微纳光子学

- 姜校顺
- 现代工程与应用科学学院

- 2020-2-26

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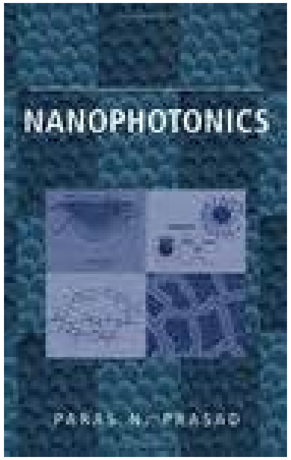
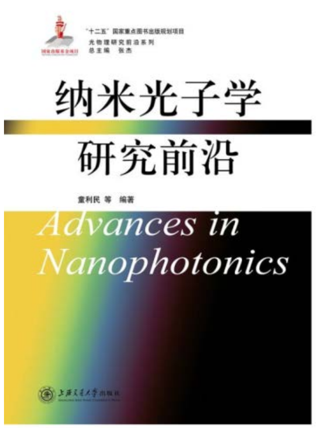
课程简介

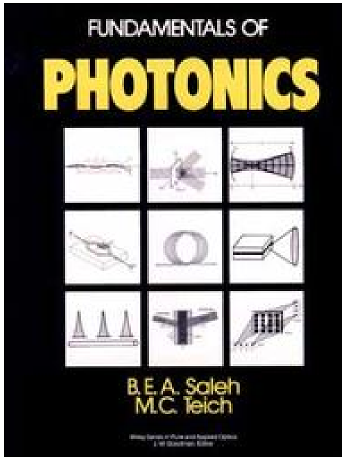
*课程名	微纳光子学		
*英文课程名	micro/nanophotonics		
*周学时	2	*学分	2
*课程类别	选修	考核方式	
*主讲教师	姜校顺		
*教材	P. N. Prasad, nanophotonics (John Wiley & Sons New Jersey,2004).		
参考书	1. 童利民等“微纳光子学研究前沿”（上海交通大学出版社，2014） 2. A. Yariv, Optical electronics in modern communications (Oxford University Press, New York, 1997). 3. E. A. Saleh, M. C. Teich, Fundamentals of Photonics, (John Wiley&Sons, New York, 2007). 4. H. A. Haus, Waves and fields in optoelectronics (Prentice-Hall, New Jersey, 1984).		

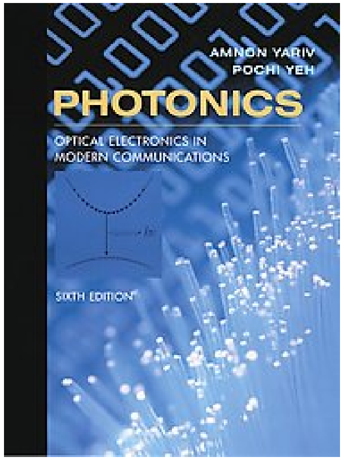
课程简介

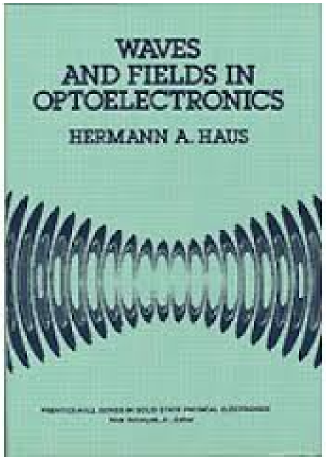
参考书


NANOPHOTONICS
PARAS N. PRASAD


纳米光子学
研究前沿
Advances in
Nanophotonics


FUNDAMENTALS OF
PHOTONICS
B.E.A. Saleh
M.C. Teich


AMNON YARIV
POCHI YEH
PHOTONICS
OPTICAL ELECTRONICS IN
MODERN COMMUNICATIONS
SIXTH EDITION


WAVES
AND FIELDS IN
OPTOELECTRONICS
HERMANN A. HAUS

课程简介

考试和成绩

平时成绩 30%

期终考试 70%（小论文）

课程简介

主要内容:

1. 光学微腔及应用
2. 光流控技术及应用
3. 光子晶体与光子晶体光纤
4. 微纳光波导
5. 硅基光子学
6. 表面等离激元
7. 液晶显示及光子学器件
8. 微纳加工技术
9. 微纳光子学前沿讨论

课程简介

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课程简介

基本要求

1. 掌握微纳光子学的基础知识，学习在微纳米尺度下光与物质相互作用过程中出现的新现象和新效应；
2. 了解基于微纳光学材料和结构的器件构造及其应用;
3. 理解光刻、电子束曝光、聚焦离子束加工、干法及湿法刻蚀等微纳加工技术。

引言
Introduction

引言 *Introduction*

为什么要研究“微纳”和“光”?

什么是微纳光子学?

为什么要研究“(微）纳米”？

There’s Plenty of Room at the Bottom（1959.12）

There’s Plenty of Room at the Bottom

Richard P. Feynman

I imagine experimental physicists must often look with envy at men like Kamerlingh Onnes, who discovered a field like low temperature, which seems to be bottomless and in which one can go down and down. Such a man is then a leader and has some temporary monopoly in a scientific adventure. Percy Bridgman, in designing a way to obtain higher pressures, opened up another new field and was able to move into it and to lead us all along. The development of ever higher vacuum was a continuing development of the same kind.

I would like to describe a field, in which little has been done, but in which an enormous amount can be done in principle. This field is not quite the same as the others in that it will not tell us much of fundamental physics (in the sense of, ‘‘What are the strange particles?’’) but it is more like solid-state physics in the sense that it might tell us much of great interest about the strange phenomena that occur in complex situations. Furthermore, a point that is most important is that it would have an enormous number of technical applications.

What I want to talk about is the problem of manipulating and controlling things on a small scale.

As soon as I mention this, people tell me about miniaturization, and how far it has progressed today. They tell me about electric motors that are the size of the nail on dots on the fine half-tone reproductions in the Encyclopaedia. This, when you demagnify it by 25 000 times, is still 80 angstroms in diameter—32 atoms across, in an ordinary metal. In other words, one of those dots still would contain in its area 1000 atoms. So, each dot can easily be adjusted in size as required by the photoengraving, and there is no question that there is enough room on the head of a pin to put all of the Encyclopaedia Britannica.

Furthermore, it can be read if it is so written. Let’s imagine that it is written in raised letters of metal; that is, where the black is in the Encyclopaedia, we have raised letters of metal that are actually 1/25 000 of their ordinary size. How would we read it?

If we had something written in such a way, we could read it using techniques in common use today. (They will undoubtedly find a better way when we do actually have it written, but to make my point conservatively I shall just take techniques we know today.) We would press the metal into a plastic material and make a mold of it, then peel the plastic off very carefully, evaporate silica into the plastic to get a very thin film, then shadow it by evaporating gold at an angle against the silica so that all the little letters will appear clearly, dissolve the plastic away from the silica film, and then look through it with an electron microscope!

J. Microelectromechan. Syst. 1, 60 (1992).

为什么要研究“（微）纳米”？

There’s Plenty of Room at the Bottom

I would like to describe a field, in which little has been done, but in which an enormous amount can be done in principle. This field is not quite the same as the others in that it will not tell us much of fundamental physics (in the sense of, ‘‘What are the strange particles?’’) but it is more like solid-state physics in the sense that it might tell us much of great interest about the strange phenomena that occur in complex situations. Furthermore, a point that is most important is that it would have an enormous number of technical applications.

为什么要研究“（微）纳米”？

There’s Plenty of Room at the Bottom

nature

20 January 2005 Volume 433 Issue no 7023

Einstein is dead

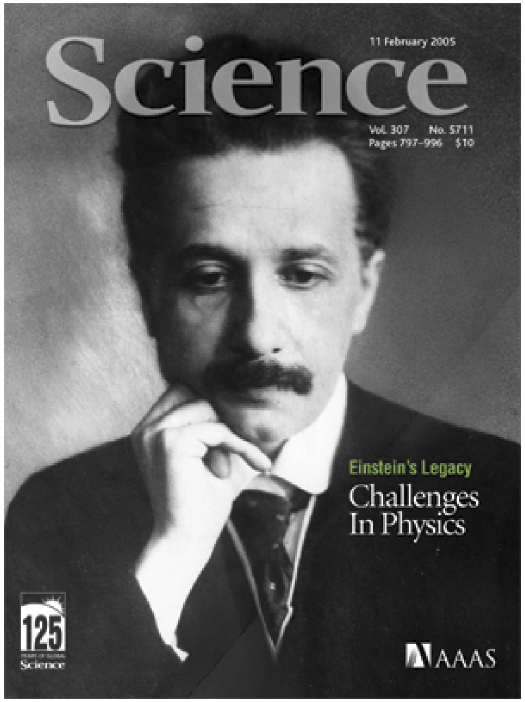
Until its next revolution, much of the glory of physics will be in engineering. It is a shame that the physicists who do so much of it keep so quiet about it.

Once upon a time there was (and still is) a multinational manufacturer of sheet metal whose researchers realized they could improve the reliability of its production processes. By solving the equations of heat transfer for the company’s rolling presses, and testing the solutions on scale models, they significantly inspiring things. Sheet metal is at the more prosaic end of the spectrum. At the other end, Steve Jobs, head of Apple, said at last week’s launch of the latest iPod: “Most people make the mistake of thinking design is what it looks like … Design is how it works.” In other words, sexy design is also about sexy engineering and the sexy science behind it.

But nanotechnology, superconducting, biology, and quantum entanglement is thriving …

为什么要研究“光”？*Why “Light”?*

The Nature of Light



All these fifty years of conscious brooding have brought me no nearer to the answer to the question, “**What are light quanta ?** ” Nowadays every Tom, Dick and Harry thinks he knows it, but he is mistaken.

——**Albert Einstein**

Explore Unknowns !

什么是微纳光子学?

微纳光子学

微纳米技术+光子学

微纳米尺度上的光与材料的相互作用