复　旦　大　学

光 科 学 与 工 程 系

Department of Optical Science & Engineering
Fudan University

2005年报

Annual Report

目录(Contents)

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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. 混沌激光 Random cavity lasers.

提出并制作了两种新型的混沌激光器。一种是具有混沌粗糙界面的波导激光器，在适当调节泵浦长度后，获得了单模激光振荡（本工作发表于Physical Review B）。另一种是平面混沌激光器。它具有DBR作为腔镜，混沌散射增益介质作为腔介质。该激光器的阈值比普通混沌激光器低6个数量级，线宽很窄。同时，该激光具有良好的远场输出方向角（1.7度）。（Physical Review Letters 已接受）

Two new schemes for random cavity laser were proposed and realized. One is a waveguide laser with random interface corrugations. Single mode laser resonance were achieved by adequately adjust the pumping length (published in Phys. Rev. B). The other is a planar random microcavity laser that comprises of two distributed Bragg mirrors and a cavity layer doped with random scattering gain materials. The planar random microcavity laser showed extremely low lasing threshold (6 orders lower than normal random laser) and very narrow laser linewidth. In addition, the laser has very good emission divergence (1.7 degree far field emission divergence). The mechanism of the laser action was concluded to come from coupling between planar microcavity mode and 2-dimensional random cavity modes (accepted by Physical Review Letters).

2. 掺铒光波导放大器及无损耗分束器研制。Fabrications of erbium doped waveguide amplifier and lossless splitter.

1)用溶胶-凝胶技术制备了掺铒玻璃光波导。通过多次提拉的方法制备了光波导薄膜，厚度为10μm，折射率为1.46。测量得到了该光波导的荧光光谱和荧光

寿命，荧光寿命为4.2 ms。提出了一种新的掺铒光波导放大器的波导结构方案，并进行了理论模拟。摸索了制备光波导放大器的基本工艺，为下一步用溶胶-凝胶法研制光波导放大器打下基础。2）通过离子交换法在掺铒硅酸盐玻璃和掺铒磷酸盐玻璃中制备了光波导。所制备的光波导的传输损耗小于0.5dB/cm，在980nm激光泵浦下测量了1550nm光放大增益，2.5cm长波导的小信号净增益为6dB。在此基础上，研制成功1×2无损耗光波导分束器，器件净增益0.64dB(插入损耗< 0 dB)。完成上海市科委重大项目子课题，通过验收。

Erbium doped optical waveguides were fabricated by sol-gel technique. Multiple layer dipping process was used to prepare waveguide films. The film thickness was 10 μm, its refractive index was 1.46. Erbium ion fluorescence spectrum was obtained with 4.2 ms lifetime at 1550 nm. A new scheme for waveguide amplifier was proposed and theoretically simulated. 2) Erbium doped silicate glass waveguide and phosphate glass waveguide were fabricated by ion-exchange method. The optical propagation loss of the waveguide was less than 0.5 dB/cm. Optical gain at 1550 nm for a 2.5 cm length channel waveguide was 6 dB, pumped by 980 nm laser. In addition, a 1×2 lossless waveguide power splitter was fabricated, the net gain of the splitter was 0.64 dB (note that the insertion loss is less than zero).

3. 8路集成光波导型热光可变光衰减器研制。Fabrications of 8 channel integrated thermo-optic variable optical attenuators.

集成光波导型可变光衰减器是光通信领域中的关键元器件。我们通过对有机/无机这种新材料的热光系数的仔细研究及紫外光直接图案化光波导图形制备技术、电学封装和光学封装工艺等的研究，完成了国际上第一个基于有机/无机复合材料的8路可变光衰减器的实验室制作，所摸索的工艺能够放大到制备更多路（多达40路）的器件。并设计出具有创新性的多模干涉波导型可变光衰减器。所研制的8路集成光波导型可变光衰减器经复测，达到的指标是：插入损耗：2.6 dB；波长响应范围：1480-1630nm；衰减动态范围：> 22 dB；功耗: < 400 mW。完成上海市科委“光科技项目”，通过验收。另外，还测量了器件的偏振依赖损耗和波长依赖损耗和器件响应时间等参数。测得的器件上升时间为3.2ms，下降时间为4.7ms，功耗最低可达到13mW，比二氧化硅波导器件的功耗低一个数量级以上。结果表明器件主要性能指标，基本达到实用要求。

Variable optical attenuator (VOA) in a form of integrated waveguide device is a key component in optical communication system. After intensive exploration of the thermal optical property of a new organic/inorganic hybrid material, direct UV photon patterning technique and electric and optical packaging technique, we accomplished the first organic/inorganic hybrid material based 8-channel VOA in the world. The fabrication procedure is scalable to larger numbers of channels (as high as 40 channels). A new configuration of multi-mode interference (MMI) waveguide VOA was also proposed and theoretically simulated. The fabricated 8 channle VOA reached the following specifications: insertion loss: 2.6 dB, working range: 1480-1630 nm, dynamic range: >22 dB. The minimum power consumption achieved was 13 mW, which was one order of magnitude lower than silica waveguide devices. Response time is 3.2 ms (rising) and 4.7 ms (down). The specs marginally reach the requirement for real applications.

4. 新型聚合物和有机分子合成及其光学性能的研究。 Study on novel polymer and organic molecules for nonlinear optics.

1) 通过增加共轭体系取代基的推拉电子性能和增加体系共轭长度，新合成了一系列光学非线性有机分子，其中氰基取代的席夫碱和芪的分子二阶非线性极化率经测量分别为146×10^{-30}esu和133×10^{-30}esu，高于国际上普遍使用的DANS分子，稳定性也有明显提高。另一种2- [4’’-(N- 烯丙基-N-甲氨基)苯乙烯基]-4- (α’-氰基-4’-硝基苯乙烯基)噻吩的分子二阶非线性极化率，经测量为335×10^{-30}esu，但分子稳定性有待提高。2）合成了侧链型有机聚合物和有机-无机高聚物体系非线性光学材料。通过体型聚合物的制备，使侧链型有机聚合物稳定性有较大的提高，获得的PU-α’-氰基-4’-硝基-4- (N-羟乙基-N-甲氨基) 芪和PU-α’-氰基-4’-硝基苯甲醛缩-4- (N-羟乙基-N-甲氨基) 苯胺，经测量，其二阶非线性系数分别为122.5pm/V和203pm/V。

A new series of organic molecules with high nonlinearity were synthesized, by strengthening the ability of the electronic donor and acceptor moieties or increasing the length of the conjugated π electron group. Cyano group substituted shiff base and stilbene molecules have molecular nonlinear hyperpolarizability β of 146×10^{-30}esu and 133×10^{-30}esu respectively. Another molecule, 2- (4’’-(N-allyl-N-methylaminostyryl) -4- (α’-cyano-4’-nitrostyry) thiophene, has β value of 335×10^{-30}esu, but the thermal stability of molecule needs further improvement. Organic polymeric and organic/inorganic hybrid polymeric materials with high optical nonlinearity were also synthesized. The thermal stability of the side-chain polymer was greatly improved by cross-linking. SHG measurements showed that the second-order susceptibility $\chi^{(2)}$ of PU-α’−cyano-4’-nitro-4-(N-hydroxylethyl-N-methyamino) stilbene and PU-α’−cyano-4’-nitrobenzal-4-(N-hydroxylethyl-N-methylamino) aniline films to be as high as 122.5 pm/V and 203 pm/V, respectively.

2005年度本课题组完成上海市科委重大项目子课题1项，通过验收。2005年新申请到国家自然科学基金重点项目子课题1项及面上项目1项。2005年度课题组在国内外刊物上发表文章11篇，其中SCI论文8篇，EI 文章9篇，合作发表SCI论文2篇；在国际会议上报告17次，其中会议邀请报告6次；在国内会议上报告3次。

飞秒时域二阶非线性光学的应用研究

Applications of Ultrafast Quadratic Nonlinear Optics

钛宝石激光系统是主要的飞秒脉冲光源，典型的工作波长在800nm附近。因其有限的波长调谐范围，应用受到限制。飞秒OPA可以从固定波长的飞秒泵浦激光获得其它波长及可调谐的飞秒激光输出，是国际上超快技术的一个主要研究内容。我们着重研究和发展中红外波段（3-5μm）的飞秒OPA技术，该重要波段的飞秒光源在生物、化学、物理及材料等领域有着广泛而重要的应用。其相应的近红外信号光波长在1μm附近，对准了钕玻璃大型激光装置的发射波长，是国家长期支持发展的重大科学技术目标。

受中红外非线性晶体材料特性的限制（低的破坏负载Ith及高的非线性折射率n2）,现有中红外飞秒OPA技术存在明显的不足和局限性，目前尚无商品化产品。本年度，课题组取得了有国际影响力的成绩（News Breaks,《Laser Focus World》2006年第2期）。在飞秒光参量放大（OPA）技术方面，做出了多项重要的创新成绩。

1．飞秒OPA技术往大口径和高能量方向的拓展，在国际上第一次直接从OPA产生mJ级的飞秒激光脉冲。Femtosecond optical parametric amplifier generates mJ-level pulses

往大口径高能量化方向的发展，将赋予飞秒OPA技术新的活力，拓展应用领域。目前的飞秒OPA输出最高在100 μJ量级，而中红外飞秒OPA输出仅数十μJ，难以将飞秒OPA技术应用于大型的高能钕玻璃激光装置。我们以新的设计理论为依据，采用太瓦级钛宝石激光泵浦，并在以外部注入技术解决输出稳定性的基础上，将现有飞秒OPA的输出能力提高了1—2个量级，在国际上第一次直接从OPA获得了数mJ的飞秒激光脉冲。该技术成果已应用于中国工程物理研究院，结合钕玻璃激光放大系统，建成了输出百焦耳的超短（<1 ps）激光装置，已成为我国规模最大的高能量超短系统。其前端方案采用了我们的飞秒OPA技术获得4 mJ的1 μm波段超短光源，它替代了有严重技术缺陷的再生放大和复杂困难的啁啾脉冲光参量放大系统。这是一个原创性的技术方案，适合于我国的技术基础，有助于我国的PW（10^{15}瓦）大型激光装置实现跨越式发展。

We have developed a mJ-level femtosecond optical parametric amplifier (OPA), which stands for one order of magnitude higher than the existing femtosecond OPAs. It may provide a feasible alternative to optical parametric chirped-pulse amplifier (OPCPA).

The device is pumped by a TW-level femtosecond Ti:sapphire laser system operating at 800 nm and a repetition rate of 10 Hz. A small portion of the pump pulse generates super-continuum white light (SWL) in a 5-mm-thick sapphire plate, which is used to seed the amplifier consisting of two type-I phase-matched $LiNbO_3$ crystals (uncoated) both with dimensions of 60 mm×60 mm×15 mm. Pulse energy of 4 mJ at 1053 nm, with duration less than 100 fs, is obtained at a pump pulse energy of 80 mJ, which corresponds to a total conversion efficiency of 6.5% (signal plus idler). The generated mJ-level pulse may be stretched to ~4 ns by a large-aperture grating, which is ready to be injected into an Nd:glass CPA booster amplifier system. The constructing facility will deliver synchronized high-power femtosecond pulses at 800 nm and 1053 nm, which may find many applications in diverse research fields.

2．发明了混合注入式飞秒OPA新技术 Hybrid seeded femtosecond optical parametric amplifier

外部窄带激光注入式飞秒OPA是一种较为先进的技术方案，它可以降低对泵浦光强的要求，从而在很大程度上避免因中红外非线性晶体低的破坏负载I_{th}和高的非线性折射率n_2带来的问题。然而，窄带激光注入具有一个显著的技术缺陷，输出飞秒信号脉冲的光谱含有强的窄带激光频率尖峰（来源于外部注入），光谱不“干净”的飞秒信号光的应用受到影响。为解决该关键问题，我们发明了混合注入式飞秒OPA新技术。在窄带激光注入第一级飞秒OPA的基础上，第二级则采用第一级输出的“干净”的闲频光注入，从而保证最终输出的飞秒信号光和闲频光均是“干净”的。混合注入是我们解决窄带激光注入式飞秒OPA输出光谱不干净问题的关键技术，实验结果表明，通过混合注入新技术，窄带注入引起的光谱不干净度可以远小于10^{-10}。

We propose and demonstrate a novel hybrid seeded optical parametric amplifier (OPA) that incorporates an external CW seeding at signal wavelength in the first stage and difference-frequency mixing between the idler and pump in the second stage. Spectrally and temporally clean signal pulses with duration less than 150 fs and energy up to 17 μJ are obtained with a $MgO:LiNbO_3$-based hybrid seeded OPA. The device may provide direct tunability to some extent and delivers signal pulses tunable from 1.01 μm to 1.08 μm.

3. 建立并实验验证了新的中红外飞秒OPA设计理论，可大幅提高转换效率。Femtosecond optical parametric amplification with dispersion pre-compensation

传统的飞秒OPA，仅考虑了晶体和泵浦光强的设计，均采用近傅氏变换极限的飞秒脉冲泵浦，不考虑脉冲性质（啁啾）的作用。经过对材料特性的分析和比较，我们发现中红外波段的非线性晶体普遍具有很大的群速度色散（GVD）量，显示出与可见光和近红外OPA晶体（BBO）的显著差异。因此，最优的中红外飞秒OPA设计不能仅简单地照搬传统的基于BBO晶体的设计思路，必须考虑到群速度色散的影响。据此，我们提出了中红外飞秒OPA新的设计理论，除了遵循已有的晶体和泵浦光强设计准则外，应补充对泵浦脉冲啁啾量的优化设计，利用预啁啾量来补偿群速度色散量。理论和实验证明利用泵浦脉冲的预啁啾可提高飞秒OPA的转换效率近2倍。结合窄带光注入新技术，预啁啾优化设计技术为中红外飞秒OPA器件创造了一种全新的理想方案，标志了中红外飞秒OPA的认识和技术上的进步，它将有助于进一步发展和完善中红外飞秒OPA技术和器件。

We study mid-infrared femtosecond optical parametric amplifier (OPA) that suffers severe affection by group-velocity dispersion (GVD). Both theoretical and experimental results show that GVDs in nonlinear crystals will significantly degrade the performance of a femtosecond OPA. By introducing a pre-chirp to the pump pulse, the effect of GVD can be compensated effectively. A lithium niobate crystal based femtosecond OPA demonstrates that the conversion efficiency with optimally pre-chirped pumping is nearly twice as much as that of the non-chirp case, and the output pulses can be compressed further to near its Fourier-transform limit by prism pairs. The obtained results in this work can be a useful guideline in designing and optimizing a femtosecond OPA in MIR.

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。有关结果被《Laser Focus World》报道，本年度共发表SCIE文章8篇，作国际会议邀请报告1次，申请并受理发明专利2项。作为主要成员，获2005年度军队系统（解放军总装备部）科技进步一等奖。

Eight papers were published in SCI journals and one invited talk was given on international conference in 2005.

Si量子点的调节及其电学和发光性质

Si quantum dots: size modification, and electrical and luminescent properties

利用离子束刻蚀可以在固体表面产生致密的量子点阵。我们开展了以下4方面工作：1）实验和模拟研究Si量子点尺寸随离子束流密度的变化，发现重沉积效应在量子点形成过程中起重要作用，修正了现有模型；2）发展了一种调节现有Si量子点形貌的方法，即所谓的后离子研磨法。根据不同的实验条件，它可以进一步缩小量子点的尺寸，也可以改善量子点分布的均匀性；3）利用电力显微镜和导电原子力显微镜研究了Si量子点的电学性质。发现Si量子点—针尖间的Schottky势垒同Si衬底—针尖间的不同，所形成的Si量子点并非和Si衬底具有相同的外延的原子排列结构，由此保证了量子点具有量子效应；4）首次发现由此形成的Si量子点室温下的光致荧光谱，并观察到蓝移。

Spatially dense quantum dot arrays can be fabricated on solid surfaces by means of ion beam etching. Four works were done in this field. 1) The evolution of Si quantum dots with ion flux has been studied by both experiments and simulations. The role of redeposition played in the formation of quantum dots was recognized, and the existing Kuramoto-Sivashinsky model was corrected; 2) A post ion-milling (PIM) method was developed to modify the surface morphology of quantum dots. It can improve the uniformity of the dot distribution, or, further shrink the quantum dots, depending on the ion flux used; 3) Electrical properties of such Si quantum dots were investigated by means of EFM and c-AFM. It is found that the Schottky barrier height on the Si dots differs from that on the Si substrate, and the dots are not epitaxially identical with the substrates, which guarantees the quantum effects of these quantum dots; 4) Finally we observed for the first time the photoluminescence from such Si quantum dots and its blueshift as well.

将利用一种新型的掺杂方法，开展纳米硅发光增强工作。

本年度发表SCI论文8篇，投稿论文2篇。 参加会议2次（国际光子学会议，5月南京；NanoChina，05， 6月北京）。

PLD制备氧化钛和掺杂氧化钛

Synthesis of doped TiO_2 by PLD

锐钛矿相的纳米氧化钛在环保和能源领域有广泛的应用。但氧化钛的光催化必须使用紫外光，而掺氮氧化钛薄膜的光催化反应则可以扩展到可见光范围，可以利用廉价的太阳光做能源，大大降低了使用成本。我们以金属钛为靶材，在氮气/氧气或氮气/氨气/氧气气氛中，用脉冲激光淀积方法合成了掺氮的氧化钛薄膜。用AFM,拉曼光谱,XPS以及吸收光谱分别分析了薄膜的表面形貌,晶体结构,组成情况以及吸收范围。结果显示,在两种气氛下得到的纳米晶体膜都是锐钛矿相结构。在氮气/氨气/氧气混合气氛中合成的薄膜的掺氮量为4.4%，高于在氮气/氧气气氛中合成的薄膜（2%），而且对可见光的吸收有很大的改进。进一步用可见光进行了亚甲基兰的光分解实验，结果发现只有在氮气/氨气/氧气混合气氛中合成的薄膜对亚甲基兰有很好的光分解作用。

Nano-structured titanium dioxide (TiO_2) thin films in anatase phase, as a photo-catalysis material, have wide potential applications in environment protection and energy sources. However, the TiO_2 films must be used in the UV region, which greatly restricts their applications. On the other hand, the N-doped titanium oxide ($TiO_{2-x}N_x$) films have a better optical reactivity and can be activated by both ultraviolet and visible light as a photocatalyst. Therefore, the application cost can be reduced greatly by using the sunlight as the light source. In our lab, N-doped TiO_2 films were prepared by laser deposition of Ti target in an atmosphere of N_2/O_2 or $N_2/NH_3/O_2$ mixture. The surface morphology, crystalline structure, film composition and absorption of the synthesized films were investigated by AFM, Raman, X-ray photoelectron spectra (XPS) and UV-Vis absorption spectroscopy, respectively. As a result, the nanostructured films prepared in both atmospheres are in the anatase phase. Nitrogen doping is more efficient when adding a little NH_3 into N_2/O_2 mixture. The nitrogen concentrations are 2.0% and 4.4% for the films deposited in N_2/O_2 and $NH_3/N_2/O_2$, respectively. A remarkable improvement of optical absorption in the visible light region has been detected for the film deposited in $NH_3/N_2/O_2$. The experiment for the photo-degradation of methylene blue shows that only the films prepared with $N_2/NH_3/O_2$ mixture can degrade the methylene blue very well with visible light.

水相半导体量子点在生物学和医学领域中已经显示出巨大的应用前景。与传统的荧光染料探针相比，用半导体量子点作标记荧光亮度更高，抗光淬灭性更强，可通过调节量子点的尺寸来控制发光波段，且发射光谱对称，谱宽窄，这对于生物学中的多元探针标记技术是非常有利的。我们成功地用半导体量子点对生物活细胞进行了标记，用共焦激光扫描显微镜研究了量子点在活体细胞中的分布和发光特性，分析了细胞中量子点荧光的淬灭和蓝移的机理。

Water soluble semiconductor quantum dots (QDs) have great potential applications in biology and medicine. Compared with the conventional labeling dyes, the QDs have higher fluorescence efficiency and less bleach effect. Besides, the spectrum of the QD fluorescence is narrow and symmetry, and its wavelength can be controlled by adjusting the QD size, which have the advantages as a multi-labeling technique. In this lab, the semiconductor QDs have been successfully applied in the living cells. The distribution and the photoluminescence of the QDs endocytosed in the living cells were investigated using confocal laser scanning microscope. The mechanism of photobleaching and blueshift of the fluorescence were studied.

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，利用遗传算法系统研究了多种 fcc(110)金属表面吸附团簇的最低能量结构。 原子间的相互作用势包括嵌入原子方法势，表面嵌入原子方法势，以及 Rosato-Guillope-Legrand 势等等。结果表明在有些表面，随着原子数的增加，最低能量结构有沿[-110]方向的链状结构向两排二维岛状结构转化，然后再是三排岛状结构。而在另一些表面最低能量结构对所有尺寸的团簇都是线型链状结构。进一步研究显示最近邻原子相互作用与总体的次近邻及第三近邻原子相互作用的竞争决定了吸附团簇的最低能量结构。

We study systematically the lowest-energy structures of adatom clusters on a series of metal fcc(110) surfaces using genetic algorithm (GA). The atomic interactions are modeled by the realistic model potentials including embedded-atom method potential, surface-embedded-atom method potential, and Rosato-Guillope-Legrand potential. The results show that on some surfaces, with increasing number of adatoms, the lowest-energy structures transit from linear chains oriented along the [-110] direction to two-dimensional islands with two rows, and then to islands with three rows. On other surfaces, the lowest-energy structures are all linear chains for all numbers of adatoms. The competition between the nearest-neighboradatom-adatom interaction and the overall interaction of thenext-nearest-neighbor and the third neighbor adatoms plays a key role in determining the lowest-energy structure.

2，利用遗传算法研究了团簇尺寸为 n=2 到 12 的(SiO2)nO2 团簇的最低能量结构。计算基于 Tsuneyuki-Tsukada-Aoki-Matsui（TTAM）势及 Flikkema-Bromley (FB)势，两者的结果都表明在(SiO2)nO2 团簇系列中 n=4 和 8 是幻数。这一结论与[(SiO2)nO2H3]-团簇系列中的实验观察相一致。通过对(SiO2)nO2 团簇的计算结果与 DFT 对(SiO2)nO2H4 的结果比较，我们发现在(SiO2)nO2 团簇的端氧上氢原子的加入而形成(SiO2)nO2H4 团簇对不同异构体的相对能量及结构影响不大， 这意味着在我们实验中所观察到的[(SiO2)nO2H3]¯ (n=4, 8)团簇的幻数行为起源与其骨架团簇(SiO2)nO2 (n=4, 8)的稳定性。

The lowest energy structures of (SiO2)nO2 cluster skeletons with size from n=2 to 12 is investigated theoretically by the Genetic algorithm (GA). The calculations based on Tsuneyuki- Tsukada-Aoki- Matsui (TTAM) and Flikkema-Bromley (FB) potentials give the same result: n=4 and 8 are magic numbers in the virtual (SiO2)nO2 cluster sequence. This conclusion is in agreement with the experimental observation on the [(SiO2)nO2H3]- cluster sequence. The comparison of the present results with those from the DFT calculations on $(SiO_2)_nO_2H_4$ shows that the addition of H atoms to the O terminals of $(SiO_2)_nO_2$ clusters to form the complex $(SiO_2)_nO_2H_4$ clusters has only minor influence on the relative energies and the structures of different isomers, this means that the magic behavior of the clusters $[(SiO_2)_nO_2H_3]^-$ (n=4, 8) observed in our previous experiment is originated from the stability of the cluster skeletons $(SiO_2)_nO_2$ (n=4, 8).

液晶光电子器件
Liquid crystal electro-optical devices

研究了基于全息聚合物分散液晶(HPDLC)的偏振非敏感的2×2光开关，其最大衍射效率达到85.7%，上升和下降时间分别为36μs和160μs，驱动电压为18.2V/μm.，在632.8nm波长的偏振依赖的损耗为0.03dB.

A polarization insensitive 232 optical switch was fabricated with liquid crystal–polymer composite by means of holography. The highest diffraction efficiency achieved was 85.7%. The rise time and the decay time measured were 36 and 160 ms, respectively, at an applied electric field of 18.2 V/ mm. The polarization-dependent loss was 0.03 dB measured for *s*- and *p*-polarized light at the wavelength of 632.8 nm.

就表面活性剂对HPDLC Bragg 光栅的电光特性的影响进行了实验研究，结果表明表面活性剂能有效降低驱动电压．阈值电压从13 V/μm降低到2.3 V/μm，开关电压为27.3 V/μm．上升时间和下降时间分别为60μs和80μs．同时用扫描电镜研究了HPDLC 的表面形貌

The effect of surfactants on the electro-optical properties of holographic polymer dispersed liquid crystal (HPDLC) Bragg gratings was studied in detail. The experimental results showed that surfactants could effectively reduce the driving voltage. The morphologies of HPDLC Bragg grating surface were also investigated by scanning electron microscope (SEM). The threshold electric .eld was reduced from 13 V/lm to about 2.3 V/lm and the switching electric .eld was 27.3 V/lm. The rising time and the falling time were 60 μs and 80 μs, respectively.

用LCOS 相位光栅构建了可调焦距透镜阵列．由于每个象素的电压可以独立调节, LCOS 可以产生高分辨的相位调制分布，从而可使透镜阵列的焦距和其他参数可以自由调节．并理论和研究上进行了分析.

We use a phase modulation method to form tunable lens arrays on liquid crystal on silicon (LCOS). With independent voltage adjustment on each pixel, LCOS generates a high-resolution gradual phase modulation profile, which makes it possible for the lens array to be freely tunable in focal length and other parameters. A tunable lens array is made on LCOS by use of this method, and we provide details of the theoretical analyses and experimental results.

用亚皮秒脉冲对5种氧化物介质薄膜的单脉冲损伤阈值进行了研究，唯象的模型显示损伤阈值随脉冲宽度的变化与多光子离化，碰撞离化及载流子的带内弛豫有关．观测到的损伤阈值与材料的带宽成线性关系，符合Keldysh 的光子离化理论，损伤阈值随脉冲宽度变化的幂指数与材料无关，该现象可理解为光子离化注入的雪崩过程.

The scaling of the single-pulse laser threshold fluence for dielectric breakdown with respect to pulse duration and material band gap energy was investigated in the subpicosecond pulse regime using oxide films sTiO_2, Ta_2O_5, HfO_2, Al_2O_3, and SiO_2. A phenomenological model attributes the pulse duration dependence to the interplay of multiphoton ionization, impact ionization, and subpicosecond electron decay out of the conduction band. The observed linear scaling of the breakdown fluence with band gap energy can be explained within the framework of this model by invoking the band gap dependence of the multiphoton absorption coefficient from Keldysh photoionization theory. The power exponent κ of the observed dependence of the breakdown threshold fluence F_{th} on pulse duration ι_p, $F_{th} \sim \iota_p^{\kappa}$, is independent of the material and is attributed to photoionization seeded avalanche ionization.

实验上研究了不同结构参数的分形波带片（FZP）的聚焦特性。推导了n=4情况下的FZPs的轴上光强分布。实验结果很好地吻合了理论预期。同时还提出了一种新的构造FZPs的方法，并利用硅上液晶设备实现了FZP结构。实验结果表明低阶的FZPs的焦深大于高阶的FZPs焦距深度

The focusing properties of fractal zone plates (FZPs) with different structure parameters are studied experimentally. The axial irradiance of FZPs is deduced at n = 4. The experimental results are in good agreement with the theoretical prediction. A method to fabricate FZPs with variable structure parameters is mentioned, and the liquid-crystal-on-silicon device is used to implement this experiment. The experimental results indicate that the focal depth of lower order FZPs is larger than that of higher order FZPs.

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

目前已能在硅片上获得垂直取向很好的FePt有序合金薄膜，通过工艺的改进，可望在实用化盘片上获得垂直取向的FePt薄膜。通过改变易轴取向，以及设计新的交换耦合薄膜结构这两种方法，已能在不改变FePt有序合金薄膜的磁晶各向异性的情况实现写入场的减小。部分结果在第五十届磁学和磁性材料年会（美国，San Jose）上做张贴报告，一篇论文接受发表，其他正在整理中。

Well-ordered, perpendicular magnetic anisotropic FePt alloys on Si etc substrates were obtained by modifying the deposition addition. Through adjusting the easy axis orientation and designing the exchange coupled multilayer structures, the writing field could be reduced in the precondition of not changing the magnetic anisotropy. Some of the results were posted in the 50^{th} MMM conference in San Jose, and one paper has been accepted for publication.

二、激光辅助磁记录的动态测试演示系统

得到由东莞SAE公司捐赠的硬盘测试用纳米转动台（Spin-stand）Guzik 1701系统（价值约25万美元），在此基础上安装了激光引入和光学监控装置，以符合激光辅助的磁记录动态测试要求。（见下图）

The spin-stand (Guzik 1701), which is for the HDD head testing , was donated by SAE in Dongguan. Laser and Optical components were mounted to meet the requirement of heat-assisted magnetic recording. (see picture below)

三、自旋电子学巨磁电阻材料的应用研究

（1）建立了平面十字AMR型磁电阻生物传感器的物理模型，理论分析了直径为250纳米的磁性标签的信号检测问题；（2）研究了低电阻隧道结中自旋力矩引起的磁化翻转效应，得到磁化翻转时间与极化电流大小的依赖关系，结果在第五十届磁学和磁性材料年会（美国，旧金山）上做张贴报告；（3）研究了自旋阀的制备条件，得到了10%的巨磁电阻信号，该结果已达国际水平。在此基础上，目前正在优化隧道结势垒层的氧化条件。

(1) A micromagnetic simulation model is estabilished for the detection of

magnetic nanobeads by using planar Hall sensors in magnetoresistive biochips. The signal detection for a 250-nm-diameter bead was studied; (2) The free layer magnetization switching induced by spin transfer torque was studied in low resistive magnetic tunnel junctions, the results show that the switching time is related to the applied current, a longer switching time, 10–15 ns, is needed when the applied current density is close to the critical value;(3) 10% CIP GMR signal in spin valves has been obtained. The oxidation condition optimization for tunnel barrier in magnetic tunnel junctions is now on going.

四、混合存储介质材料的自旋超快动力学研究

对一些特殊磁性材料进行了自旋相关的pump-probe超快过程的测量，得到了自旋体系在泵浦后的超快退磁和较长时间恢复的过程。部分结果在全国磁学和磁性材料会议（武夷山）上报告。

The magneto-optical Kerr effect (MOKE)-based pump-probe ultrafast process in some special magnetic materials was conducted, and an ultrafast demagnetization and very long recovery of magnetization were observed for a special structure, which shows an abnormal behavior of spin dynamics.

五、纳米结构材料的模板辅助电化学合成

利用电化学脉冲腐蚀制备出规则的多孔Al_2O_3模板，尺寸达几十纳米甚至更小，并制备出相应几十纳米直径的磁性纳米线，结果正在整理之中。进一步实验将以此制备纳米尺度的多种材料纳米线，研究其物理性质。

Using electro-chemical depositon with the assisted Al_2O_3 template, a root structure was fabricated and clearly observed in TEM with diameter in sub-ten nanometer range. The nanostructure is important for studying nanowires in many areas.

本年度发表SCI论文2篇，待发表3篇论文。获上海市浦江人才计划团体项目（张宗芝、王松有和马斌）。

Two papers were published and three were accepted for publication.

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

在激光烧蚀等离子体与ECR微波等离子体、弧光放电等离子体、Kaufman离子束之间相互作用研究的基础上，继续探索它们在材料制备上的应用，包括摸索发展了一种基于ECR-PLA等离子体的制备掺杂薄膜的新方法，即ECR等离子体辅助双激光束双靶共烧蚀制备掺杂化合物薄膜，并研究了相应的相应过程和机理。除了具有一般的反应脉冲激光沉积的特征外，该方法还具有以下主要特点：ECR等离子体提供大量化学活性的气相成分，它们易于与激光烧蚀产物反应；同时实现化合物基质膜层的合成沉积和杂质原子的原位掺入，即一步法制备掺杂化合物薄膜材料；低能等离子体束流对衬底和膜层的轰击促进表面反应，有利于膜层生长和杂质掺入；载能气相杂质原子作用于膜层使得在原位掺杂的同时还兼有类似于注入的效果；既可以用气相掺杂源，也可以用固相掺杂源，还可以同时用气相和固相源进行多元素共掺杂；可以实现均匀掺杂，并且可以在材料制备过程中方便地控制和调整掺杂浓度。该方法已申请两项发明专利。

Based on the fundamental research on the interactions of laser ablation plasma with ECR microwave plasma, arc discharge plasma and Kaufman ion beam, we explored their applications. New methods for thin film preparation were explored, including two targets co-ablation by two laser beams for film deposition and in situ doping. The processes involved in and mechanisms responsible for film preparation were studied. Besides the characteristics of conventional pulsed laser deposition, the method possesses several additional features: ECR plasma can provide large amounts of reactive gaseous species which can react with the species created by laser ablation at high rates; the deposition of the host film and the incorporation of the dopants are performed at the same time, i.e., one-step method for the preparation of doped thin films; the bombardment of the substrate and the growing film by the low-energy plasma stream promotes surface reactions, which is beneficial to the film growth and dopant incorporation; besides in situ doping, the action of the energetic gaseous dopants on the film has additional effect similar to implantation; the raw material for dopants can be a gas, a solid, or using a gas and a solid as the raw materials for multi-element co-doping; doping concentration can be easily controlled and adjusted for uniformly doped films.

开展了多种新型功能薄膜材料合成制备的尝试和摸索。为了相关课题和研究的需要，利用自己摸索的方法制备了多种不同稀土种类和不同掺杂浓度的III族氮化物薄膜，同时也演示了这一方法的可行性。用我们的方法，可以得到均匀的掺杂膜层，掺杂浓度可以在0.1 – 8 at. % 范围内控制和调整。用PLD法制备了N掺杂ZnSe (ZnSe:N) 纳米晶薄膜，纳米晶粒尺寸为20-100纳米。开展了N掺

杂ZnSe (ZnSe:N)纳米线的制备尝试，制备出线度为10纳米左右的ZnS:N纳米线。通过弧热等离子体源所产生的甲烷和氮等离子体喷射，直接在覆盖有Co/Ｎi膜的衬底上生长了氮化碳（CN）纳米晶薄膜。用多种方法尝试了P型ZnO薄膜的制备，包括使用GaAs衬底对生长的ZnO薄膜进行渗As处理和用掺有As_2O_3的ZnO混合靶为原材料直接制备As掺杂ZnO（ZnO:As）薄膜，用原位掺杂方法制备N掺杂ZnO（ZnO:N）薄膜和N-Al共掺杂ZnO（ZnO:N-A）薄膜，其中在兰宝石和硅衬底上制备的ZnO:As薄膜呈p型导电，受主载流子浓度达到10^{18}-$10^{19}$$cm^{-3}$。

Many attempts have been made to synthesize functional thin films. Using the method developed by ourselves, III-nitrides thin films doped with different rare earth elements at at various concentrations were prepared, through which the feasibility of the method was demonstrated. The dopant concentration can be controlled to vary in the range between 0.1 and 8 at. % Nano crystalline ZnSe:N thin films were prepared by PLD, with the crystal size distribution of 20－100 nm. We also succeeded in the preparation of ZnSe:N nano-wires. The diameter of nano-wires is about 10 nm. By making use of the ejection of methane and nitrogen plasma generated by arc discharge, carbon nitride (CN) nano-crystalline films were prepared on Co/Ｎi covered substrates. Several methods were attempted at preparing p-ZnO thin films including the deposition of ZnO film on GaAs substrate or using ZnO/ZnSe as the target material for the preparation of As doped ZnO (ZnO:As) thin films, the preparation of N doped ZnO (ZnO:N) thin films and N－Al co-doped ZnO (ZnO:N－Al) thin films by means of in situ doping method. On sapphire or Si substrates, p-ZnO:As thin films with acceptor carrier concentrations of 10^{18}-10^{19} cm^{-3} were prepared.

本年度发表SCI论文2篇，在印SCI论文3篇，另有部分结果已投稿；国家自然科学基金项目结题1项，在研3项；培养硕士3名。

Two papers were published, another three are in press and some other results were submitted. A NSFC project was accomplished and another three are on going. Three graduate students completed their M.S. courses and got M.S. degree.

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. 高性能薄膜生长系统的研制

目前国际上先进的薄膜生长系统都采用了静态波长（单波长）的实时光学测量和表征方法，其局限性是难以在一定带宽范围内对样品进行全光谱的实时检测和分析，无法按纳米层薄膜结构和亚纳米生长速率对器件制备过程中的全光谱特性、谱线形状以及谱线的移动进行与制备过程同步的准确快速分析和监控。对于原位光谱监控的薄膜生长系统，需要在薄膜生长过程中，用光学方法（透射光谱或反射光谱）对生长的薄膜进行实时监控，并及时将信息反馈给生长系统，以用来调整薄膜的生长材料、生长速率和生长条件等等。为了获得包括薄膜生长过程中的光谱线型、带宽、谱峰、特征波长和强度在内的全光谱信息，实现高精度光谱的快速检测和分析，我们尝试将自行研制的高分辨快速红外光谱分析装置用于薄膜生长系统的监控，结合光谱定标来准确读解全光谱信息，并用于高性能薄膜生长过程的实时监控。研制的高性能薄膜生长系统包括双源电子束蒸发、ICP离子源辅助沉积、石英晶振测厚和实时光学监控等功能。其中两台蒸发源为EEG-10B型电子枪，可分别蒸发TiO_2、Ta_2O_5和SiO_2等生长材料，其生长过程可与石英晶振测厚仪通讯实现全自动控制。石英晶振测厚仪选用美国MAXTEK公司生产的MDC-360石英晶振测厚仪，两个石英晶体探头，每只探头带6片晶片，分别控制两个电子枪工作。同时为改善膜层结构，配备ICP离子源对工件进行清洗和等离子体辅助沉积。预留给光学监控的接口为一垂直光路，通光玻璃选用15mm厚高纯度石英玻璃，光路从下至上垂直穿过样品。该生长系统具有以下特点：

(1).真空室采取了特别的加厚处理，减弱了在镀膜过程中由于震动或受压变形造成的膜厚测量误差，提高了系统的稳定性。

(2).真空系统有良好的减震措施，减弱了震动对镀膜的影响。

(3).样品能在真空室中作高速旋转，由真空电机驱动，可实现真空环境中工件平稳高速旋转。电机轴为中空，探测光可从轴中无阻挡通过。在样品高速旋转时，垂直样品的入射角偏差小于0.05度。

(4).工件盘和电子枪挡板都由内置的真空步进电机控制，反应速度快，提高了膜厚控制精度。

(5).单台坩埚容积为1000ml，能满足多层复合薄膜的制备要求。

(6).独立的冷却循环水可确保被镀工件温度相对恒定。

I、Development of film deposition system with high performance

At present, real time optical testing and monitoring methods with single wavelength are adopted in advanced film deposition system all over the world. The limitation of this method makes it difficult to test and analyse the wide band spectra of the sample in real time, so that it is hard to quickly and precisely analyse and monitor the full band spectra characteristics、line shape and spectra shift of the film, which is under deposition following the desired nano-structure of the film and sub-nanometer deposition rate, at the same time. As for the film deposition system with in-situ monitor of spectroscopy, it is necessary to inspect the film in real time with optical method (reflection spectra or transmission spectra) during the deposition process and betimes feed the concerning information back to the deposition system for adjusting the material、rate and conditions of deposition, etc. In order to obtain the spectra information such as line shape、bandwidth、peak、character wavelength and intensity of film sample and realize quick testing and analyse of spectra with high precision, we try to use a self-made apparatus of infrared spectra analyzer with high resolution and high speed as monitor for film deposition system and monitor the deposition process of high performance film in real time by precisely acquiring the whole spectra after careful calibration of the spectra analyzer. The developed high performance film deposition system includes double electron beam evaporation sources、ICP ion beam assisted deposition function、thickness tester based on quartz crystal oscillator and real time optical monitor. The EEG-10B electron guns are used for two sources and evaporation materials cover TiO_2、Ta_2O_5 and SiO_2,etc. The evaporation process is automatically controlled by a thickness tester, which is based on quartz crystal oscillator. The MDC-360 thickness tester of quartz crystal oscillator is a product from MAXTEK (a company in U.S.A). Each quartz crystal detector includes 6 crystal wafers. At the same time, in order to improve the film structure, ICP ion gun is equipped to clean the workpiece and plasma assisted deposition is used. A vertical optical path is prepared for optical monitor in the chamber in advance, highly purified quartz glass with thickness of 15 mm is chosen as light window and the light goes upwards from bottom and passes through the sample. The system is of the following characters:

1) In order to decrease the error of thickness measurement caused by vibration or pressure-induced deformation during the process of film deposition and improve the stability of the system, a special treatment is adopted to thicken the vacuum chamber.
2) The vacuum system is treated with a damping step of high performance and it decreases the effect of vibration on the deposition of film.
3) Driven by the vacuum motor, the sample is able to rotate with high speed and stability in the vacuum. The motor is of hollow axis and the testing light can pass through it without countercheck. The deviation of incidence angle away from normal of the sample is less than 0.05^{o} when the sample rotates at high speed.
4) Workpiece plate and baffle of electron gun are controlled by a built-in vacuum step motor, which responds at high speed and promote the precision of thickness control of film.
5) The volume of a single crucible is 1000 ml, which can meet the requirement for producing multilayer composite film.
6) Independent recycle cooling water system assures the relative stability of the workpiece temperature.

二． 光谱学：200-1000 纳米区光谱图像折叠的 CCD 光谱仪*

在传统的光谱仪中，通常采用机械转动装置连续地旋转光栅或棱镜色散器件对波长进行精细扫描并实现高分辨的光谱测量。我们通过采用一个由10个子光栅组成的特殊光栅装置，成功研制了一种高分辨率的CCD光谱仪，无任何机械位移部件就可将色散光谱图像折叠10次，在小于100毫秒的时间内获得200至1000纳米波长范围的光谱。该光谱仪系统的特点在于采用独特的光栅结构，沿26.8×28毫米CCD阵列的成像光谱分布的垂直方向，依次设计安排了10个不同波长的子光谱区，从而覆盖了200-1000纳米的全波长区。该集成光栅结构含有10个不同入射角但槽密度均为1200线/毫米的子光栅。每块子光栅的尺寸约为60×5毫米，光栅的槽方向与其短边平行。在实验装置中，光栅被置于一个光学腔内，将来自汞灯的光聚焦到CCD的焦平面上。所设计的光路将穿过狭缝的入射光投送到平面镜，再到球面镜，到光栅，然后经过一个轮胎镜到达CCD。入射狭缝由8根直径为125微米的熔石英光纤组成，形成一个缝长约为1毫米的点对缝光纤束。对于具有1340×1300个像素的CCD阵列， 每一个约80纳米的波长区被成像在CCD的1340×130像素区内。从汞灯发出的谱线被成像在CCD上，形成了边界分明的10个光谱区，分别与10块光栅的色散区相对应。为了修正色散误差，在定标过程中采用了一台焦距为0.5米的标准单色仪，并且与10光栅中的每一个光谱区相对应，采用了多项式函数对于波长与像素位置之间的对应关系进行了拟合。虽然像素位置与波长之间不是完全的线性关系，但在200到1000纳米范围内的误差很小，这是由于每一个孤立的波长区被成像在一个狭窄的7度角物理范围内。在测量中使用了定过标的波长/像素位置曲线，在全光谱区内经计算的光谱分辨率约为0.065纳米/像素。通过对于He-Ne激光器光谱线半高宽的测量，显示了0.12纳米的实验测量分辨率，即两条间隔为0.12纳米的光谱线能够被很容易分辨开来。上海市计量测试技术研究院(中国上海)的资深光学科学家袁海林教授认为：“ CCD或CMOS阵列探测器光谱仪是一项革命性设计，通过采用多光栅结构对成像光谱进行高密度折叠，在很宽的光谱区内实现高分辨率、快速和长时间可靠测量，将会成为现代光谱仪设计中一个主流技术和发展趋势”。

II、Spectrometry: CCD spectrometer folds spectral images from 200 to 1000 nm

In traditional spectrometers, grating or prism dispersion elements are rotated continuously in fine steps using a mechanical mechanism to scan the wavelength and achieve high-resolution spectral measurements. Using a special grating consisting often sub-gratings, we have succeeded in developing a high-resolution CCD spectrometer that folds dispersed spectral images ten times, without any mechanical moving parts, to cover the full 200 to 1000 nm working wavelength range with an acquisition time of less than 100 ms. The secret to the spectrometer system is its unique grating, designed to arrange ten spectral zones with different wavelength windows covering the 200 to 1000 nm range in sequence along the direction perpendicular to the spectral distribution, to till the image plane of the 26.8 ×28-mm CCD array. The integrated grating structure consists of 10 sub-gratings at different angles of incidence, each with a density of 1200 grooves/mm. Each sub-grating is approximately 60 × 5 mm, with the grooves parallel to the short side. In the experimental setup, the grating was placed within an optical cavity that focused the light from *a* mercury (Hg) lamp to the focal plane of the CCD. The optical path sent the light from the entrance slit to a plane mirror, to a spherical mirror, onto the grating, and then to a toroidal mirror before reaching the CCD. The entrance slit was fabricated from eight 125-μm-diameter silica fibers, arranged to form a spot to-slit fiber bundle with a slit length of approximately 1 mm. For the CCD array with 1340× 1300 pixels, each approximate 80-nm wavelength zone was imaged to a 1340 ×130-pixel region of the CCD. Spectral lines from the Hg lamp were imaged to the CCD, with ten clearly defined spectral regions corresponding to the ten sub-grating regions. To correct for any dispersion errors, a polynomial function was used to fit the wavelengths to the pixel positions for each of the ten grating regions in a calibration procedure that used a standard 0.5-m-focal-length monochromator. Although the pixel position is not exactly linear to the wavelength, the error is small from 200 to 1000 nn because each individual wavelength region is imaged on a narrow physical region of about *7°*. Using the calibrated wavelength-to-pixel curves in the measurement, the calculated spectral resolution is approximately 0.065 nm/pixel over the full wavelength range. Experimental determination of the spectral resolution by measuring the full width at half maximum of the spectral line from a HeNe laser yields a value of 0.12 nm; that is, wavelengths with a separation of 0.12 nm are easily resolved. "The CCD or CMOS array detector spectrometer is a revolutionary design—it will become a mainstream technology and a trend in modern optical spectrometer design to have a densely folded image by using multiple gratings to realize measurement in the wide spectral range with high speed, high resolution, and long-term reliability," says Hai Ling Yuan, senior optical scientist and professor from the Shanghai Institute of Measurement and Testing Technology (Shanghai, China).

Gail Overton

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* 本部分引自***Laser Focus World***杂志对本组研究工作的介绍。CCD spectrometer folds spectral images from 200 to 1000 nm. By: Overton, Gail. ***Laser Focus World***, Feb2006, Vol. 42 Issue 2, p42-43, 2p; (*AN 20081580*)

三． 科研项目及成果

2005年度本课题组承担了7项研究项目，其中国家自然科学基金面上项目4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，上海市科委光科技项目1项。申请国家发明专利和实用新型专利各1项。发表论文SCI论文7篇，国内会议论文5篇，国际会议论文11篇，其中口头报告4篇，板报7篇。

III、Research projects and results

In 2005, our group has been charged with 7 research projects, including 4 NSFC general projects, 1 grand project from Shanghai committee of science and technology, 1 key project from Shanghai natural science foundation, 1 project on optical science and technology program from Shanghai committee of science and technology. We applied for 1 item of national invention patent and 1 item of new type utility patent in 2005. In addition, we have published 7 papers included in SCI journals and published 5 papers in domestic conference and 11 papers in international conferences, which included 4 oral presentations and 7 post presentations.

在研课题和经费
Projects & Budgets

强激光光束质量的非线性控制研究
负责人：王韬, 起止年月：2003.1-2005.12
拨款来源：国家基金10276012 （25万），2005年到款7.5万

稀土掺杂宽能隙III族氮化物薄膜的特性研究和应用探索
负责人：吴嘉达, 起止年月：2003.1-2005.12
拨款来源：国家基金90201029(重大研究计划)（24万），2005年到款7.2万

纳米光电子器件光学性质的实时光谱学分析和研究
负责人：陈良尧, 起止年月：2003.1-2005.12
拨款来源：国家基金60277031（24万），2005年到款7.2万

有机铁电超薄膜的相变特性研究
负责人：马世红, 起止年月：2003.1-2005.12
拨款来源：国家基金10274014（25万），2005年到款7.5万

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) ，2005年到款9万

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) ，2005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) ，2005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) ，2005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) ，2005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) ，2005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) ，2005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) ，2005年到款+4万

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) ，2005年到款7.5万

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），2005年到款15万

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) ，2005年到款17.4万

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），2005年到款14.4万

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），2005年到款12万

一种新型快速椭圆偏振光谱技术研究
负责人：郑玉祥, 起止年月：2005.1-2005.12
拨款来源：国家基金60478019（6万），2005年到款6万

强激光束非线性传输模拟
负责人：王韬, 起止年月：2002.1-2005.12
拨款来源：863-804-5-3.3, 2002AA845033(40万) ，2005年到款3万

级联非线性在高能激光驱动器技术创新中的应用
负责人：朱鹤元, 起止年月：2002.1-2005.12
拨款来源： 863-804-5-20，2002AA845180(10万)

高能宽带超短光源的创新技术及实验系统
负责人：朱鹤元, 起止年月：2004.9-2005.12
拨款来源： 863探索基金，2004AA84TS12(50万) ，2005年到款38万

高能短脉冲激光系统信噪比和色散控制技术研究（神光III）
负责人：钱列加, 起止年月：2005.1-2005.12
拨款来源：863-804北京总装备部 2005AA845051 (10万) ，2005年到款10万

宽带激光高效的二倍频技术及实验研究
负责人：王韬, 起止年月：2003.10-2005.10
拨款来源：863创新基金 2003AA84TS12 (11万)

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)

快速信息获取和传输中的关键技术基础研究（重大）
负责人：陈良尧, 起止年月：2002.1-2005.12
拨款来源：市科委02DJ14001(500万)

单量子点的物理性质和物理调控(市重大基础研究项目)
负责人：徐雷(首席专家), 起止年月：2003.7-2005.12
拨款来源：上海市科委 03DJ14001（600万），2005年到款65万

导弹武器用电磁材料技术
负责人：陆明, 起止年月：2003.8-2005.8
拨款来源：中国航天科工集团2002-HF-FD（8万）

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)

掺杂氧化钛纳米材料
负责人：王培南, 起止年月：2004. 1-2005.12
拨款来源：上海市科委03ZR1401 (5万) ，2005年到款1万

高性能小型全固化飞秒激光器
负责人：钱列加, 起止年月：2002.1-2005.7
拨款来源：上海市科委光科技专项012261065 (50万)

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)

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)

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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)

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），2005年到款35万

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) ，2005年到款18万

低电阻微米磁性隧道结的制备及其超薄势垒层性能研究
负责人：张宗芝, 起止年月：2005. 1-2005.12
拨款来源：教育部回国人员基金　(3万) ，2005年到款3万

FePt基薄膜的结构和磁化翻转机理研究
负责人：马斌, 起止年月：2004. 1-2005.12
拨款来源：校青年基金 (4万)

2005 年总到款：　440 万元人民币

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参加国际、国内会议情况
Scientific Activities

1. Lei Xu (invited talk)
   "Directional lasing from extremely deformed micro-ring cavities", the Mini-Workshop for Microdisk Laser, Daejeon, Korea, Feb. 23, 2005

2. Lei Xu, Liying Liu, Wencheng Wang (invited talk)
   "Electrical and photo control of refractive index of hybrid glasses", 2005' International Symposium on Glass in connection with the Annual Meeting of the International Commission on Glass (ISG/ICG2005), Shanghai, China, April 10~14, 2005

3. Lei Xu, Tao Ling, Qinghai Song, Liying Liu, Wencheng Wang (invited talk)
   "Intense directional lasing from non-circular micro-ring cavities", International Symposium on Photonics, Biophotonics, and Nanophotonics, Nanjing, China, May 14-18, 2005

4. Lei Xu, (invited talk)
   "Directional lasing from micro-cavities", International Symposium on Coherent Optical Science, Tokyo, Japan, July 16, 2005

5. Lei Xu, (invited talk)
   "Directional lasing from micro-cavities", International Workshop on Atoms and Photons for Quantum Information, Shanghai, China, July 25-26, 2005

6. Lei Xu, Liying Liu, Dongxiao Li, Xianjiang Wang, Yanwu Zhang, Wencheng Wang, (invited talk)
   "Thermal-optic property of organic/inorganic hybrid materials and its application to integrated optical circuits", APOC 2005 (Asia-Pacific Optical Communications Conference and Exhibition), Shanghai, China, Nov. 6-10, 2005

7. Liejia Qian (invited talk)
   "Ultrafast nonlinear technologies for petawatt laser", 20th Congress of the international Commission for Optics , Changchun,China Aug.21-26, 2005

8. Tao Ling, Liying Liu, Qinghai Song, Wencheng Wang, Lei Xu, (oral)
   "1.2 degree narrow divergence intense directional lasing from extremely deformed non-circular micro-ring cavities", CLEO/QELS 2005, Baltimore, Maryland, May 22-27, 2005

9. Lei Xu, Qinghai Song, Shumin Xiao, Liying Liu, (oral)
   "Random laser emission from surface-corrugated waveguide", CLEO Pacific Rim, Tokyo, Japan, July 11-15, 2005

10. Cong-Hui Xu, Yu-Fei Kong, Yu-Xiang Zheng, Liang-Yao Chen (oral)
"The Structure Analysis of the Optical Disk Considering the Noise of the Disk While Operating", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10,2005

11. Guo-Qiang Xie, Hua Yang, Lie-Jia Qian and He-Yuan Zhu (oral)
"Repetition rate enhancement in a diode-pumped femtosecond Nd:glass laser by using a coupled cavity",3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10,2005

12. Peng Zhou, Yue-Rui. Chen, Yun-Hua Wu , Yin-Yin Lin, Ting-Ao Tang and Liang-Yao Chen (oral)
"Structural study and optical response of Ag:Bi2O3 nanoswitch materials",3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

13. Li-Yong Ji, Xiu Liu, Pei Yang, Li-Ying Liu, Lei Xu (oral)
"Azo-dye Induced Enhancement of Optical Nonlinearity in Liquid Crystals", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

14. Hao Zhang, He-Yuan Zhu, Lie-Jia Qian, Xi-Quan Fu, Dian-Yuan Fan (oral)
"Optical Properties of Leaky Modes of Photonic Crystal Waveguides", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

15. Hai-Tong Sun, Wen-Bin Fan, and Ming Lu (oral)
"Electrical properties of Si nanodots on Si(100)", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10,2005

16. Pei Yang, Li-Yong Ji, Li-Ying Liu, Lei Xu (oral)
"Large Second Order Nonlinearity from Dip-Coated Pure DPN-2CN Thin Film", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10,2005

17. Yu-Fei Kong, Song-You Wang, Ming Xu, Gang Yin, Yu Jia, Liang-Yao Chen (oral)
"Density functional calculations for ferromagnetic Mn3Ge with the Cu3Au-type structure", 3rd International on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

18. Shu-Min Xiao, Li-Ying Liu, Lei Xu (oral)
"Synthesis and Optical Properties of Mesoscopically ordered Polyacetylene/silica Nanocomposite Thin Film", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

19. Xiu Liu, Liyong Ji, Pei Yang, Liying Liu, Lei Xu (poster)
"The dynamic influence of photoisomerization on optical reorientationm in absorbing Liquid Crystals", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

20. Gang Yin, Songyou Wang, Ming Xu, Liangyao Chen (poster)
"Theoretical calculation of optical properties of golden nanoparticles", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

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"Theoretical investigation of the electronic and optical properties of pseudocubic Si_3P_4, Ge_3P_4, Sn_3P_4", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

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"Chemical-ordered-dependent Magneto-Optical Kerr Effect of FePt(001) thin films", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

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"Spin reorientation transition and its gas absorption effect of Ni/fct-Fe films at 110 K", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

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"Er^{3+}/Yb^{3+} co-doped waveguide amplifier and lossless power splitter fabricated by two-step ion-exchange on commercial phosphate glasses", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

25. Bin Sun, Yuerui Chen, Peng Zhou, Yuxiang Zheng, Liangyao Chen (poster)
"Ellipsometric study of silicon based Si:SiO2 composite thin films under different annealing temperature", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

26. Yunhua Wu, Wen Gu, Yuerui Chen, Bin Sun, Conghui Xu, Yufei Kong, Xiaosong Zhu, Peng Zhou, Yuxiang Zheng, Liaoyao Chen (poster)
"Experimental test of Snell's law of the optically absorbing material", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

27. Yuerui Chen, Bin Sun, Yufei Kong, Conghui Xu, Peng Zhou, Xiaofan Li, Songyou Wang, Yuxiang Zheng, Liaoyao Chen (poster)
"Densely-folded spectral images of the CCD spectrometer working in the full 200-1000nm wavelength range with high resolution", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

28. Mingyu Sheng, Jianke Chen, Shouzhi Feng, Yuxiang Zheng, Yunhua Wu, Yuerui Chen, Yufei Kong, Conghui Xu, Bin Sun, Liaoyao Chen (poster)
"Ellipsometric study of the space-affected multiple reflection of the light propagating in the film structure", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

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"Effect of concentration and annealing on the optical properties of Ag nano-granular composite films", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

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"Electronic and optical properties of BaMxO1-x(m=S,Se,Te) studied using first-principles calculations", 3rd International Symposium on Advanced Photonic Science and Technology, Yangzhou, China, Nov.6-10, 2005

31. Ming Lu (poster)
"Photoluminescence enhancement of Si nanocrystals embedded in a SiO2 matrix via doping of CeF_3", International Symposium on Photonics, Biophotonics, and Nanophotonics, Nanjing, China, May 14-18, 2005

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"Silicon nanodots formation sputter erosion:tuning the dot size via ion flux variation", NanoChina，2005，June 9-11, Peijing, China

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"$Co_{80}Fe_{20}$软磁多晶薄膜的超快自旋动力学研究"，
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“制备条件对FePt薄膜结构和磁性的影响”，
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“沉积在织构Si衬底上$L1_0$ FePt薄膜的结构和磁性能”，
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“射频偏压对磁性隧道结的界面平整度及热稳定性影响”，
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“Perpendicular exchange coupling in TbFeCo/FePt bilayer film,
50th Magnetism and Magnetic Materials Conference (MMM05), San Jose, California, October 30~November 3, 2005 (poster)

8. Z. C. Zhao, H. Wang, S. Xiao, D. Huang, Y. X. Xia, Q. Y. Jin and C. L. Zha, (GQ-13)
“Inverse magnetoresistance and large saturation field change in doped Co/Cu-typed sandwiches”,
50th Magnetism and Magnetic Materials Conference (MMM05), San Jose, California, October 30~November 3, 2005 (poster)

9. Y. S. Zhang, Z. Z. Zhang, Y. W. Liu, B. Ma and Q. Y. Jin,
“Spin-transfer-induced magnetization switching in magnetic tunnel junctions” , (ES-28)
50th Magnetism and Magnetic Materials Conference (MMM05), San Jose, California, October 30~November 3, 2005 (poster)

10. C. L. Zha, J. Gao, B. Ma, Z. Z. Zhang, Q. Y. Jin, F. X. Gan, T. R. Gao and S. M. Zhou,
“Preferred Orientation and Magnetic Properties of FePt Films Deposited on Different Substrates”, (CU-14)
50th Magnetism and Magnetic Materials Conference (MMM05), San Jose, California, October 30~November 3, 2005 (poster)

11. Qingyuan Jin, “Topics we are focusing on”,
Hanyang University, Seoul, April 26, 2005 (invited Seminar)

12. Qingyuan Jin, “Magnetic anisotropy and spin reorientation of ultrathin Fe films on Cu(001),
Korea-China Joint Workshop on THz and spin photonics, Daejeon, April 24-25, 2005 (invited)

13. Y. W. Liu, Z. Z. Zhang, Q. Y. Jin,
“Micromagnetic simulation for nanobeads detection using planar Hall sensors”,
IEEE International Magnetic Conference (InterMAG2005), April 4-8, 2005, Nagoya, Japan

14. B. Ma, C. L. Zha, J. Gao, Z. Z. Zhang, Q.Y. Jin,
“Coexistence of two magnetic phases and exchange coupling in TbFeCo films”,
7th International Symposium on Optical Storage (ISOS’2005), Zhangjiang, April 2-6, 2005

人员名单
Faculty Members

在研人员：Faculty members in 2005

陈良尧　教授，博士，凝聚态光学
CHEN Liangyao, Prof., Ph.D., Optical properties in condensed matter

戴海涛　讲师，博士，液晶光电子器件
DAI Haitao, Lecturer, Ph.D., Liquid crystal photoelectron devices

范滇元，教授，工程院院士，高功率激光技术、激光与物质相互作用
FAN Dianyuan, Prof., Academician, Highpower laser physics, Laser-material interactions

干福熹　教授，中科院院士, 光学和凝聚态物理
GAN Fuxi, Prof., Academician, Optics and condensed matter physics

金庆原　教授，博士，低维结构磁性和磁光性质、自旋动力学、超高密度光-磁混合存储
JIN Qingyuan, Prof., Ph.D., Magnetism in low-dimensional structures, Spin dynamics, Hybrid recording

李　晶　副教授，博士，凝聚态光学
LI Jing, Associate Prof., Ph.D., Optical properties in condensed matter

李毅刚　讲师，博士，稀土材料与光波导器件的研究。
LI Yigang, Lecturer, Ph.D., Optics, Rare earth doped materials and waveguide devices.

刘建华　副教授，博士，超短光脉冲和超快现象
LIU Jianhua, Associate Prof., Ph.D., Ultra-short optical pulse, Ultra-fast phenomena

刘丽英　教授，博士，非线性光学与光波导器件物理
LIU Liying, Prof., Ph.D., Nonlinear optics, Physics of optical waveguide devices

陆　明　教授，博士，材料物理
LU Ming , Prof., Ph.D.,　Material physics

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MA Bin, Associate Prof., Ph.D., Magnetic thin films and devices, Hybrid recording technology

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QIAN Liejia, Prof., Ph.D., Laser physics

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SUN Diechi, Prof., ultra-short optical pulse generation and ultra-fast phenomena

孙　剑　副教授，博士，激光物理
SUN Jian, Associate Prof., Ph.D., Laser physics

王培南　教授，博士，激光光谱、激光烧蚀过程的动力学
WANG Peinan, Prof, Ph.D., Laser spectroscopy, Laser ablation dynamics

王松有　副教授，博士，凝聚态光学
WANG Songyou, Associate Prof., Ph.D., Optical properties in condensed matter

王　韬　副教授，博士，激光物理
WANG Tao, Associate Prof., Ph.D., Laser physics

韦　玮　教授，博士，光电功能材料与器件
WEI Wei, Prof., Ph.D., photoelectron functional materials and device.

吴嘉达　教授，博士，激光物理，等离子体物理
WU Jiada, Prof., Ph.D., Laser physics, plasma physics

徐　雷　教授，博士，玻璃波导线性和非线性光学性质
XU Lei, Prof., Ph.D., Silica waveguide and its linear & nonlinear optical properties

许　宁　副教授，博士，氮原子束辅助激光烧蚀合成氮化物薄膜
XU Ning, Associate Prof., Ph.D., Nitrogen-based thin film deposition via laser ablation with atomic nitrogen ion beam

应质峰　副教授，硕士，激光溅射成膜研究
YING Zhifeng, Associate Prof., Films deposition by laser ablation

张荣君　副教授，博士，凝聚态光学
ZHANG Rongjun, Associate Prof., Ph.D., Optical properties in condensed matter

张宗芝　副教授，博士，自旋电子学薄膜材料与器件
ZHANG Zongzhi, Associate Prof., Ph.D., Spin-based electronic thin film materials and devices

郑玉祥　副教授，博士，凝聚态光学
ZHENG Yuxiang, Associate Prof., Ph.D., Optical properties in condensed matter

朱鹤元　教授，博士，超短光脉冲和超快现象
ZHU Heyuan, Prof., Ph.D., Ultra-short optical pulse, Ultra-fast phenomena

庄　军　教授，博士，原子分子物理，理论物理
ZHUANG Jun, Prof., Ph.D., (theoretical) Atomic and molecular physics

戴祝萍　工程师　　DAI Zhuping, Engineer

胡谊梅　工程师　　HU Yimei, Engineer

钱红声　实验师　　QIAN Hongsheng, Engineer

徐新民　技　师　　XU Xinmin, Technician

张敏毅　工程师　　ZHANG Minyi, Engineer

杨月梅　　　　　　YANG Yuemei

返聘人员：

陈凌冰 教授，激光物理和激光光谱，重点在室温微粒烧孔
CHEN Linbin, Prof., Laser physics and laser spectroscopy, especially in spectral hole burning based on morphology-dependent resonance in micro-particles

李富铭　教授，激光物理、激光光谱和超快光学
LI Fuming, Prof., Laser physics, Laser spectroscopy, Ultra-fast optics

李郁芬 教授，团簇物理、激光光谱
LI Yufen, Prof., Cluster physics, Laser spectroscopy

王恭明　副教授，光学非线性LB膜及光波导
WANG Gongming, Associate Prof., Optical nonlinear LB films and waveguides

王国益　副教授，激光光谱
WANG Guoyi, Associate Prof., Laser Spectroscopy

王文澄　教授，非线性光学与光波导器件物理
WANG Wencheng, Prof., Nonlinear Optics, Physics of optical waveguide devices

伍长征 教授，激光物理、激光材料改性
WU Changzheng, Prof., Laser physics, Laser assisted material modification

徐克璹　教授，信息光学和铁电液晶器件
XU Keshu, Prof., Optical information processing, Ferroelectric liquid crystal display device

应萱同　教授，博士，金刚石薄膜的研制、测试与分析
YING Xuantong, Prof., Ph.D., Fabrication and analysis of diamond thin films

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

02级　沈宏(SHEN Hong),　苏文华(SU Wenhua)

03级　盛明裕(SHENG Mingyu), 张豫(ZHANG Yu), 张浩(ZHANG Hao)
张艳武(ZHANG Yanwu), 袁鹏(YUAN Peng), 罗航(LUO Hang)
任久春(REN Jiuchun), 王昕(WANG Xin)

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)

硕士生: M.S. students

03级　汤恒晟(TANG Hengcheng), 宫兆松(GONG Zhaosong), 孙斌(SUN Bin),
徐琮辉(XU Conghui), 孔宇菲(KONG Yufei), 陈岳瑞(CHEN Yuerui),
姬利永(JI Liyong), 肖淑敏(XIAO Shumin), 王闯(WANG Chuang),
董占斌(DONG Zhanbin), 范文彬(FAN Wenbin), 高静(GAO Jing),
何兵(HE Bing), 徐鹏(XU Peng), 王锋(WANG Feng)

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), 沈轶群(SHEN Yiqun), 张鹏(ZHANG Peng), 张贻松(ZHANG Yisong), 姜书同(JIANG Shutong), 顾闻(GU Wen), 谢志强(XIE Zhiqiang), 蒋建兴(JIANG Jianxing), 殷刚(YIN Gang), 张成先(ZHANG Chengxian), 张廷卫(ZHANG Tingwei), 胡魏(HU Wei), 陆舟军(LU Zhoujun)

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), 魏崃(WEI Lai)

光学工程：**Optical Engineering**

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

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. Chil-Min Kim，男，出生年月 1958. 2，博士, 教授, 韩国培材大学校
（2005.6-2007.6）“微腔光学混沌的研究”。 5万

2. 徐永兵，男，出生年月 1965.12, 博士, 教授, Univ. of York,UK
（2005.6-2007.6）“特殊磁结构的自旋动力学研究”。 5万

3. 唐定远，男，出生年月 1963.7，博士, 副教授, 新加坡南洋理工大学
（2005.6-2007.6）“Physics and techniques of ultrashort pulse generation in diode pumped solid-state lasers”。5万

4. 戴宁，男，出生年月 1959，博士, 研究员，上海技术物理研究所
（2005.12-2007.12） “CdSe/ZnS量子点制备与研究”。5万

5. 彭迁，男，出生年月 1956.8，博士, Senior researcher，Oslo University, Norway
（2005.12-2007.12） “ALA及ALA脂化物用于膀胱癌诊断的研究”。 5万

6. Roy Williab Chantrell, 男，出生年月 1950，博士, 教授, The University of York, UK
（2005.12-2007.12） “热辅助磁记录研究”。5万

二．部分来室访问及作报告的学者

2005.3.3　Prof. Kenji Ebiharaand Tomoaki Ikegami, Kumamoto University, Japan
报告：“Separated pulsed laser ablation of inorganic/organic light emitting thin films”

2005.3.28　Prof. Nai Ho Cheung，Department of physics, Hong kong Baptist University
报告：“Ultrasensitive bio-detections”

2005.3.29　Prof. Nai Ho Cheung，Department of physics, Hong kong Baptist University
报告：“Anaalytical laser spectroscopy”

2005.3.30　顾敏教授，澳大利亚 Swinburne 技术大学杰出教授，美国光学学会和 SPIE 学会会士
报告：
1. “Nanophotonics- a key to next generation information technology and biotechnology”
2. “Nano-fabrication using fs laser and confocal microscopy”

2005.4.1　顾敏教授，澳大利亚 Swinburne 技术大学杰出教授，美国光学学会和 SPIE 学会会士
报告：“Near-field nonlinear optical microscopy and laser tweezers”

2005.4.20　Prof.Tatsuo Okada, Kyushu University, Japan
报告：“Development and application of lasers and light sources”

2005.4.21　Prof.Tatsuo Okada, Kyushu University, Japan
报告：“Introduction to Kyushu University and research activities on lasers”

2005.4.21　Dr.Yongfeng Lu, Department of Electrical Engineering Univ. of Nebraska Lincoln, NE
报告：“Laser nanomachining and nanoprocessing-ftontiers beyond the optical diffraction limit”

2005.5.17　Prof. Steve Feller, Physics Department, Coe College, USA
报告：“Some recent observations on the structure of binary and ternary borate glasses”

2005.5.23　Prof. Steve Feller, Physics Department, Coe College, USA
报告：“The intermediate range order of borate glasses related to elastic properties”

2005.5.23　Chris Larson, Physics Department, Coe College, USA
报告：“A structural analysis of the lithium silicate glasses”

2005.5.16　Hua-Ching Tong (童华庆)博士，原美国Read arite磁记录公司，资深研究员（高访学者）
系列报告：1.“A review on magnetic recording and recording physics”
2005.5.19　2.“Advanced magnetic recording media”
2005.5.24　3.“Introduction to film materials analysis techniques (part 1)”
2005.5.26　4.“Introduction to film materials analysis techniques (part 2)”

2005.5.25　戴宁教授， 中科院技术物理所
报告：“量子点的物性”

2005.6.27　唐定远副教授，新加坡南洋理工大学
报告：“被动锁模光纤环形激光器中的光孤子”

2005.6.27　余玮教授， 中科院上海光机所
报告：“相对论强激光与等离子体相互作用”

2005.8.24-9.3　顾敏教授，澳大利亚 Swinburne 技术大学杰出教授
来室访问。

2005.9.13　Prof. Peng Qian, Biophysics & Physiology Department University of OsLo, Norwar
报告：“Current status and possible future of ALA-based photodynamic therapy and photodetection”

2005.10.11　陆斌博士, Seagate Research，USA
系列报告：1.“Application of x-ray diffraction in thin film deposition（1）”
2005.10.13　2.“Application of x-ray diffraction in thin film deposition（2）”

2005.11.4　卫星博士, 美国贝尔实验室
报告：“Analysis of the phase noise in optical transmission using DPSK”

2005.11.5　朱柏廉教授, 香港城市大学
报告：“Polymer optical waveguide device”

2005.11.9　　Prof. Keiji Shon, 日本Fujitsu
　　报告：　“Lectare on related topics recently on HAMR”

2005.11.16　Prof. Jianan Qu，　Univ. of Science and Technology 香港
　　报告：　“Fluorescence spectroscopy and imaging for characterization of tissue of pathology”

2005.11.21　Prof. Jacques DELAIRE，法国Cachan 高等师范大学、
Prof. LAURENT BONNEVIOT，法国里昂高等师范大学、
Dr. Mario Maglione ,Senior scientist, 法国波移凝聚态化学研究所，
等4人来室访问。

2005.12.9　Proc. Chil-min Kim, PaiChai University, Korea
　　报告：　1. “Directional lasing from triangle-shaped semiconductor microcavity laser”
2. “A novel quantum key distribution scheme based on random polarization”

2005.12.9　Dr. Soo-Young Lee, PaiChai University, Korea
　　报告：　“Scarred modes and quasi-scarred modes in deformed microcavities”

2005.12.30　Associate Professor:Sun Xiaowei, Nanyang Technological University, Shool of Electrical & Electronic Engineening
　　报告：　“The growth of ZnO nano-rod by hydrothermal method and its applications in biosensor”

附录：发表文章首页
First Page of Selected Publications