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光科学与工程系

Department of Optical Science & Engineering
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Annual Report

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课 题 进 展
Progress in Research Projects

微光子学材料与器件
Micro-photonic materials and devices

微光子学以光波导、光学微腔等具有一定功能的微小光学光路为研究对象，不同功能的微小光学光路的集成（称为集成光学，或集成光子学）是取代体光学光路的必由之路，也是人们所追求的终极目标。本课题组的工作集中于探索功能玻璃材料作为光子芯片应用的可能性，研究涉及材料的性能、微结构和微图形及光子学器件。

Micro-photonic chips are miniature optical circuits of waveguides and microcavities. Integration of circuits that have different functions will eventually replace bulk optical components, just like integrated circuits of micro-electronics replaced discrete electronic components and changed our normal life. Our group focused on functional glassy materials, exploring the possibility of using these materials as part of photonic chips. Our research covers material characterization, micro-patterning technique and prototype photonic chip devices.

1． 光激励下材料光学非线性增强效应 Optical nonlinearity enhancement in optical materials under light irradiation

通过激光的激励提升材料的非线性光学效应是我们新建立的激光材料改性的重要研究课题，目地是研究在现有非线性光学材料的基础上，如何通过激光改性增强材料的固有光学非线性系数以及光学非线性增加的机理。本课题涉及液晶材料和硫系玻璃材料，它们都是重要的光电子材料并都具有很大的光学非线性。液晶分子受光作用会在空间发生偏转因而具有很大的非线性光学系数，我们在对少量偶氮苯染料分子掺杂液晶光学非线性进行了研究，发现当偏振激光作用可使系统的宏观三阶光学非线性产生明显的增强，该增强被归结为偶氮苯染料分子在光激励下发生光致异构，并通过偶氮苯分子与液晶分子的相互作用而导致液晶整体的各向异性排列。首次获得的光学非线性产生的原初动力学过程清晰地揭示了不同时间尺度上染料与液晶作用的细节行为。另外，对多种硫系玻璃的光致三阶光学非线性增强效应也进行了详细的研究。发现总体上光激励都可导致非线性增强，但起源各不相同。光致异构同样存在于硫系玻璃中并可导致在光照下材料各向异性的产生及相应的非线性折射率增加，而光激励产生的大量缺陷态则是各向同性的非线性折射率增加的主要原因。

Laser driven enhancement of optical nonlinearity of materials is an important project that we are carrying on, with the mission to find out the mechanism of the enhancement and seek optimistic enhancement. Chalcogenide glass and liquid crystals are two kinds of opto-electronic materials that we are interested, with high optical nonlinearity and feasibility of light induced orientation. We found out that a small amount of azo-benzene dye doping can significantly increase the third-order optical nonlinearity of liquid crystals under light excitation. The enhancement was attributed to be come from photoisomerization effect and smearing out of polarized

light excitation induced anisotropy of *trans* isomers. Picosecond time scale optical nonlinear response of the materials reveals the detailed early dynamics of the interaction between azo dye and liquid crystal molecules. We also found obvious optical nonlinearity enhancement in chalcogenide glasses after light irradiation, originated from generation of large number of defects and consequently the increase of refractive index of the material.

2. 新型光学微腔的材料、微腔结构及新颖激光发射特性 Novel optical microcavities: material, new structures and excellent laser characteristics

光学微腔因预期其在集成光电子学、传感、通信中的重要作用而成为近几年中国际研究的热点课题。本研究组在近一二年里发展了若干种新型光学微腔构型，利用有机/无机复合材料的特有光学加工特性制备了高质量的光学微腔激光器，并在几种特殊构型的微腔激光器中得到高亮度、高光谱分辨率和高准直性的激光输出，第一次展示了特殊设计的微腔激光能够获得与大尺度激光同样光学质量的激光性能。其中提出并实现的平面随机微腔概念结合了随机结构与人工周期结构，获得极佳的光子三维约束和激光性能，研究结果发表于Physical Review Letters上。

Many research papers on optical microcavity have been published in recently years, with expectation of finding important applications in integrated opto-electronic circuits, sensing and optical communications. We devised several new structures of microcavities in the past years by using organic/inorganic hybrid materials with their exclusive advantage in photo-processing, highly collimated lasing with high brightness and high cavity quality factor were obtained. It was demonstrated for the first time that specially devised microcavity laser could achieve the similar laser performance as bulk lasers. A new structure of planar random microcavity combining a random scattering and an artificial periodic photonic crystal can efficiently confine photons in 3-dimention. In consequence, excellent laser characteristics were obtained. The result was published in Physical Review Letters.

2006年度本课题组完成国家自然科学基金项目1项。2006年新申请到国家自然科学基金重点项目1项，上海市科委基础性研究计划连续支持项目1项。2006年度课题组在国际期刊上发表文章7篇，均为SCI论文；在国际会议上报告9次，其中会议邀请报告3次；在国内会议上报告6次。2005年底授权国家发明专利1项。

In 2006, one NSFC project was accomplished. A key project from NSFC and a successive fund from Shanghai Commission of Science and Technology were approved. 7 SCI papers were published. In addition, there are 9 presentations (3 are invited) in international conferences and symposiums, 6 presentations in domestic conferences. A China patent was licensed.

飞秒时域二阶非线性光学的应用研究
Applications of Ultrafast Quadratic Nonlinear Optics

课题组以发展超高功率短脉冲(PW)等大型激光装置为牵引目标，从事高功率激光技术和二阶非线性光学的研究工作。在基础性研究方面，着重开展超快非线性光学的科学研究工作，探索新的时空非线性光学现象和效应，拓展非线性光学的新应用，并发展形成新的光学技术和测量方法。在工程性激光技术研究方面，将超快非线性光学的科学研究结果作为基础和创新源泉，驱动高功率激光技术的发展，解决大型激光工程中的关键技术难题。课题组取得了一系列重要的创新技术，已有4项成果应用于国家级大工程项目，并起到关键作用。近期致力于发展自主创新的非线性超快激光技术,在近红外和中红外波段飞秒光参量放大技术（OPA）方面做出了有国际影响力的成绩，已在我国的高功率激光工程方面起到重要作用。今年度发表SCI文章共22篇，授权了1项和申请了5项国家发明专利。

1. 发明了一种测量非均匀相速度分布的新方法 Frequency mixing of off-axis focused Gaussian beams: an approach to measure the phase velocity distribution

过去传统的测量相速度的方法是直接对波失及其相位进行测量。但该方法不适用于聚焦高斯光束中相速度分布的测量。因为：i）聚焦光束中的相速度不是均匀分布的；ii）在聚焦光束中，不同位置之间的相速度差别非常小，比如对于束腰小到波长的10倍量级的光束，其相速度差别也仅在10-4c的量级。因此有必要探索新的、有效的方法以实现高斯光束中相速度的测量。对于聚焦的高斯光束，谐波转换效率会在相位失配量达到稍偏离完全匹配的某一值时达到最大值。我们证明了最佳相位失配量和聚焦光束的相速度之间存在一个简单的关系。从而为聚焦光束的相速度测量提供一种新的方法。据此，我们发明了一种利用两个离轴的高斯光束进行倍频，通过最佳相位失配量间接测量高斯光束中非均匀相速度分布的方法，并已申请专利。

We theoretically study frequency mixing of two off-axis focused Gaussian beams. The optimal phase-mismatch corresponding to maximized conversion efficiency depends on the separation of off-axis fundamental beams and can be expressed in terms of the phase velocities analytically, which provides an effective approach to measure the phase velocity distribution of a Gaussian beam.

2. 实现了多级的级联非线性压缩脉冲新技术 Multi-stage Pulse Compression by Use of Cascaded Quadratic Nonlinearity

传统的Nd：YLF锁模激光器可方便地输出50mJ/50ps的激光脉冲，而且有商品化器件。我们应用了我们近期发明的级联非线性压缩技术，进行多级脉冲压缩，最终可获得10mJ级的百飞秒脉冲输出。这不仅是一个新的技术路线，而且是非常经济的，将使10mJ级飞秒脉冲激光系统的成本从30-40万美元下降到~15万美元。

Multi-stage compression of picosecond pulses by cascaded quadratic nonlinearity is studied theoretically, and the dependence of pulse compression on phase mismatch, laser intensity, and crystal characteristic has been discussed in detail. We demonstrate that the multi-stage pulse compression is much more efficient than the single stage with a same total crystal length. Pulses as short as ~ 150 fs can be generated by compressing 30-ps initial pulses in a two-stage configuration on the realistic crystal and laser conditions, and shorter pulses of ~30 fs may be obtained by three-stage compression. Pulse compression performances with BiBO and BBO crystals are compared and discussed finally.

3． 研究了1 μm波段时间望远镜技术 Generation of tunable narrowband pulses initiating from a femtosecond optical parametric amplifier

从宽带飞秒光脉冲产生同步的窄带长脉冲，是发展OPCPA技术的重要组成部分，它将被用作OPCPA泵浦源的种子。我们采用啁啾控制的差频过程即时间望远镜技术来实现这一任务。将1 μm波段宽带飞秒激光脉冲先由非线性光学晶体进行倍频，倍频光和剩余的基频光经分光后、分别由光栅色散展宽成啁啾脉冲，若通过适当设计和精细调整，使倍频光和基频光脉冲具有相同的啁啾量，则两者在第二块非线性光学晶体中通过光学参量过程，产生的闲频光即为窄带长脉冲。我们用以前建立的飞秒OPA作为时间望远镜的前端，实验上产生了带宽~0.1 nm、脉冲宽度~50 ps、能量~10 nJ的输出，并且可以在1000 nm~1090 nm范围内调谐。这样，基于飞秒钛宝石激光系统，我们可以同时获得具有高精度同步能力的可调谐宽带飞秒和窄带长脉冲光源，从而将高时间分辨能力(~100 fs)和高光谱分辨能力(~0.1 nm)集成于一个系统中，对光谱学研究将是一个非常重要的工具。

We report a tunable optical pulse expander capable of producing narrowband long pulses, starting from a femtosecond optical parametric amplifier, which is based on chirp-matched frequency mixing technique. The device delivers nJ-level pulses with bandwidth of ~0.1 nm and duration of ~45 ps within its tuning range from 1000 nm to 1090 nm. The combination of a femtosecond OPA and a pulse expander may provide synchronized and both tunable femtosecond and tens of picoseconds pulses simultaneously, which should be promising in the applications where both temporal and spectral resolutions are needed.

课题组从事高功率激光技术和二阶非线性光学的研究工作，近年来取得了一批重要的创新成绩，逐步形成一套系统的非线性超快激光技术。已有多项成果应用于国家级大工程项目，并起到关键作用。本年度共发表SCIE文章22篇，申请并受理发明专利5项，授权了1项。

22 papers were published in SCI journals and 5 new techniques were patented in 2006.

纳米材料的发光增强、发光特性及电学特性研究
Luminescent and electrical properties and luminescence enhancement of nano-materials

本年度在4个方向上开展了工作，分别是：1）在去年工作的基础上，发展了双向掺杂技术，并结合氢钝化，使得Si纳米晶的光致发光强度从原来的最高增强3.6倍增加到目前的~20倍。由于实验条件尚未优化，预计发光增强将进一步提高。2）建立了Si纳米晶的电致发光系统，确定了Si纳米晶的电致发光。3）利用电力显微镜研究了离子束辐射形成的Si量子点的电学特性和原子构型，证明由此形成的Si量子点具有和Si衬底不同的结构核电荷分布。这个结论和以往报导的不同，为量子点的应用提供了基础。4）发现经HF腐蚀的SrTiO3 (001) 晶体，其光致发光信号增强~10倍。研究表明发光为其中的氧空位缺陷所致。

Research works cover four subjects. 1) Based on our previous work, a two-side doping technique of Si nanocrystals was developed, combining with H passivation method. The photoluminescence (PL) of Si nanocrystals was enhanced by a factor of ~20, which was much greater than the previous 3.6. Since the doping condition has not been optimized, it is expected that the PL intensity can be further enhanced. 2) An electroluminescence (EL) measurement setup was built, and the EL emission of Si nanocrystals was observed and identified. 3) The electric properties and atomic arrangement of Si quantum dots (QDs) induced by ion sputtering of Si(100) were studied. It was found that the Si QDs thus formed were not epitaxially grown on Si(100) substrate, hence their charge distributions were different. This conclusion differs from preceding ones and laid a foundation for the applications of QDs so formed. 4) It was observed that transparent SrTiO3 (001) gave off more PL emission after etching in a HF solution. The PL enhancement could be ~10 times. Oxygen-vacancy defects were found to be responsible.

本年度发表SCI论文4篇。授权发明专利1项。国内会议报告1次。

半导体量子点在生物细胞中的发光特性研究
Study on the PL behavior of semiconductor QDs in living cells

研究了水溶的 CdTe 量子点在生物细胞中的光致发光行为，发现发光光谱随着光照时间的延长会有一个增强、蓝移和淬灭的过程。进一步的研究发现上述过程是由光氧化反应引起的，最初的氧化使量子点表面钝化引起发光的增强，进一步的氧化使量子点表层发生化学结构的改变，从而使量子点的尺寸变小引起发光的蓝移，同时产生大量的表面态导致非辐射驰豫的增强因此引起发光的淬灭。研究表明参与光氧化过程的是单态氧。这些单态氧是通过量子点吸收光能量以后将能量转移给吸附在量子点表面的氧分子而产生的。这些结果已经发表在 JACS.杂志上（J. Am. Chem. Soc.128 (2006) 13396-13401）。论文发表以后，Biophotonics International 杂志专门撰文全文介绍了我们这一工作（Biophotonics International，13（11）（2006）50-51）。

Photoluminescence (PL) behavior of water-soluble CdTe quantum dots (QDs) in living cells has been studied. An enhancement, blueshift and quenching process was observed for the PL with the irradiation time. Further study showed that this process resulted from photooxidation. The enhancement was due to the oxidation induced surface passivation. The blueshift occurred when the diameter of semiconductor core was reduced by oxidation of the core surface. Meanwhile, the nonradiative decay due to the surface states generated from oxidation caused the quenching of PL. It is proved that singlet oxygen was the reactant in the oxidation reaction. The siglet oxygen molecules were formed by photoenergy transformation from QDs to the oxygen molecules adsorbed on the QD surface. Those results were published in JACS (J. Am. Chem. Soc.128 (2006) 13396-13401). After the paper was published in JACS, a news report to introduce our results was published in Biophotonics International (Biophotonics International, 13（11）（2006）50-51).

在对生物细胞中的量子点发光稳定性的研究中发现，量子点的光稳定性比传统的染料指示剂好得多。量子点的光稳定性与环境氧的浓度、光能量密度以及量子点的局域浓度有关，环境氧的浓度和光能量密度越高，稳定性越差，量子点的局域浓度越高，稳定性越好。这些结果已经在 Nanotechnology 发表（Nanotechnology, 17 (2006) 17 (2006) 2083-2089），而且被该杂志评选为 2006 年的 Highlights（每年总共评选 10 篇 Highlights）。

The photostability of CdTe in living cells was also studied. It was found that the photostability of QDs is much better than the traditional fluorescent probes. The photostability is dependent on the local oxygen density, energy density of irradiation light and the local density of QDs. The higher density of QDs and the lower oxygen density and energy density of light, the better photostability of QDs. These results were published in Nanotechnology (Nanotechnology, 17 (2006) 17 (2006) 2083-2089) and this paper was chose as the Highlights of Nanotechnology of 2006. (It was totally 20 Highlights in 2006).

我们用 NaBH4 对量子点进行了表面处理。处理以后，量子点的发光效率提高了一倍，而光稳定性提高了将近 3 倍。经过表面处理的量子点在细胞内部的发光效率和稳定性也得到了同样的提高。这些结果已经发表于 Nanotechnology（Nanotechnology, 17 (2006) 5875–5881）。

We treated the CdTe QDs with NaBH4. After surface treatment, the PL quantum yield was doubled and the photostability was improved by a factor of 3. Same results were obtained in living cells. These results have been published in Nanotechnology (Nanotechnology, 17 (2006) 5875–5881).

金属表面吸附原子及团簇的扩散动力学研究
Studies on self-diffusion of adatoms and adatom clusters on metal sufaces

1. 基于原子嵌入方法研究了系列 fcc(111)金属表面吸附团簇在平衡态的结构。结果显示与吸附原子-基底相互作用相关的边界类型的能量对于平衡态的结构有着重要的作用。除此之外，吸附原子-吸附原子的相互作用也有一定的影响。因此在所有的能量较低的结构中，边界的差总是趋向于最大，同时结构保持最近邻原子键数最多。在不同表面，这两种因素的竞争结果各不相同，有些表面边界的能量差不大，那么平衡态吸附团簇的形状就是六角型的；而对于边界能量差较大的表面，平衡态吸附团簇的形状将是三角型的， 而且都是指向同一个方向，与实验结果一致。

A direct determination on the equilibrium structures of adatom clusters and their shapes are made on a series of metal fcc(111) surface by applying the embedded atom method. It is found that the different energetic preference of two types of edges, which is caused by different the adatom-substrate interaction, plays a significant role in deciding the equilibrium structures as well as the adatom-adatom interactions. All structures intend to have large length differences of A-type and B-type edges, along with trying to keep the maximum number of nearest neighbor adatom-adatom bonds. The competition between the two kinds of interactions results in that on some surfaces, where no strong partialness to either type of edge, the equilibrium shapes of clusters are hexagonal, whereas on the other surfaces, clusters are shaped as triangular with certain orientations.

2. 研究了在 Ag(111)表面对 Ag 吸附原子的横向操纵可靠性问题。采用了三种不同构型的探针，单尖，双尖和三尖。模拟结果表明从单尖，双尖到三尖，操纵稳定性逐步增加。在此基础上进一步研究了稳定性增加的机制，在不同的操纵高度，稳定性增加的机制有两种，一是增强的相互作用机制；另一个是原子悬浮机制。双尖探针主要基于增强的相互作用机制；三尖探针增强机制随高度的不同而不同。

The reliability of the manipulation of single Ag adatom on Ag(111) surface with the single and multi-apex tips is studied using semiempirical method. The results show that from the single-apex tip to the double and triple-apex tips the reliability of the lateral manipulation is improved incertain tip height range. Two kinds of mechanisms for the improvement are discussed, they are named the enhanced interaction mechanism and the atom suspended mechanism. The reliability improvement with the double-apex tip is mainly due to the enhanced interaction mechanism. To the manipulation with the triple-apex tip, the main mechanism for the reliability improvement is different for the different tip height range.

本年度发表 SCI 论文 1 篇。

光学矩阵方法用于光致聚合过程的实时观测

Matrix method for the observation of laser-induced photopolymerization with short time curing

对光致聚合的动力学过程进行了理论分析和模拟，提出了一种光致聚合动态过程的研究分析方法，在此基础上建立了相应的实验测量系统．该系统具有±0.3%的测量稳定性．目前系统的响应时间为50ms，可以实现光致聚合的实时测量．通过改进系统配置，我们可以进一步提高系统的测量响应速度。利用该系统我们研究了丙烯酸脂单体的实时聚合过程，很好地分辨了0.1%的折射率变化。初步建立了一套双通道的数据采集系统，及激光脉冲输出的控制软件，并使其很好地用于上述研究.

A phenomenological theory, based on curing intensity-dependent photopolymerization and its influence on gaussian beam wave front distortion, was proposed to model the absolute variation process of the refractive index of curable chemical composite in laser-induced photopolymerization. An experimental setup that relied on this theory with a systematic resolution of ±0.3% was also established for the measurement of photopolymerization for acrylate composite. The data rate of more than 20 Hz made this method suitable for real-time investigation on photopolymerization. Data acquisition software for two channel simultaneous operation, and program for laser shot controlling, were also established for the experiment.

光-磁混合存储研究和低维磁结构的磁性
Heat-assited magnetic recording (HAMR), and magnetic properties in low-dimension magnetic structures

一、光-磁混合磁记录介质研究 Magnetic media for hybrid recording

(1)首次发现通过高温退火，可以获得具有（200）织构的Fe膜，而不是通常的（110）取向；(2)在腐蚀过的金字塔形硅片，利用斜入射的技术制备了易轴倾斜的FePt有序合金，在垂直方向具有好的磁滞回线，但矫顽力最小；结果发表在Appl. Phys. Lett.；(3)研究了垂直取向FePt有序合金薄膜的取向机理，发现衬底的表面能在薄膜的取向过程中起了决定作用；(4)采用射频氧化法在多种金属衬底上制备了易轴垂直取向的FePt有序合金薄膜，并申请了专利；(5)通过在不同基板上，在不同的热处理条件下制备垂直取向的FePt薄膜，研究了外延和非外延生长时薄膜的有序化过程，发现适当的应力有利于降低FePt薄膜的有序化温度，部分结果在美国Baltimore举行的10th joint MMM/Intermag 国际会议上报道。

(1) (200) textured Fe films are obtained by high temperature annealing for the first time. The as-deposited films exhibit (110) texture in general. (2) FePt ordered films with tilted easy axis are prepared by oblique sputtering on pyramid-type Si wafer etched by 10 % HF solution. Along film normal direction, the hysteresis has high square ratio, and coercivity increases when the applied field departs from film normal. The result was presented on Appl. Phys. Lett.; (3) The texture mechanism is studied in the FePt ordered alloy films. It is found that surface energy dominates the orientation of the grains. (4) *C*-axis orientation $L1_0$ FePt films are fabricated on the oxidized underlayers by RF bias sputtering. Patent is applied according to these results. (5) The ordering process of (002) FePt films are studied in epitaxial and non-epitaxial growth in the films. These films are prepared on different substrates by different annealing condition. Suitable stress is helpful to reducing the ordering temperature. Some results are present on the 10^{th} joint MMM/intermag international conference in Baltimore, USA.

二、激光辅助磁记录的动态测试演示系统Dynamic demo system of laser-assisted mgnetic recording

光辅助磁记录、磁读出动态测试系统部分已初步搭建完成，在激光辅助的基础上，使用水平磁头实现了垂直盘片的全动态写入和读出，实验表明激光辅助降低了介质的矫顽力，起到了对介质的加热作用。这是目前国内仅有的具有激光辅助磁记录功能的动态测试系统。

A primary HAMR demo system has been completed. With the laser (wavelength: 405 nm) heating, we succeeded a dynamic writing and reading on the perpendicular media (provided by Seagate Research with a collaboration agreement) using longitudinal head (LMR HGA), which showed that the laser heating assisted to decrease the coercivity of the media, thus helped writing data on the media. But this system needs a further modification for reliability and easy adjustment.

三、自旋电子学薄膜材料和模拟计算 spintronic thin film materials and micromagnetic simulation

（1）研制了以L10-FePt为交换钉扎层的自旋阀材料，与相同条件下制备的以传统Mn基反铁磁材料作为交换层的自旋阀相比，具有相同大小的GMR信号(7%)和更高的交换场（近2000 Oe）。（2）研究了磁性隧道结的热稳定性，发现通过对衬底施加合适功率与时间的射频偏压有利于降低界面粗糙度，从而可以提高隧道结的稳定性，（3）模拟计算了低电阻隧道结中自旋转移矩效应引起的自由层磁化翻转效应，提出了一种隧穿和金属传导共存的导电模型来解释隧道结中翻转电流比较低的现象。相关工作发表在Appl. Phys. Lett、Chin. Phys. Lett 和Thin Solid Films杂志上，另有部分结果将在10th joint MMM/Intermag 国际会议上报道，并已整理投稿。

(1) Spin valves with L10 FePt as exchange pinning layer have been prepared and studied. Compared with conventional MnIr-pinned spin valves, our samples show similar GMR signal of 7% and higher swithcing field of ~2 kOe. (2) Interface roughness between the mangetic bottom electrode and tunnel barrier can be reduced by substrate bias with proper power and treating time, which hence improves the thermal stability of the magnetic tunnel junctions. (3) The spin transfer induced magnetization switching of free layer for low resistance magnetic tunnel junctions has been investigated by micromagnetic simulation. The switching behaviors are found to be closely related to the nano current channel(ncc) size and its actual location. The switching time t and critical current density J_c decrease with increasing ncc size. Faster switching and lower J_c are observed for the ncct located in the center than that in the edge. This work suggests a reasonable design frame of confined current path for efficient J_c manipulation in practical spin-transfer-switched devices. Relevant works have been published in Appl. Phys. Lett, Chin. Phys. Lett and Thin Solid Films，and some results were presented in 10th joint MMM/Intermag held in Baltimore, Maryland, USA.

四、混合存储介质材料的自旋超快动力学研究Spin dynamics of hybrid media materials

利用基于磁光克尔效应（MOKE）的Pump-Probe测量技术，在大气中测量得到了磁光薄膜TbFeCo材料、外延Fe3O4超薄膜以及TbFeCo/FePt交换耦合薄膜的自旋弛豫过程，分别得到了不同的弛豫现象。对于TbFeCo薄膜，自旋在退磁后经过较长时间（几百皮秒）才弛豫恢复到原先的自旋平衡状况。采集了在不同泵浦功率和不同基板温度下的弛豫情况，得到了一批结果；结果表明TbFeCo之中的相分离在激光作用下的退耦合现象导致弛豫时间的不同。从实验设计上可以对此进行调节，以保证在磁记录过程中的较快记录和恢复过程，有利于快速的记录。结果正在撰写之中。

Using the MOKE-based pump-probe technique, we studied the spin relaxation process of sputtered TbFeCo, epitaxial Fe_2O_3 ultrathin films and other exchange-coupled films. For TbFeCo, we found a relatively long recovery of magnetization (several hundred ps). We contribute this novel phenomena to be a

result of decoupling of FeCo and TbFeCo small grains upon laser heating and also the effect of the heat transfering. The calculation using these two models are being undertaken.

五、纳米结构材料的模板辅助电化学合成 Electrochemcal fabrication of nanostructured materials using anodized alumina template

利用电化学模板技术首先制备了六角对称具有良好结构、整齐规则的Al2O3多孔模板，发现在氧化阻挡层（barrier layer）存在枝状结构，尺度在几个纳米尺寸。正是这种结构造成阻挡层厚度较厚但电阻却较小；用此制备了具有枝状结构的FeNi纳米线。此结果已发表于Nanotechnology（影响因子3.0）。

With the assistant of anodized alumina template, we fabricated branched structures of FeNi, with a diameter of sub-ten nanometers. This paper was published in Nenotechnology.

本年度发表SCI论文7篇，申请专利1项，著有国家重点图书的一个章节（约2万字）。获上海市重大基础研究项目、国家基金委面上项目2项、上海市浦江人才计划团体项目。

7 papers have been published in 2006. One patent application has been submitted, and one chapter of a book was published. We got two new NSF projects and one major project support on basic research from Shanghai Science and Technology committee, and one Pujiang program.

等离子体特性和应用、氮化物薄膜的制备和性质
Characteristics and Applications of Plasmas, Preparation and Properties of Nitride Thin Films

通过弧热等离子体源所产生的甲烷/氮气等离子体喷射，直接在覆盖不同配比Co/Ni，Fe膜的衬底上生长氮碳薄膜，获得较高氮含量并以N-C键存在的氮碳纳米晶，并测量了实验条件下的发射光谱，观察到很强的氮碳基发射谱。用PLD法制备了尺寸在20-100纳米可控的ZnSe纳米薄膜和直径在10纳米左右纳米线。用PLD法制备了ZnSe:Bi、ZnSe:Sb等多种掺杂ZnSe薄膜，其中在石英和硅衬底上合成的ZnSe:Bi薄膜呈p型导电，受主载流子浓度达到10^{17}-$10^{18}$$cm^{-1}$。还以金属Zn为原材料进行了ZnO薄膜的尝试，用ECR氧等离子体和氧/氮等离子体辅助PLD方法制备了ZnO薄膜和氮掺杂ZnO薄膜。

Nanocrystalline carbon nitride thin films with high N content and N-C bonding structure are prepared on Co/Ni, Fe covered substrates by means of CH_4/N_2 plasma ejection generated by an arc plasma source. Optical emission from the plasma is measured during film preparation and strong emissions from CN radicals are observed. ZnSe nanocrystalline films with size controlled in 20-100 nanometers and ZnSe nanolines with diameter of about 10 nanometers are prepared by pulsed laser deposition. Attempts are also made on the preparation of ZnSe films doped with other elements. ZnSe:Bi and ZnSe:Sb thin films are prepared. The prepared ZnSe:Bi films on quartz and Si substrates are p-type with acceptor carrier concentrations of 10^{17}-$10^{18}$$cm^{-3}$. We also synthesize ZnO thin films using metallic Zn as raw material. ZnO films and N-doped ZnO films are prepared on sapphire and Si substrates by means of ECR oxygen plasma or ECR oxygen/nitrogen plasma assisted pulsed laser deposition.

另一方面的工作是脉冲激光烧蚀在材料成分分析上的应用探索，特别是对材料中痕量元素的探测和分析。用短脉冲和超短脉冲激光烧蚀固体或液体材料引发低温度的冷等离子体，用激光诱导等离子体光谱测量和分析方法分析等离子体成分，进而间接分析被烧蚀材料的成分，探测其中所含的痕量杂质。选择多种材料为样品、用纳秒和飞秒两种脉宽的激光烧蚀样品、用诱导等离子体光谱方法对样品中的杂质元素进行了分析探测的尝试和演示，包括铝合金Al6061。其中铝合金Al6061中含有的主要杂质和含量为22ppm Na、0.084% Si、0.23% Cu、0.67% Mg、0.15％(Max) Mn、0.04-0.35% Cr、0.15%(Max) Ti、(Max) Fe 0.7%、0.2% (Max) Zn等。这些杂质都能被方便地检测到，即使对于含量为22ppm 的Na，只需要脉冲能量为0.1mJ的纳秒脉冲激光烧蚀样品，就可以清晰地分辨识别出Na的信号，并有很高的信噪比。飞秒脉冲激光烧蚀诱导的等离子体温度低，连续谱的干扰小，信号的信噪比高，探测灵敏度高；飞秒脉冲激光烧蚀阈值比较确定，在近阈值烧蚀时等离子体光谱的涨落小，只需数个飞秒激光脉冲的烧蚀、数次光谱信号的累加平均就能得到一定信噪比的信号谱；飞秒脉冲激光对

不同元素的烧蚀速率基本相同，择优烧蚀现象不明显，等离子体的成分更接近于待分析材料的成分。因此，在这一应用上，超短脉冲激光诱导等离子体光谱具有一定的优势，有可能发展为一种高灵敏度的无损分析方法。

Pulsed laser ablation is also used for composition analysis of materials, with emphasis on the application for detection and analysis of trace elements in the material. Solid and liquid materials are ablated by short or ultra-short pulsed lasers to generate cold plasmas with low temperatures. The composition of the induced plasmas is analyzed by laser induced plasma spectroscopy, in order to analyze the ablated materials indirectly and detect the impurities and trace elements incorporated in the materials. Several materials are selected as sample materials including aluminum alloy 6061 (Al 6061) for demonstration by ablating the samples with nanosecond or femtosecond pulsed lasers and analyzing and detecting the impurities with laser induced plasma spectroscopy. The main impurities in Al 6061 include 22ppm Na, 0.084% Si, 0.23% Cu, 0.67% Mg, 0.15％(Max) Mn, 0.04-0.35% Cr, 0.15%(Max) Ti, (Max) Fe 0.7%, 0.2% (Max) Zn. These impurities are identified. Even for Na with concentration of 22ppm, the Na signal can be unambiguous distinguished with high signal to noise using 0.1-mJ 5-ns laser pulses. The plasmas induced by femtosecond pulsed laser have lower temperatures with weak continuum and less interference for high detection sensitivity. Due to the defined threshold of femtosecond laser ablation, the fluctuation of plasma emission is small when generated by femtosecond pulsed laser near threshold. Only a few femtosecond laser pulses for ablation and a few signal accumulations for measurement are needed for a spectrum with certain signal to noise. With femtosecond pulsed laser, the ablation rates for all elements are almost the same with no obvious preferential ablation of some elements. The composition of the plasma is more close to that of the material to be analyzed. Hence, in the application for material analysis and trace element detection, ultra-short pulsed laser induced plasma spectroscopy has advantages and it is expected to develop a new method for high-sensitivity lossless analysis of trace elements in materials based on laser induced plasma spectroscopy.

本年度发表SCI论文5篇；结题1项国家自然科学基金项目，在研2项；培养硕士生2名。

Five papers are published in SCI magazines. A NSFC project is accomplished and another two are on going. Two M.S. graduate students completed their M.S. courses.

凝聚态光学性质与光谱学研究进展
The Progresses on the Study of Optical Properties of Condensed Matters and Spectroscopy

一、 主要研究进展 **Progress on Research**

1． 金属吸收材料的光学性质研究：用溅射方法生长系列金属和非金属锲形样品，精确测量了激光束经过锲形样品后的折射角，发现了锲形金膜存在明显的负折射率效应。

Study on the optical properties of some absorbing materials like metals： A series of edged Au samples were prepared with sputtering method. The refraction angle of a laser beam passing through an edged Au samples were carefully measured and the negative refraction phenomenon was obviously observed.

2． 新型三维高密度光存储方法的研究：目前取得的进展包括，1）文字编码制图：编写 VC 程序，以二进制方式读取文件内容，并生成 AutoCAD 的脚本文件; 2）制版：基于 SEM 的扫描电子束曝光系统，利用图形发生器在硅片上制版；3）CMOS 读图：选取平行度好、非相干光源，用配套软件 XCAP 读取各像素点的感应光强。

The progress of the study on 3D high areal density optical recording includes: 1) Cartography for coded text: A VC program has been compiled to read the text in binary form, and a script text in form of AutoCAD was generated. 2) Plate making: On the basis of scanning electronic beam exposal system, a graph generator was used to make pattern on a silicon wafer. 3) The recorded pattern was read out by CMOS devices using a corresponding software XCAP. An incoherent light beam with good parallelity was chose to illuminate the recorded pattern.

3． 太阳光谱波段高吸收率太阳能薄膜研究：制备了高吸收率太阳能薄膜，在太阳光谱波段吸收高达 90%以上。

Progress on the study of solar energy absorbing film includes: The solar energy absorbing films were fabricated and the absorptivity is larger than 90% over the whole wave band of the solar spectra.

4． 原位功能可控的复杂薄膜结构研究：1）完成透射和反射光谱光路与真空系统的高精度耦合，对薄膜材料的原位光谱分析系统进行调试，有效解决高真空条件下的光谱测量、器件高速旋转、入射角控制等难题，长时间工作的入射角控制精度优于 0. 2 度。2）与薄膜器件 0.1-1nm/s 的生长速率同步，结合离子反应辅助生长方法，对生长系统进行综合性能调试。在研究中，进一步完善器件的制备方法和工艺。3）完成对薄膜结构的快速和高分辨率的原位功能和特性的高精度光谱实时分析。原位动态功能分析的时间<0.5s,光谱分辨率优于 0.1nm。

The progress on the study of complicated functional film which structure is controllable in-situ includes: 1) The coupling of the optical path for reflection spectra and the transmission spectra with the vacuum system has been fulfilled, and the in-situ spectral analysis system for depositing film materials has been tested. Many difficult problems like accurate measurement of the spectra in high vacuum, high speed rotating of the work-piece, controlling of incident angle, etc. have been effectively solved. The deviation of the incident angle of the monitoring light beam is less than 0.2º. 2) The synthesis performance test for the film deposition system has been performed with a film device deposited at speed of 0.1-1nm/s under condition of ion beam aided deposition. During the process of the study, the preparation method and the technique conditions for the film devices were further perfected. 3) A real time analysis of the spectra obtained quickly and accurately in-situ for the film under deposition has been performed. The time for the dynamical analysis of in-situ test of the spectra is less than 0.5s and the spectra resolution is better than 0.1nm.

5．纳米硅晶薄膜研究：纳米硅晶的介电函数不同于体材料硅的介电函数，纳米硅晶在复合膜中的体含量对纳米硅晶介电函数及复合膜介电函数有重要影响；随着纳米硅晶体积含量的增加，复合膜介电函数谱出现明显的峰；椭偏仪作为一种快速、准确、非破坏性的工具，可以用于表征纳米硅晶及其与氧化物复合薄膜的光学性质和成分。

The dielectric function and optical constants of composite films of SiO_2 and nc-Si have been determined by the EMA model with the use of Lorentz oscillator model to describe the dispersion relation of nc-Si. In different sample, the mean size of nc-Si is different. By compare the dielectric spectra of the samples, we found the volume fraction of nc-Si plays a important role in the optical properties of the composite films in the range of visible light, with the increasing of fraction of nc-Si, the dielectric function of the composite have peaks, which is similar with bulk Si. Furthermore, all of these work are based on spectroscopic ellipsometry, which is a nondestructive and fast method, so it can be used to control the microstructure of the thin films, and the optical constants of the films which is very important in the design and fabrication of solid-state physics devices.

6． Si_3P_4, Ge_3P_4, Sn_3P_4 光学性质理论研究：理论分析表明 Si_3P_4, Ge_3P_4, Sn_3P_4 具有窄的间接带隙。M_3P_4 系列材料的模量低于 M_3N_4 系列材料的模量。Si_3P_4, Ge_3P_4, Sn_3P_4 的介电常数理论计算值分别为 14.66, 18.03, 以及 15.32。M_3P_4 系列材料中每个原子参与带间跃迁的有效电子数分别为 4.37,4.3 及 3.56。

The energy band and density of states for Si_3P_4, Ge_3P_4, Sn_3P_4 are theoretically analyzed. The results are in good agreement with the early works. The pseudocubic Si_3P_4, Ge_3P_4, Sn_3P_4 all have narrow indirect band gaps. The moduli of M_3P_4 are lower than that of M_3N_4. The dielectric constant and energy-loss function are also calculated .The static dielectric constants for three compounds are 14.66, 18.03, and 15.32, respectively. The saturation values of n_{eff} participating in the interband optical transitions of M_3P_4 are 4.37,4.3 and 3.56/per atom.

7. Ag-Bi_2O_3 纳米复合膜的光学性质研究：用 LAB600sp 共溅射系统生长系列 Ag-Bi_2O_3 纳米结构复合膜样品，在 150ºC 至 700ºC 温度范围对样品进行退火处理，然后对各样品进行椭圆偏振谱测试、扫描电子显微镜、X 射线衍射谱测试。实验结果表明，在 150ºC 至 450ºC 温度范围退火，Ag-Bi_2O_3 的光学常数主要受 Ag 颗粒尺寸影响。在较高退火温度下，Ag 的聚合对光学常数影响很大。

A series of Ag-Bi_2O_3 nano-composite films annealed at temperatures from 150ºC to 700ºC were prepared by using the LAB600sp co-sputtering system. For annealing temperatures from 150ºC to 450ºC, optical constants are mainly affected by Ag particle sizes. After annealed at temperatures 525ºC, 600ºC and 700ºC, the concentration and aggregation of Ag particles have a great impact on the optical constants of the composite films.

二. 科研项目及成果 **Research Projects and Results**

1. 本年度获国家自然科学基金委面上基金两项，项目名称为：“DNA 杂交的光学性质及其温度特性椭圆偏振光谱分析研究”及“纳光子薄膜器件制备的原位光谱快速获取和特性分析研究”。
2. 本年度完成国家自然科学基金一项,项目名称：“二维 CCD 快速成像光谱仪研制”。
3. 2006 年度本课题组承担了 4 项研究项目，其中国家自然科学基金面上项目 2 项，上海市科委重大项目 1 项，上海市科委自然科学基金重点项目 1 项。申请国家发明专利 1 项。
4. 发表论文 SCI 论文 12 篇，发表国内会议论文 5 篇及国际会议论文 4 篇。

In 2006, two projects supported by national science foundation of China (NSFC) were newly authorized, and one project from NSFC was fulfilled. At present, our group has been charged with 4 research projects, including 2 NSFC general projects, 1 grand project from Shanghai committee of science and technology, 1 key project from Shanghai natural science foundation. We applied for 1 item of national invention patent in 2006. In addition, we have published 12 papers included in SCI journals and published 5 papers in domestic conference and 4 papers in international conferences.

新型激光工作物质的研究
Research on novel laser working medium

对新型Nd配合物的研究取得了一定进展，获得了荧光寿命643 μs，量子产率77.4%的双核配合物。采用改进的自燃法制备了Nd2O3纳米颗粒，对纳米颗粒的表面修饰进行了系统的研究，获得了有机硅烷修饰的分散性很好的Nd2O3纳米颗粒，其在DMSO中在1064 nm波长处的荧光寿命高达492 μs，为Nd离子在液体中荧光寿命目前报道的最高值，量子产率为52.5%，有望成为一种低成本、高能量和高平均功率的液体激光介质。其结果发表于Advanced Materials和Applied Physics Letters，引起了相关领域的极大重视，进一步的研究工作将有望实现固体激光材料与流体热性能的完美结合，对国防、经济与科学研究均具有重大意义。

We have made progress on developing neodymium complexes. A novel binuclear neodymium complex was synthesized. Its photoluminescence life time is as high as 643 μs and the quantum yield goes up to 77.4%. Well dispersed Nd2O3 nanoparticles were prepared by using a modified solution-combustion method, followed by the silane coupling process. The modified Nd2O3 nanoparticles have a long photoluminescence life time of 492 μs at 1064 nm in DMSO. It is the highest life time of Nd ions in liquid according to report. The quantum yield is 52.5%. It is believed to be a promising liquid medium for low cost, high energy and high average power lasers. The research result was published in Advanced Materials and Applied Physics Letters, which raised great attention in related field. Further research work would lead to the perfect combination of the merits of solid laser medium and the thermal conductivity of fluid, which is of great importance to the national defense, economy and scientific research.

新型量子信息载体材料研究
New quantum information materials research

采用新型绿色低温合成方法得到了直径可控的InAs 纳米线，研究成果发表在***Nanotechnology***（2006, 17, 3416–3420）上；对InAs纳米线中的声子－等离子耦合等行为进行了研究，发现了一种纳米线直径相关的振动模的屏蔽/非屏蔽效应，其理论分析和讨论发表在***Applied Physics Letters***（2006, 89, 253117）上；提出了一种全新的纳米材料非平衡生长动力学模型，其工作被***ChemPhysChem***（2007, 8(5), 703-711）评价为“非常重要，将对设计新型纳米材料具有重要意义”。

Diameter controllable InAs nanowires were synthesized by a new green low-temperature route. The research work was publish in ***Nanotechnology*** (2006, 17, 3416–3420); The phonon-plasmon model in InAs nanowires was studied and a new nanowire diameter-dependent screen-unscreen LO mode behavior was discovered.

The theoretic discussion was published in ***Applied Physics Letters*** (2006, 89, 253117); A new kinetic model was built to describe the nanocrystal morphology evolution under nonequilibrium growth conditions. The work was published in ***ChemPhysChem*** (2007, 8(5), 703-711) with the comments of "very important" and "be very helpful in designing new nanoparticles".

在研课题和经费
Projects & Budgets

高能短脉冲激光系统信噪比和色散控制技术研究
负责人：钱列加, 起止年月：2006.1-2007.12
拨款来源：863, 2006AAXXX502 (15万)

高功率脉冲激光谐波转换光束质量研究
负责人：钱列加, 起止年月：2004.1-2006.12
拨款来源：国家基金 10376009(25万) ，2006年到款7.5万

激光诱导冷等离子体及其在痕量元素分析中的应用
负责人：应质峰, 起止年月：2004.1-2006.12
拨款来源：国家基金 10375014(31万) ，2006年到款9.3万

离子束刻蚀生成的自组织半导体量子点：形貌调控及发光性质研究
负责人：陆明, 起止年月：2004.1-2006.12
拨款来源：国家基金 10374016 (27万) ，2006年到款8.1万

特殊磁结构的自旋动力学研究
负责人：金庆原, 起止年月：2004.1-2006.12
拨款来源：国家基金 10374019 (30万) ，2006年到款9万

光照飞秒激射硫系玻璃和碲玻璃产生增强三阶光学非线性效应的机理及直写光波导的光-开关效应研究
负责人：徐雷, 起止年月：2004.1-2006.12
拨款来源：国家基金 60378034 (26万) ，2006年到款7.8万

二维CCD快速成像光谱仪研制(科学仪器基础研究专款)
负责人：陈良尧, 起止年月：2004.1-2006.12
拨款来源：国家基金 60327002 (70万) ，2006年到款21+2.1万

掺杂有序组装有机分子超薄膜热释电特性及应用
负责人：马世红, 起止年月：2004.1-2006.12
拨款来源：国家基金 60378035 (21万) ，2006年到款6.3万

超高密度、高速光-磁混合数字信息存储研究
负责人：金庆原（首席专家）, 起止年月：2004.7-2008.6
拨款来源：国家基金（重大）60490290 (800万) ，2006年到款48+11.2万

高强度飞秒激光的真空电子加速研究（实验部分工作）
负责人：钱列加, 起止年月：2004. 1-2007.12
拨款来源：国家基金（重点）10335030 (30万) ，2006年到款5万

基于ECR- PLA等离子体的原位掺杂机理和应用
负责人：吴嘉达, 起止年月：2005.1-2007.12
拨款来源：国家基金10475019（25万），2006年到款10万

介孔环境中掺杂液晶主-客体相互作用诱导光学非线性效应增强的
原初动力学过程研究
负责人：徐雷, 起止年月：2005.1-2007.12
拨款来源：国家基金 10474015 (29万) ，2006年到款11.6万

有机/无机复合材料热光效应增强机理及光波导器件制备研究
负责人：刘丽英, 起止年月：2005.1-2007.12
拨款来源：国家基金60478005（24万），2006年到款9.6万

N-Ga共掺P型ZnO薄膜的制备及其性质研究
负责人：孙剑, 起止年月：2005.1-2007.12
拨款来源：国家基金60408003（20万），2006年到款8万

1μm波段全系列宽带激光技术研究
负责人：范滇元, 起止年月：2006.1-2009.12
拨款来源：国家基金（重点）60538010（198万），2006年到款118.8+9.48万

超短脉冲信噪比测量方法研究
负责人：朱鹤元, 起止年月：2006.1-2008.12
拨款来源：国家基金 10576009 (28万) ，2006年到款16.8万

共振激励研究全息聚合物分散液晶的相分离
负责人：刘建华, 起止年月：2006.1-2008.12
拨款来源：国家基金10574031（30万），2006年到款18万

DNA杂交的光学性质及其温度特性的椭圆偏振光谱分析研究
负责人：李晶, 起止年月：2006.1-2008.12
拨款来源：国家基金60578047（23万），2006年到款13.8万

纳光子薄膜器件制备的原位光谱快速获取和特性分析研究
负责人：王松有, 起止年月：2006.1-2008.12
拨款来源：国家基金60578046（23万），2006年到款13.8万

基于回廊耳语模式的非圆对称光学微谐振腔的发光特性及传感性能研究
负责人：刘丽英, 起止年月：2006.1-2008.12
拨款来源：国家基金10574032（33万），2006年到款19.8万

半导体单量子点的光谱特性研究
负责人：王培南, 起止年月：2006.1-2006.12
拨款来源：国家基金60578045（7万），2006年到款7万

共轭聚合物固体激光材料及光特性研究
负责人：韦玮, 起止年月：2006.1-2008.12
拨款来源：国家基金60578039（24万），2006年到款14.4万

无机基有机杂化非线性光学材料的基础研究（分课题）
负责人：刘丽英, 起止年月：2006.1-2009.12
拨款来源：国家基金50532030（30万），2006年到款18万

含氟稀土共轭聚合物波导放大器
负责人：韦玮, 起止年月：2005.1-2007.12
拨款来源：国家基金60544001（19万），2006年到款9.5万

新型量子信息载体材料
负责人：彭波, 起止年月：2005.1-2007.12
拨款来源：国家基金90401027（24万），2006年到款9.6万

半导体表明的有机修饰与改性
负责人：许国勤（海外）彭波, 起止年月：2005.1-2007.12
拨款来源：国家杰出青年基金B 20428304（40万）

KDP晶体元件复合功能化学薄膜研究
负责人：彭波, 起止年月：2005.1-2007.12
拨款来源：国家基金10476008（25万），2006年到款10万

磁性复合有机半导体中的自旋注入、输运以及自旋相关效应
负责人：倪刚, 起止年月：2006.1-2008.12
拨款来源：国家青年基金60501002（25万），2006年到款15万

激光辅助混合磁存储的基础研究
负责人：金庆原, 起止年月：2006.11-2008.10
拨款来源：上海市重大项目06DJ14007（250万），2006年到款55万

新构型量子点微腔激光器
负责人：徐雷, 起止年月：2006.9-2008.9
拨款来源：上海市科委（重点）06JC14010（20万）

飞秒脉冲光参量放大的激光物理问题研究与新技术发展
负责人：钱列加, 起止年月：2006.1-2008.12
拨款来源：上海市教委曙光计划（12万），2006年到款6万

光参量啁啾脉冲放大光束耦合传输特性研究和增益稳定研究
负责人：王韬, 起止年月：2004. 4-2006.3
拨款来源：总装武器装备预研基金51480040204JW0701 (15万)

离子辐射引发的硅表面量子点阵列及其光学性质
负责人：陆明, 起止年月：2004. 1-2006.12
拨款来源：教育部优秀青年教师　(8万)

高分辨率高可靠性的智能光网络监控系统研究
负责人：陈良尧, 起止年月：2005.10-2007.9
拨款来源：上海市科委光科技专项　(110万) ，2006年到款80万

原位功能可控的复杂薄膜结构研究
负责人：郑玉祥, 起止年月：2005.10-2007.9
拨款来源：上海市科委　重点 (35万) ，2006年到款25+6.5万

可调谐高功率中红外激光光源及其应用研究
负责人：范滇元, 起止年月：2005.10-2007.9
拨款来源：上海市科委　重点 (30万) ，2006年到款21+6万

超高密度磁记录材料与器件性能研究
负责人：张宗芝、马斌、王松有，起止年月：2005.10-2007.12
拨款来源：首届浦江人才计划（50万），2006年到款10万

三维扫描多光子激发在超辨微区荧光分析中的应用
负责人：王培南, 起止年月：2005. 1-2006.12
拨款来源：上海市科委04DZ05617 (19万)

2006 年总到款：　787.18 万元人民币

发表文章情况
Publications

1. Wang K, Qian LJ, Luo H, Yuan P
"Ultrabroad supercontinuum generation by femtosecond dual-wavelength pumping in sapphire"，OPTICS EXPRESS，14 (13): 6366-6371 JUN 26 2006

2. Lu D, Qian LJ, Li YZ, Fan DY
"Frequency mixing of off-axis focused Gaussian beams: An approach to measure the phase velocity distribution"，APPLIED PHYSICS LETTERS，88 (26): Art. No. 261112 JUN 26 2006

3. Su WH, Qian LJ, Fu XQ, Luo H, Zhu HY, Wang T, Becc. K, Chen YF, Wise F
"Induced dispersion in phase-mismatched second-harmonic generation", JOURNAL OF THE OPTICAL SOCIETY OF AMERICA B-OPTICAL PHYSICS，23(1), 51-55(2006)

4. Yuan P, Qian LJ, Luo H, Zhu HY, Wen SC
"Femtosecond optical parametric amplification with dispersion pre-compensation"，IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS，12 (2), 181-186(2006)

5. Zhang H, Zhu HY, Qian LJ, Fan DY
"Analysis of leaky modes of photonic crystal slabs with deeply patterned lattice"，JOURNAL OF OPTICS A-PURE AND APPLIED OPTICS，8 (5): 483-488 MAY 2006

6. Li YZ, Qian LJ, Lu DQ, Fan DY
"Ultrafast four-wave mixing in single-pumped fibre optical parametric amplifiers"，JOURNAL OF OPTICS A-PURE AND APPLIED OPTICS，8 (8): 689-694 AUG 2006

7. Luo H, Qian LJ, Yuan P, Zhu HY
"Generation of tunable narrowband pulses initiating from a femtosecond optical parametric amplifier"，OPTICS EXPRESS，14 (22): 10631-10635 OCT 30 2006

8. Li Y, Qian LJ, Lu DQ, Fan DY
"Widely tunable femtosecond fiber optical parametric oscillator"，OPTICS COMMUNICATIONS，267 (2): 491-497 NOV 15 2006

9. Zhang H, Zhu HY, Qian LJ, et al.
"Optical properties of leaky modes of photonic crystal waveguides"，JOURNAL OF THE KOREAN PHYSICAL SOCIETY，49 (5): 2118-2123 Part 1 Sp. Iss. SI NOV 2006

10. Zheng WG, Han W, Qian LJ, Yuan P, Xie GQ, Luo H, Zhu HY, Fan DY
"Second-harmonic generation of weak femtosecond pulses under the condition of vanishing group-velocity mismatch"，JOURNAL OF OPTICS A-PURE AND APPLIED OPTICS，8 (11): 939-946 NOV 2006

11. Xie GQ, Qian LJ, Zhu HY, Yuan H
"Repetition rate multiplication in a diode-pumped femtosecond Nd : glass laser by using a coupled cavity"，JOURNAL OF THE KOREAN PHYSICAL SOCIETY，49 (4): 1438-1443 OCT 2006

12. Ng SP, Tang DY, Qian LJ
"Satellite pulse generation in diode-pumped passively Q-switched Nd : $GdVO_4$ lasers"，IEEE JOURNAL OF QUANTUM ELECTRONICS，42 (7-8): 625-632 JUL-AUG 2006

13. Liu JF, He XM, Xia CT, Zhou GQ, Zhou SM, Xu J, Yao W, Qian LJ
"Preparation of crystalline beta barium borate thin films on Sr2+-doped alpha barium borate substrates by liquid phase epitaxy"，THIN SOLID FILMS，510 (1-2): 251-254 JUL 3 2006

14. Song QH, Liu LY, Xiao SM, Zhou XC, Wang WC, Xu L
"Unidirectional high intensity narrow-linewidth lasing from a planar random microcavity laser"，PHYSICAL REVIEW LETTERS，96 (3): Art. No. 033902 JAN 27 2006

15. He Z, Li YG, Zhang YW, Li DX, Liu LY, Xu L
"Er3+/Yb3+ co-doped waveguide amplifier and lossless power splitter fabricated by a two-step ion exchange on a commercial phosphate glass"，JOURNAL OF THE KOREAN PHYSICAL SOCIETY，49 (5): 2159-2163 Part 1 Sp. Iss. SI NOV 2006

16. Yang P, Ji LY, Liu LY, Xu L, Fu HY, Xiao F
"Large second-order nonlinearity from a dip-coated pure dye (4-(2-(3,3-dicyanomethylene-5,5-dimethyl-1-cyclohexylidene)vinyl)phenyl(1-naphthyl)phenylamine) thin film"，JOURNAL OF THE KOREAN PHYSICAL SOCIETY，49 (5): 2164-2167 Part 1 Sp. Iss. SI NOV 2006Wu X, Liu LY,

17. Ye MX, Xu L, Ji LY, Liu LY, Wang WC
"Synthesis of novel cross-linked polyurethane containing modified stilbene and Schiff base chromophores for second-order nonlinear optics"，JOURNAL OF NONLINEAR OPTICAL PHYSICS & MATERIALS，15 (2): 275-285 JUN 2006

18. Liu X, Yang P, Ji LY, Liu LY, Xu L
"The dynamic influence of photoisomerization on optical reorientation in absorbing isotropic liquid crystals", OPTICS EXPRESS, Vol.14, No.24, 11709-11714, 2006

19. Li DX, Zhang YW, Liu LY, Xu L
"Low consumption power variable optical attenuator with sol-gel derived organic/inorganic hybrid materials", OPTICS EXPRESS, 14 (13): 6029-6034 JUN 26 2006

20. Wu X, Zhang YW, Li DX, Wang WC, Xu L
"Low electric power drived thermo-optic multimode interference switches with tapered heating electrodes", OPTICS COMMUNICATION, S 258 (2): 135-143 FEB 15 2006

21. Li WQ, Qi LJ, Yang XJ, Ling L, Fan WB, Zhao YY, Lu M
"Synergetic effect between ion energy and sample temperature in the formation of distinct dot pattern on Si(110) by ion-sputter erosion", Applied Surface Science, 252 (22): 7794-7800 SEP 15 2006

22. Fan WB, Qi LJ, Sun HT, Zhao YY, Lu M
"Modification of Si nanostructures on Si(100) by post ion millin", Nanotechnology, 17 (8): 1878-1883 APR 28 2006

23. Fan WB, Ling L, Qi LJ, Li WQ, Sun HT, Gu CX, Zhao YY, Lu M
"The effect of redeposition on the ion flux dependence of Si dot pattern formation during ion sputter erosion", Journal of Physics: Condensed Matter, Vol.18, p.3367-3375, 2006

24. Zha CL, Ma B, Zhang ZZ, Gao TR, Gan FX, Jin QY
"L1(0) FePt films deposited on pyramid-type Si substrate for perpendicular magnetic recording media", APPLIED PHYSICS LETTERS, 89 (2): Art. No. 022506 JUL10 2006

25. Zhang YS, Zhang ZZ, Liu YW, Ma B, Jin QY
"Spin-transfer-induced magnetization switching in magnetic tunnel junctions", JOURNAL OF APPLIED PHYSICS, 99 (8): Art. No. 08G515 APR 15 2006

26. Xu M, Wang SY, Yin G, Chen LY, Jia Y
"Theoretical investigation of the electronic and optical properties of pseudocubic Si3P4, Ge3P4 and Sn3P4", OPTICS EXPRESS, 14 (2): 710-716 JAN 23 2006

27. Xu M, Wang SY, Yin G, Li J, Zheng YX, Chen LY, Jia Y
"Optical properties of cubic Ti3N4, Zr3N4, and Hf3N4", APPLIED PHYSICS LETTERS, 89 (15): Art. No. 151908 OCT 9 2006

28. Xu P, Mi L, Wang PN
"Improved optical response for N-doped anatase TiO2 films prepared by pulsed laser deposition in N-2/NH3/O-2 mixture", JOURNAL OF CRYSTAL GROWTH, 289 (2): 433-439 APR 1 2006

29. Ma J, Chen JY, Guo J, Wang CC, Yang WL, Xu L, Wang PN
"Photostability of thiol-capped CdTe quantum dots in living cells: the effect of photo-oxidation", Nanotechnology, 17 (9): 2083-2089 MAY 14 2006

30. Zhang Y, He J, Wang PN,Chen JY, Lu ZJ, Lu DR, Guo J, Wang CC, Yang WL
"Time-dependent photoluminescence blue shift of the quantum dots in living cells: effect of oxidation by singlet oxygen", J. Am. Chem. Soc., 128 (2006) 13396-13401

31. Wu RWK, Chu ESM, Yow CMN, Chen JY
"photodynamic effects on nasopharyngeal carcinoma (NPC) cells with 5-aminolevulinic acid and its hexyl ester", Cancer Letters, 242, 112-119 (2006)

32. Jin YL, Chen JY, Xu L, Wang PN
"Refractive index measurement for biomaterial samples by total internal reflection", Phys. Med. Biol., 51 (2006) N371-N379

33. Chu ESM, Wu RWK, Yow CMN, Wong TKS, Chen JY
"The cytotoxic and genotoxic potential of 5-aminolevulinic acid on lymphocytes: a comet assay study", Cancer Chemother Pharmacol., 58: 408-414 (2006)

34. Ji ZY, Yang GR, Vasovic V, Cunderlikova B, Suo ZH, Nesland JM, Peng Q
"Subcellular localization pattern of protoporphyrin IX is an important determinant for human carcinoma its photodynamic efficiency of and normal cell lines", JOURNAL OF PHOTOCHEMISTRY AND PHOTOBIOLOGY B-BIOLOGY, 84 (3): 213-220 SEP 1 2006

35. Lu YF, Sun J, Yu D, Shi LQ, Dong ZB, Wu JD
"ECR plasma assisted pulsed laser deposition for compound host film synthesis and in situ doping", J. Vac. Sci. Technol., A 24 (3), 413–417 (2006)

36. Chen JY, Mak Naiki, Leung Wongneng, Cheung Naihou, Peng Qian
"Comparison of merocyanine 540-mediated photodynamic action on leukemia cells between pulsed and continuous wave light sources"，Journal of Environmental Pathology, Toxicology, and Oncology，25: 217-222 (2006)

37. Mi XQ, Chen JY, Zhou LW
"Effect of low power laser irradiation on disconnecting the membrane-attached hemoglobin from erythrocyte membrane"，J.Photochem.Photobiol.B:boil，83, 146-150 (2006)

38. Ma J, Chen JY, Guo J, Wang CC, Yang WL, Cheung NH, Wang PN
"Surface treatment to enhance photostability of thiol-capped CdTe quantum dots in aqueous solution and in living cells"，Nanotechnology，17 (2006) 5875–5881

39. Furre IE, Moller MTN, Shahzidi S, Nesland JM , Peng Q
"Involvement of both caspase-dependent and -independent pathways in apoptotic induction by hexaminolevulinate-mediated photodynamic therapy in human lymphoma cells"，APOPTOSIS，11 (11): 2031-2042 NOV 2006

40. Amarzguioui M, Peng Q, Wiiger MT, Vasovic V, Babaie E, Holen T, Nesland JM, Prydz H
"Ex vivo and in vivo delivery of anti-tissue factor short interfering RNA inhibits mouse pulmonary metastasis of B16 melanoma cells"，CLINICAL CANCER RESEARCH，12 (13): 4055-4061 JUL 1 2006

41. Hu W, Xu N, Sheng YQ, Zhang TW, Sun J, Wu JD, Ying ZF
"Synthesis of nanocrystalline carbon nitride films by glow discharge plasma beam deposition"，Mater. Sci. Eng., A 432 (1-2) 142-148 (2006)

42. Shen XK, Sun J, Xu N, Ying ZF, Shi LQ, Wu AM, Gong ZS, Wu JD
"Spectroscopic study on pulsed laser ablation of graphite target in ECR nitrogen plasma for carbon nitride film deposition"，Diamond Rel. Mater., 15 (9) 1350–1356 (2006)

43. Wu AM, Sun J, X.K. Shen XK, Xu N, Ying ZF, Dong ZB, Wu JD
"Diamond-like carbon thin films prepared by ECR argon plasma assisted pulsed laser deposition"，Diamond Rel. Mater., 15 (9) 1235–1241 (2006)

44. Xu N, Xu YL, Li L, Sheng YQ, Zhang TW , Wu JD, Sun J, Ying ZF
"Arsenic doping for synthesis of nanocrystalline p-type ZnO thin films"，J. Vac. Sci. Technol., A 24 (3), 517–520 (2006)

45. Ma SH, Li SH, Wang WC, Wang GS, Sun JL, Meng XJ, Chu JH
"Pyroelectric figure of merit in alternating hemicyanine/NC Langmuir-Blodgett films incorporating barium ions"，COLLOIDS AND SURFACES A-PHYSICOCHEMICAL AND ENGINEERING ASPECTS, 284: 74-77 Sp. Iss. SI AUG 15 2006

46. Wang CA, Ma SH, Zeng H, Li J, Chen LY, Wang WC
"Spectroscopic ellipsometry on a novel cyanine dyes in Langmuir-Blodgett multilayers"，COLLOIDS AND SURFACES A-PHYSICOCHEMICAL AND ENGINEERING ASPECTS, 284: 414-418 Sp. Iss. SI AUG 15 2006

47. Li SH, Ma SH, Li B, Sun JL, Wang GS, Meng XJ, Chu JH
"Enhancement of ferroelectricity in Langmuir-Blodgett multilayer films of weak-polar organic molecules"，COLLOIDS AND SURFACES A-PHYSICOCHEMICAL AND ENGINEERING ASPECTS，284: 419-423 Sp. Iss. SI AUG 15 2006

48. Xu CH, Zheng TX, Zhang RJ, Chen LY
"The effect of light-beam wobble on the noise characteristics for an optical disk"，JOURNAL OF THE KOREAN PHYSICAL SOCIETY，49 (5): 2103-2107 Part 1 Sp. Iss. SI NOV 2006

49. Zhang ZJ, Zheng Z, Qiang LL, Ma Z, Xie SX, Peng B, Huang W,Wei W
"Novel water-soluble shape-regulatable luminescent nanoparticles by non-covalently bonded self-assembly"，MACROMOLECULAR RAPID COMMUNICATIONS，27 (16): 1317-1322 AUG 23 2006

50. Zhang ZJ, Qiang LL, Liu B, Xiao XQ,Wei W, Peng B, Huang W
"Synthesis and characterization of a novel water-soluble block copolymer with a rod-coil structure"，MATERIALS LETTERS，60 (5): 679-684 MAR 2006

51. Jiang HJ, Wang HY, Feng JC, Wang CM, Fan QL, Wei W, Huang W
"Novel oligomers based on fluorene and 2,4-difluorobenzene: Correlation between the structures and optical properties", JOURNAL OF POLYMER SCIENCE PART A-POLYMER CHEMISTRY, 44 (14): 4346-4353 JUL 15 2006

52. Jiang HJ, Feng JC, Wang HY, Wei W, Huang W
"A novel fluorene-containing oligomer with relative high photoluminescence quantum efficiency"，JOURNAL OF FLUORINE CHEMISTRY，127 (7): 973-976 JUL 2006

53. Gong T, Feng JC, Wei W, Huang W
"Recent progress in diarylethene as a photoswitching unit", PROGRESS IN CHEMISTRY , 18 (6): 698-706 JUN 2006

54. Xu XX, Yu KH, Wei W, Peng B, Huang SH, Chen ZH, Shen XS
"Raman scattering in InAs nanowires synthesized by a solvothermal route", APPLIED PHYSICS LETTERS, 89,253117 (2006)

55. Xu XX, Wei W, Qiu XM, Yu KH, Yu RB, Si SM, Xu GQ, Huang W,Peng B
"Synthesis of InAs nanowires via a low-temperature solvothermal route", NANOTECHNOLOGY, 17 (14): 3416-3420 JUL 28 2006

56. Yin G, Wang SY, Xu M, Chen LY
"Theoretical calculation of the optical properties of gold nanoparticles", JOURNAL OF THE KOREAN PHYSICAL SOCIETY, 49 (5): 2108-2111 Part 1 Sp. Iss. SI NOV 2006

57. Wu X, Yu J, Wei S, Zhou P, Li J, Chen LY
"Effect of Ag concentration and annealing on the optical properties of Ag nanoparticle composite films", JOURNAL OF THE KOREAN PHYSICAL SOCIETY, 49 (5): 2155-2158 Part 1 Sp. Iss. SI NOV 2006

58. Sun B, Chen YR, Zhou P, Xu CH, Kong YF, Zheng YX, Chen LY
"Ellipsometric study of the optical properties of silicon-based Si : SiO2 composite thin films under different annealing temperatures", JOURNAL OF THE KOREAN PHYSICAL SOCIETY, 49 (5): 2184-2187 Part 1 Sp. Iss. SI NOV 2006

59. Kong YF,Wang SY, Xu M, Yin G, Chen LY, Jia Y
"Density functional calculations for ferrornagnetic Mn3Ge with a Cu3Au-type structure", JOURNAL OF THE KOREAN PHYSICAL SOCIETY, 49 (5): 2188-2191 Part 1 Sp. Iss. SI NOV 2006

60. Zhou P, Chen YR, Wu YH, Lin YY, Tang TA, Li J, Chen LY
"Structural study and optical response of Ag : Bi2O3 nanoswitch materials", JOURNAL OF THE KOREAN PHYSICAL SOCIETY, 49 (5): 2151-2154 Part 1 Sp. Iss. SI NOV 2006

61. Zhou L, Pan ZY, Wang YX, Zhu J, Liu TJ, Jiang XM
"Stable configurations of C-20 and C-28 encapsulated in single wall carbon

nanotubes”，NANOTECHNOLOGY，17 (8): 1891-1894 APR 28 2006

62．Gao J, Zha CL, Ma B, Wang SY, Zhang ZZ, Jin QY
“Magnetic and magneto-optical properties of co-sputtering FePt films”，JOURNAL OF THE KOREAN PHYSICAL SOCIETY，49 (5): 2099-2102 Part 1 Sp. Iss. SI NOV 2006

63．Qiu HS, Gao J, Ma B, Zhang ZZ, Jin QY
“Spin reorientation transition and its gas absorption effect on Ni/fct-Fe films at 110 K”，JOURNAL OF THE KOREAN PHYSICAL SOCIETY，49 (5): 2095-2098 Part 1 Sp. Iss. SI NOV 2006

64．Zang LK, Wang YX, Pan ZY, Zhou L, Liu TJ, Zhu J, Jiang XM
“Ar-buffer-assisted deposition of Cu-13 on Cu(111) surfaces”，SURFACE SCIENCE，600 (3): 527-531 FEB 1 2006

65．Liu TJ, Wang YX, Pan ZY, Jiang XM, Zhou L, Zhu J
“Atomistic simulation of He clustering and defects produced in Ni”，CHINESE PHYSICS LETTERS，23 (5): 1261-1264 MAY 2006

66．Sui Z, Lin HH, Wang JJ, Zhao HM, Li MZ, Qian LJ, Zhu HY, Fan DY
“A compact nanosecond-pulse shaping system based on pulse stacking in fibres”，CHINESE PHYSICS LETTERS，23 (8): 2074-2076 AUG 2006

67．Zhang XM, Qian LJ, Yuan P, Luo H, Zhu HY, Zhu QH, Wei XF, Fan DY
“Femtosecond optical parametric amplifier for petawatt Nd : Glass lasers”，CHINESE PHYSICS LETTERS，23 (5): 1204-1206 MAY 2006

68．Xie GQ, Wang T, Zhu HY, Qian LJ
“Diode-pumped tunable laser with dual Cr:LiSAF rods”，Chin. Phys.，15 (3), 547-551 (2006)

69．Zheng WG, Qian LJ, Yuan P, Luo H，Zhu HY
“Second harmonic generation of femtosecond laser at one micron in a partially deuterated KDP”，Chin. Phys. Lett.，23 (1), 139-142 (2006)

70．Wei XH, Qian LJ, Li KY, Zhu HY, Fan DY
“Stimulated Raman scattering of a modulated laser beam in air: a perturbation approach”，CHINESE PHYSICS LETTERS, 23 (11): 2985-2988 NOV 2006

71．Shao HZ, Li YF, Zhuang J
“Magic number behaviour and structures of silicon dioxide-based clusters”，

CHINESE PHYSICS LETTERS,23(2) 428-431 FEB 2006

72. Wang SY, Duan GY, Qiu JH, Jia Y, Chen LY
"PtN in zinc-blende structure: An unstable metallic transition-metal nitride compound"，ACTA PHYSICA SINICA, 55 (4): 1979-1982 APR 2006

73. Fang YC, Zhang ZJ, Shen J, Lu M
"Photoluminescence from electron-beam deposited CeO2 thin film after high temperature annealing"，Chinese Physics Letters, 23 (7): 1919-1922 JUL 2006

74. Zha CL, Zhang YS, Ma B, Zhang ZZ, Jin QY, Gan FX, Liu YW, Gao TR
"Perpendicular exchange coupling in TbFeCo/FePt bilayer films"，CHINESE PHYSICS LETTERS, 23 (4): 978-981 APR 2006

75. Zhang ZZ, Zhao H, Cardoso S, Freitas PP
"Effect of anti-diffusion oxide layer on enhanced thermal stability of magnetic tunnel junctions"，CHINESE PHYSICS LETTERS, 23 (4): 932-935 APR 2006

76. Zhang YP，Yan SS, Liu YH, Ren MJ, Fang Y，Chen YX , Liu GL, Mei LM, Liu JP, Qiu JH，Wang SY, Chen LY
"Magneto-optical Kerr rotation enhancement in Co-ZnO inhomogeneous magnetic semiconductor", APPLIED PHYSICS LETTERS, 89 (4): Art. No. 042501 JUL 24 2006

77. Zhao ZC, Wang H, Xiao SQ, Huang D, Gu YZ, Xia YX, Jin QY, Zha CL, Wu XS
"Inverse magnetoresistance caused by nano-nitride-layer doping at the inner interfaces in the sandwich of Co/Cu/Co", J. Appl. Phys., 99(8), 08R507 (2006)

78. Zhao ZC, Wang H, Xiao SQ, Zhong XX, Gu YZ, Xia YX, Jin QY, Wu XS
"Doping effects of a nano-nitride layer at the interfaces of a NiO/Co/Cu/Co/Cu tructure", Phys. Stat. Sol. A 203(5), 956 (2006)

79. Ma SH, Gao F, Zeng H, Wang C, Wang WC, Tian H
"Structure characterization of new cyanine dye Langmuir-Blodgett multilayers by polarized UV-vis spectroscopy", SPIE Vol.6294, 62940G-01-07, 2006

80. Wang C, Gao F, Zeng H, Ma SH, Liu W, Liu LY, Wang WC, Tian H
"Linear and nonlinear optical properties in new cyanine dye Langmuir-Blodgett multilayers", SPIE Vol.6331, 633114-01-05, 2006

81. Zhang XM, Fan DY, Zeng XM, Wei XF, Huang XJ, Wang X, Zhu QH, Qian LJ

"Acquiring 1053 nm femtosecond laser emission by optical parametric amplification based on supercontinuum white-light injection", Optics Letters Vol.31, No.5,646 (2006)

82. 王科，钱列加
"高功率超短激光脉冲信噪比的研究"，强激光与粒子束, 18(1) 1-5(2006)

83. 叶云霞，余柯涵，钱列加，范滇元，彭波
"Nd^{3+}螯合物的含氢有机溶液光谱性能研究"，物理学报，55（12）6424-06,（2006）

84. 静国梁，余玮，李英骏，赵诗华，钱列加，田友伟，李丙辰
"非相对论线偏振激光下的J×B加热"，物理学报，55（7）3475-05（2006）

专著

1. 干福熹，徐雷
《Photonic Glasses》World Scientific Publishing Co.Pet.Ltd.，
2006年 ISBN 981-256-820-4

2. 马斌，金庆原
《光磁混合存储及其材料》国家重点图书《中国材料工程大典》第12卷第八编第13章，化学工业出版社，2006年 ISBN7-5025-7314-3

参加国际、国内会议情况
Scientific Activities

1. Xu L (invited talk)
   "Directional lasing from microcavities", International Winter School on Applications of Modern Optics to condensed Matter Sciences，Beijing, China Jan.4-9, 2006

2. Chen LY (invited talk)
   "Densely-folded spectral images of the CCD spectrometer working in the full 200-1000nm wavelength range with high resolution", The 3rd ROK-PRC Optics Technology Workshop，Jeju, Korea, March 1-4，2006

3. Xu L (invited talk)
   "Directional emission from microcavities", International Symposium on Advanced Photonics (ISAP), Gwangju，Korea, May 9-10 2006

4. Xu L (invited talk)
   "Highly collimated laser emission from a peanut-shaped microcavity", The 8th International Conference on Transparent Optical Networks: ICTON 2006, Nottingham, United Kingdom, June18-22, 2006

5. Xu L (invited talk)
   "Hybrid functional materials for micro-photonic", Chinese-French Seminar on Functional Inorganic, Organic and Hybrid(Nano) Materials, Shanghai, China, Nov. 21-22, 2006

6. Chen LY (invited talk)
   "Densely-folded spectral images of the CCD spectrometer working in the full 200-1000nm wavelength range with high resolution", The 7th Chitose International Forum (CIF'7), Chitose, Japan, Nov. 27-28, 2006

7. Zha CL, Ma B, Zhang ZZ, Jin QY (oral)
   "Formation of (100) texture in Fe films fabricated by DC magnetron" sputtering, International Conference on Magnetism (ICM2006), Kyoto, Japan, August 20-25, 2006

8. Xu L, Liu X, Ji LY, Liu LY (oral)
   "Ultrafast optical nonlinearity enhancement of azo-dye doped liquid crystals", Photonics Wast, San Jose, California, USA, Jan.21-26, 2006, SPIE 6135-26

9. Liu LY, Li DX, Zhang YW, Xu L (oral)
   "An8-channel integrated variable optical attenuator fabricated with stable organic/inorganic hybrid materials", 4th International Symposium on Advanced Photonoc Science and Technology (4th ISAPST), Seoul and Kyeongju/Puhang, Korea, Aug.28-31, 2006

10. Song QH, Xiao SM, Liu LY, Xu L (oral)
"Planar random cavity lasers", 4th International Symposium on Advanced Photonoc Science and Technology (4th ISAPST), Seoul and Kyeongju/Puhang, Korea, Aug.28-31, 2006

11. Qian LJ, Zhu HY, Yuan O, Luo H, Fan DY (oral)
"Generation of synchronized tunable femtosecond and picosecond pulses based on parametric amplifications", 4th International Symposium on Advanced Photonoc Science and Technology (4th ISAPST), Seoul and Kyeongju/Puhang, Korea, Aug.28-31, 2006

12. Wang F, He B, Sun X, Dai HT, Liu JH (oral)
"Matrix modeling in real time observation of laser induced photopolymerization", 4th International Symposium on Advanced Photonoc Science and Technology (4th ISAPST), Seoul and Kyeongju/Puhang, Korea, Aug.28-31, 2006

13. Xie S, Zhang Z, Wei W (oral)
"Syntheses and optical properties of polyimide-based materials", 4th International Symposium on Advanced Photonoc Science and Technology (4th ISAPST), Seoul and Kyeongju/Puhang, Korea, Aug.28-31, 2006

14. Wu YH, Gu W, Chen YR, Zhu XS, Zhou P, Zheng YX, Chen LY (oral)
"Experimental observation of the net negative refraction for the single air/pure-Au interface structure in the visible region", 4th International Symposium on Advanced Photonoc Science and Technology (4th ISAPST), Seoul and Kyeongju/Puhang, Korea, Aug.28-31, 2006

15. Feng SZ, Zhang RJ, Zheng YX, Li J, Wang SY, Chen LY (Poster)
"Spectroscopic ellipsometric study of silicon nano-crystals composite thin films with size-controlled silicon dioxide", 4th International Symposium on Advanced Photonoc Science and Technology (4th ISAPST), Seoul and Kyeongju/Puhang, Korea, Aug.28-31, 2006

16. Jia LC, Mao PH, Zheng YX, Zhang RJ, Chen LY (Poster)
"the propagation of converged light from high-NA optical system in multilayer thin film structure", 4th International Symposium on Advanced Photonoc Science and Technology(4th ISAPST), Seoul and Kyeongju/Puhang, Korea, Aug.28-31, 2006

17. Zhang YW, Mao ZL, Liu LY, Xu L (oral)
"Non-hydrolytic organic-inorganic hybrid material synthesis and waveguide fabrication with low absorption at 1550nm", 2006'Sol-Gel Symposium of China &International Forum, Wenzhou, China, Nov.22-25,2006

18. Li YG, Yang H, He ZA, Liu LY, Wang WC, Li FY, Xu L (oral)
"Significant increment of photoluminescence quantum yield by efficiently prohibiting fluorescence quenching in erbium(III) organic complexes", Photonics West, San Jose, California, USA, Jan. 21-26, 2006

19. Chen LY (oral)
"Densely-folded spectral images of the CCD spectrometer working in the full 200-1000nm wavelength range with high resolution", The 6th International Symposium on Instrumentation and Control Technology, Beijing, China, Oct. 13-15, 2006.

20. Chen LY (oral)
"Densely-folded spectral images of the CCD spectrometer working in the full 200-1000nm wavelength range with high resolution", The 5th Asia Pacific Laser Symposium, Nov. 23-27, 2006, Guilin, Guangxi, China.

21. Chen YR, Chen LY (oral)
"Densely-folded spectral images of the CCD spectrometer working in the full 200-1000nm wavelength range with high resolution", 第6届全国光学大会，广州，2006年9月

22. Chen YR, Chen LY (oral)
"Densely-folded spectral images of the CCD spectrometer working in the full 200-1000nm wavelength range with high resolution", 第十三届全国凝聚态物质光学性质学术会议，厦门，福建, 2006年8月

23. 金庆原 (invited talk)
"基于FePt有序合金的热辅助磁记录介质研究"，
2006年北京材料周（2006BIMW）国内会议，2006年6月25-30日，北京

24. 马斌，查超麟，何世海，张宗芝，金庆原 (oral)
"易轴倾斜的FePt有序合金薄膜介质",中国物理学会2006年秋季学术会议(CPS2006)北京，2006年9月15-17日

25. 张贻松，张宗芝，马斌，金庆原 (oral)
"磁性隧道结器件中自旋极化电流诱导的磁化反转"，第五届全国磁性薄膜与纳米磁学会议，2006年5月12-15日，苏州

26. 李晶，周仕明，金庆原 (oral)
"光辅助磁记录静态及动态测试系统的研制"，第五届全国磁性薄膜与纳米磁学会议，2006年5月12-15日，苏州

27. 查超麟，何世海，马斌，张宗芝，干福熹，金庆原 (oral)
“应力诱导FePt薄膜有序化的研究”，第五届全国磁性薄膜与纳米磁学会议, 2006年5月12-15日，苏州

28. 何世海，马斌，张宗芝，金庆原 (oral)
“直流磁控溅射Fe(200)织构薄膜的形成机理”，第五届全国磁性薄膜与纳米磁学会议，2006年5月12-15日，苏州

29. 徐雷 (oral)
“微腔光子学进展”，第十三届激光物理讨论会，湖南张家界，2006.10.20-25

30. 宋清海，肖淑敏，周信传，刘丽英，徐雷 (oral)
“平面随机微腔中可调谐方向性出射随机激光的研究”，中国光学学会2006年学术大会，广东广州，2006.9.3-6

31. Song QH, Xiao SM, Zhou XC, Liu LY, Xu L (oral)
“Directional random laser emissdion from planar random microcavity”, 2006 物理博士生论坛，北京，2006，获优秀论文奖

32. 李毅刚，李皓，汤恒晟，刘丽英，徐雷 (oral)
“溶胶凝胶法制备高掺镱光纤预制棒的研究”，中国光学学会2006年学术大会, 广东广州, 2006.9.3-6

33. 徐雷 (oral)
“微纳激光新技术及其在科学研究中的应用”, 上海物理学会年会, 2006.12.30

34. 杨佩，姬利永，刘秀，刘丽英，徐雷 (oral)
“光致异构类染料掺杂导致的液晶光学非线性增强效应研究”，中国物理学会秋季会议，北京，2006.9.14-18

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赵有源 教授，高分辨率激光光谱与固体光谱烧孔研究
ZHAO Youyuan, Prof., Laser spectroscopy and spectral hole burning in solids

郑家骠 教授，表面、界面的非线性光学性质
ZHENG Jiabiao, Prof., Optical nonlinear properties of surfaces and interfaces

吴善亮 实验师 WU Shanliang, Engineer

邢中菁 实验师 XING Zhongjing, Engineer

博士后: Postdoctoral fellows

吴翔(WU Xiang)

博士生: Ph.D. candidates

03级 盛明裕(SHENG Mingyu), 张豫(ZHANG Yu), 罗航(LUO Hang)，
张艳武(ZHANG Yanwu), 袁鹏(YUAN Peng),

04级 邬云华(WU Yunhua), 何子安(HE Zian), 谢国强(XIE Guoqiang),
宋清海(SONG Qinghai), 糜岚(MI Lan), 蒋丹(JIANG Dan),
魏小红(WEI Xiaohong), 谢逸群(XIE Yiqun), 刘伟(LIU Wei),
尚磊(SHANG Lei), 王科(WANG Ke), 杨佩(YANG Pei)

05级 陆大全(LU Daquan), 杨华(YANG Hua), 李永忠(LI Yongzhong),
廖嘉霖(LIAO Jialin)，张启明(ZHANG Qiming), 任杨(REN Yang),
李晓凡(LI Xiaofan)

06级 周薇溪(ZHOU Weixi)，胡婧婷(HU Jngting), 周靖(ZHOU Jing),
沈轶群(SHEN Yiqun), 张鹏(ZHANG Peng), 胡巍(HU Wei),
张尉(ZHANG Wei), 李皓(LI Hao)

硕士生: **M.S. students**

04级　周信传(ZHOU Xinchuan), 魏慎金(WEI Shenjin), 孙海彤(SUN Haitong), 冯守志(FENG Shouzhi), 肖金华(XIAO Jinhua), 张璋(ZHANG Zhang), 贾李琛(JIA Lichen), 张贻松(ZHANG Yisong), 姜书同(JIANG Shutong), 谢志强(XIE Zhiqiang), 蒋建兴(JIANG Jianxing), 陆舟军(LU Zhoujun), 殷刚(YIN Gang), 张成先(ZHANG Chengxian), 张廷卫(ZHANG Tingwei) 顾闻(GU Wen)

05级　潘苏醒(PAN Suxing), 毛鹏辉(MAO Penghui)， 赵慧(ZHAO Hui), 刘明辉(LIU Minghui)，徐明(XU Ming), 俞丹(YU Dan)， 邱静燕(QIU Jingyan), 邵劼(SHAO Jie)，吴遐(WU Xia), 李政皓(LI Zhenghao), 魏峡(WEI Lai)

06级　唐隽逸(TANG Juanyi), 戴仲鸿(DAI Zhonghong), 赵佳琦(ZHAO JiaQi), 方芳(FANG Fang), 张东方(ZHANG Dongfang), 李喧(LI Xuan), 陈一鸣(CHEN yiming), 李锦江(LI Jinjiang),刘燕妮(LIU Yaini), 尹德全(YIN Dequan), 陶光明(Tao Guangming), 冯雷(FENG Lei), 王娜(WANG Na), 许晓锋(XU Xiaofeng)

光学工程：**Optical Engineering**

05级　孙学诚(SUN Xuecheng), 何世海(HE Shihai), 吴云飞(WU Yunfei), 卢意飞(LU Yifei)

06级　顾培培(GU Peipei), 裴斐(PEI Fei), 段朝阳(DUAN ChaoYang), 蔡清元(CAI Qingyuan), 刘磊(LIU Lei)

本系访问学者和部分参观人员
Guest Scientists & Some Visitors

一. 重点实验室高访学者

1. 陈国荣，男，出生年月 1954. 8，工学博士, 教授, 华东理工大学
（2006.7-2008.7）“主动光学用新型硫系玻璃及性能表征”。 5万

2. 陆永峰，男，出生年月 1963.8, 博士, 教授, Univ. of Nebraska-Lincoln,USA
（2006.7-2008.7）“纳米材料激光处理和表征”。 5万

3. 陆斌，男，出生年月 1967.9, 博士, 技术主管经理, Seagate Technology，USA
（2006.12-2008.12）“介质研究的学术培训和技术指导”。 5万

4. 许春晖（Chris Xu）男，出生年月 1967.12, 博士, 副教授, Cornell Univ., USA
（2006.12-2008.12）“collaborate with Prof. Liejia Qian in the area of ultrafast and nonlinear optics”。 5万

二．部分来室访问及作报告的学者

2006.4.5-4.11 Prof. Roy William Chantrell， 英国 York 大学
系列报告：
1. “Nanomagnetism”
2 “Future trends and physical limits of high density magnetic recording”
3. “The physics of heat assisted magnetic recording”
4. “Self-organised magnetic arrays”
5. “Microstructure and magnetic properties of FePt”
6. “Atomistic models of magnetic materials and devices”
7. “Dynamic proportion of FePt”

2006.4.28 张庆瑞教授，国立台湾大学物理系
“磁性随机内存的发展与挑战”

2006.5.19 Prof. Reza Adhami，Chairman of Department of Electrical and Computer Engineering, The University of Alabama in Huntsville (UAH), Alabama, USA （顺访）

2006.5.19 Prof. Junpeng Guo Department of Electrical and Computer Engineering, The University of Alabama in Huntsville (UAH), Alabama, USA（顺访）

2006.5.25　陈达宇，飞利浦东亚研究实验室
“光盘系统中的光学”

2006.7.6　Prof.Tang Dingyuan，Nanyang Technological Univ. Singapore
“High-power ultrashor pulse Erbium-doped fiber laser”

2006.7.12　彭迁教授, 奥斯陆大学肿瘤研究所，Norwar
“卟啉前体光动力治疗引起的肿瘤凋亡”

2006.9.26　Dr.Deyuan Shen，　Univ. Southampton, UK
“High power fiber laser”

2006.10.11-10.14　Ulrich Goesele所长, 马普微结构物理研究所，德国
“Light emitting silicon and sinlicon nanowires: past and future”
并同信息学院院长和部分教授座谈。

2006.10.26-10.27　Prof.Yuen-Ron Shen,加州大学伯克利分校 USA
“Survey of laser spectroscopic techniques for condensed matter physics”

2006.11.6　Prof. Kok -Wai Cheah,　Baptist Univ. Hong Kong
1. “Plasmonic coupling in texturec metallic microcavity”
2. “OLED research in centre for advanced luminescence”

2006.11.28　Prof. Yongfeng Lu, Department of Electrical Engineering Univ. of Nebraska-lincoln USA
“Nanomaterial synthesis and nanodevice fabrication by laser chemical processing”

2006.12.1　Prof. Unchung Cho, Dept.of Mechanical Engineering Korea Polytechnic University　(顺访)

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