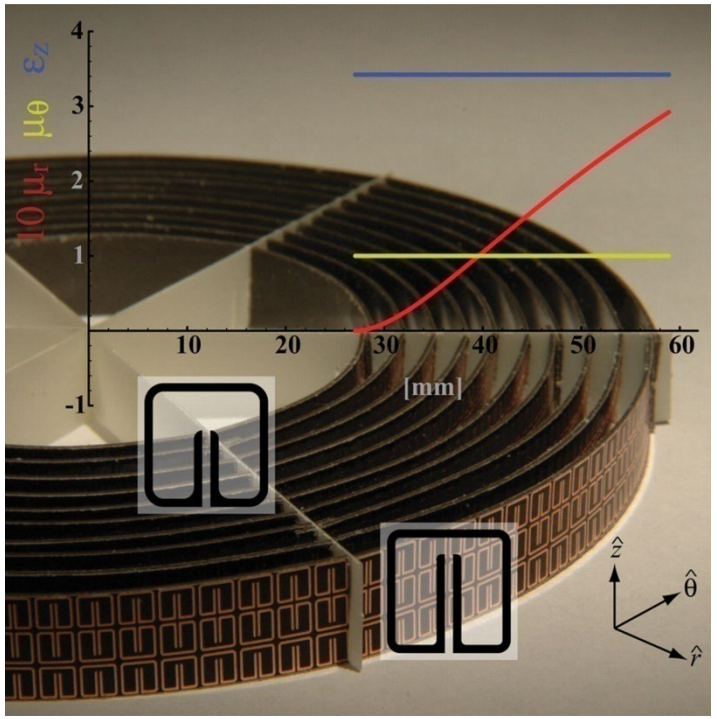
Selected Topics in Advanced Optics – Content

- Metamaterials and metasurfaces





Selected Topics in Advanced Optics – Content

- Metamaterials and metasurfaces