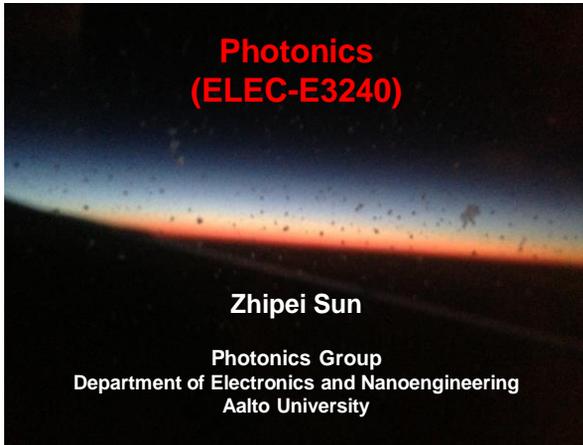


Syllabus

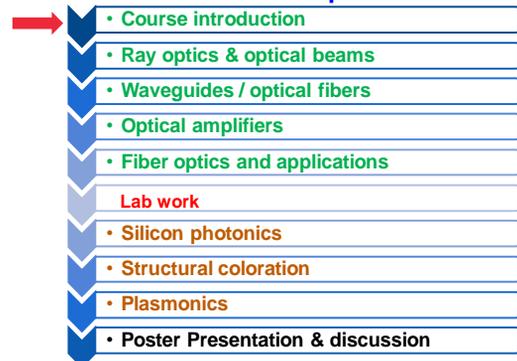
- **Introduction.** Overview of the course & photonics.
- **Theory of optical waveguides.** Ray theory of the slab waveguide, electromagnetic theory of waveguides, TE and TM modes, planar guides with graded index profiles, channel waveguides.
- **Optical fibers and amplifiers.** Optical properties, guided modes, pulse propagation, group velocity dispersion, modal dispersion. Rare-earth doped fiber amplifiers, gain and amplified spontaneous emission, optical noise in amplifiers, Raman amplifiers.
- **Silicon photonics.** Introduction to silicon photonics, its applications and recent progress.
- **Structural coloration.** Fundamentals of structural coloration in nature.
- **Plasmonics.** Fundamentals of plasmonics and their applications; graphene and other nanomaterials based plasmonics.
- **Project works:** Poster presentations & home-assignments



Arrangement

Lecturers	
Zhipei Sun	Email: Zhipei.sun@aalto.fi Room: 4185; Phone: 0504322979
Assistant	
MD Gius Uddin	Email: uddinm2@aalto.fi Room: 4167
YOU	The more you give, the more you gain!

Lecture Topics



Grading

Home assignment Weight: 15%

- Each group has to prepare one set of questions as a home assignment for your peers (each 5%).
- The group members share the duty: (1) prepare home assignments; (2) collect answers from your peers; (3) evaluate home assignments; (4) exercise lecture discussion.

Poster presentation Weight: 15%

- Everybody needs to give a poster presentation: (1) prepare a poster A1 size; (2) Discuss/practice with your team members, (3) print the poster; (4) present it

Team work Weight: 5%

- All group members evaluate the team work of all group members (including their selves)

Lab work Weight: 5%

- This year, we arrange a hands-on laboratory experiment on fiber splicing. You will learn how to connect optical fibers. **Please sign the paper on 2nd, May.**

Class Participation Weight: 10%

- At least attending **80%** of the contact-teaching (excluding the exercise sessions, but including the poster presentation sessions)
- **Please sign the paper.**

Final Exam Weight: 50%

Home Assignment

Group 1: prepare exercise based on the lecture (on 18th,April)
Content: Ray optics and wave optics

Group 2: prepare exercise based on the lecture (on 23th,April)
Content: Waveguides and optical fibers

Group 3: prepare exercise based on the lecture (on 25th,April)
Content: Optical amplifiers



Home Assignment

Home assignment Weight: 15%

- Each group has to prepare one set of home assignment for your peers outside of the groups(each 5%).
- The group members discuss to share the duty: (1) prepare home assignments; (2) collect & evaluate home assignments; (3) exercise lecture discussion.

Practical issues:

- Each home assignment should include at least 3 questions (~1-hour difficulty in total, total score: 5)
- **Deadline to announce the home assignments**
- **Deadline to collect the home assignments**
- **Evaluation deadline**
- **Examples of home assignment will be given during exercise session**



Poster Presentation

Poster presentation Weight: 15%

- Everybody needs to give a poster presentation:
 - (1) Select a topic (from the recent Nature Photonics);
 - (2) Read, read, and read again the paper;
 - (3) Prepare a poster A1 size (<5Mbit);
 - (4) Discuss with your group members & Revise & practice;
 - (5) Print the poster (Free-printing within ELEC);
 - (6) **2-min** in-class presentation + **2-min** question



Poster presentation

Topic Selection:

Group 1: Any papers (i.e., reviewers, articles, letters) in **2016**, Nature Photonics
<http://www.nature.com/hphoton/archive/index.html>

Group 2: Any papers (i.e., reviewers, articles, letters) in **2017**, Nature Photonics

Group 3: Any papers (i.e., reviewers, articles, letters) in **2018**, Nature Photonics

In each group, please do not select two identical papers.



Lab work Weight: 5%

- Content: optical fiber splicing (*Discuss with Mr. MD Gius Uddin if you already know how to splice fibers*)
- Lab room: Lecture room in Micronova
- Assistant: Mr. MD Gius Uddin (Office number: 4167; Email: uddinm2@aalto.fi)

2, May: 10:15-10:45 Group 1

2, May: 10:45-11:15 Group 2

2, May: 11:15-11:45 Group 3



Poster presentation

Practical guidelines:

1. Topic selection deadline: **10AM, 18th, April, 2017**
2. Group leaders collect the topics, and send me by emails. Thanks.
3. Group leaders collect the poster PPT, and send them to me by **10AM, 14th, May**. Thanks.

Suggestions before preparation of the poster:

- (1). Google with "how to design a poster presentation" e.g.,
<http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.0030102>
- (2) Please ignore some hard problems, focus on concepts.
- (3). Discuss/practice with your group members.

- (4). Please do **NOT** forget to put your name.



To-do-list for Group 1

1. Select a poster topics (DL: **10AM, 18th April**, Group leaders email me)
2. Home exercise:
 - Prepare the home assignment (3 questions) and announce it on the mycourses website before **10AM 30th, April**.
 - Collect all answers from your peers before **10AM 7th, May**
 - Evaluate the home assignments of your peers and announce it on the mycourses website before **10AM 9th, May**, and send me the results (the evaluation + answer sheets).
 - Exercise lecture on **9th, May 12:30-14:00**.
3. Finish the exercises prepared by group 2 (DL: **10AM 7th, May**) & group 3 (DL: **10AM 7th, May**)
4. Submit your poster PPT to your group leaders (DL: **14th, May**)

To-do-list for Group 2

1. Select a poster topics (DL: 10AM, 18th April, Group leaders email me)
2. Home exercise:
 - Prepare the home assignment (3 questions) and announce it on the mycourses website **before 10AM 30th, April.**
 - Collect all answers from your peers before **10AM 7th, May**
 - Evaluate the home assignments of your peers and announce it on the mycourses website before **10AM 9th, May**, and give me the results (the evaluation + answer sheets).
 - Exercise lecture on **9th, May, 12:30-14:00.**
3. Finish the exercises prepared by group 1 (DL: 10AM 7th, May) & group 3 (DL: 10AM 7th, May)
4. Submit your poster PPT to your group leaders (DL: 14th, May)



Deadlines



To-do-list for Group 3

1. Select a poster topics (DL: 10AM, 18th April, Group leaders email me)
2. Home exercise:
 - Prepare the home assignment (3 questions) and announce it on the mycourses website **before 10AM 30th, April.**
 - Collect all answers from your peers before **10AM 7th, May**
 - Evaluate the home assignments of your peers and announce it on the mycourses website before **10AM 9th, May**, and give me the results (the evaluation + answer sheets).
 - Exercise lecture on **9th, May, 12:30-14:00**
3. Finish the exercises prepared by group 1 (DL: 10AM 7th, May) & group 2 (DL: 10AM 7th, May)
4. Submit your poster PPT to your group leaders (DL: 14th, May)



Calendar

(Please follow the Weboodi/Mycourses)

Week	Day	Time	Room	Teacher
16	16, Apr. (Tue.)	10:15-12:00	2190 (Iso-sali)	Zhipei Sun
	18, Apr. (Thu.)	10:15-12:00	2190 (Iso-sali)	Zhipei Sun
17	23, Apr. (Tue.)	10:15-12:00	2190 (Iso-sali)	Zhipei Sun
	25, Apr. (Thu.)	10:15-14:00	2190 (Iso-sali)	Zhipei Sun
18	30, Apr. (Tue.)	10:15-12:00	2190 (Iso-sali)	Zhipei Sun
	2, May (Thu.)	10:15-12:00	2190 (Iso-sali)	Uddin (fiber splicing)
19	7/9, May.	10:15-12:00	2190 (Iso-sali)	NO -COURSE
	9, May. (Thu.)	12:45-14:00	2190 (Iso-sali)	Exercise(Groups 1-3)



Calendar

(Please follow the Weboodi/Mycourses)

Week	Day	Time	Room	Teacher
20	14, May (Tue.)	10:15-12	2190 (Iso-sali)	Zhipei Sun
	16, May (Thu.)	10:15-12	2190 (Iso-sali)	Zhipei Sun
21	21, May (Tue.)	10:15-12	2190 (Iso-sali)	Zhipei Sun
	23, May (Thu.)	10:15-12	2190 (Iso-sali)	Poster preparation & Conclusion
Exam (3 hours) 29, May (Wednesday), 13:00- 16:00: ISO-Sali room				



What is Photonics?

The science of photonics: light/Photon's

- Generation/Emission
- Transmission
- Modulation/processing/switching
- Amplification
- Detection/sensing/conversion



Readings

- B.E.A. Saleh, M.C. Teich, Fundamentals of Photonics, Wiley, 2007
- A. Yariv, Optical Electronics in Modern Communications, 5th edition, Oxford University Press, 1997.
- G. P. Agrawal, Fiber-Optic Communication Systems, 3rd edition, Wiley, 2002.
- K. Izuka, Elements of Photonics, Vol. II, For Fiber and Integrated Optics, Wiley, 2002.
- C. R. Pollock, Fundamentals of Optoelectronics, Irwin, 1995.
- P. C. Becker, N. A. Olsson, and J. R. Simpson, Erbium-Doped Fiber Amplifiers: Fundamentals and Technology, Academic Press, San Diego, 1999
- Reed, Graham T. - Knights, Andrew P. Silicon photonics: an introduction, Wiley



The Electromagnetic Spectrum

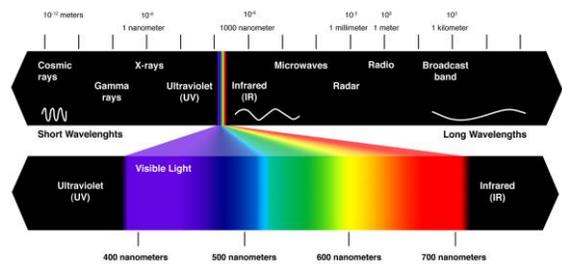


Image credit: Premedia

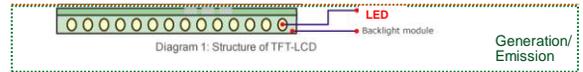
Photonics VS Optics

- Photonics was coined in analogy to Electronics
 - Electronics: The generation and control of electrons
 - Photonics: The generation and control of photons
- Compared with “Optics”, photonics has more emphasis on guided waves and optoelectronic devices
- Photonics has much in common with optical communications technology and integrated devices.



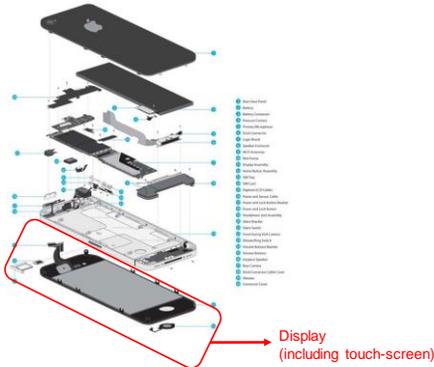
What is Photonics?

An example: Smartphone display structure



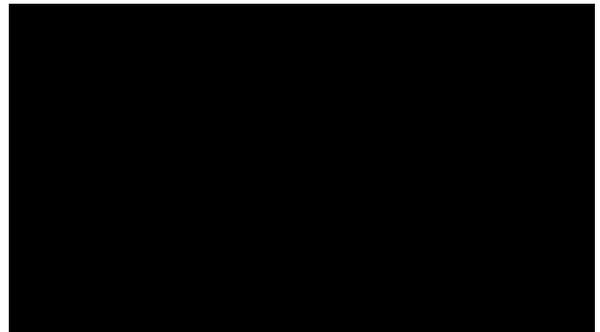
Even a small display is related to all aspects of integrated photonics!

What is Photonics? An example: Smartphone



What is Photonics?

The International Year of Light in 2015



Summary about the work to be done

- **Poster topic selection (DL: 18, April)**

The International Day of Light, 16 May

Next Lecture Topics

- 
- **Course introduction**
 - **Ray optics & Optical beams**

Key Reading List

- Chapters 1-3: B.E.A. Saleh, M.C. Teich, *Fundamentals of Photonics*, Wiley, 2007
- Chapters 2-3: A. Yariv, *Optical Electronics in Modern Communications*, 5th edition, Oxford University Press, 1997.
- Chapter 2: C. R. Pollock, *Fundamentals of Optoelectronics*, Irwin, 1995.