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# Femtosecond Laser Pulses Principles Experiments

**femtosecond laser pulses** - [unclear] [unclear] - the first chapter simply recalls the basic laser principles necessary to understand the generation process of ultrashort pulses. the second chapter is a brief introduction to the basics behind the experimental problems generated by ultrashort laser pulses when they travel through different optical devices or samples. **femtosecond laser pulses - gbv** - femtosecond laser pulses principles and experiments second edition with 296 figures, including 3 color plates, and numerous experiments 4ü springer r. contents preface v contributors xv 1 laser basics c. hirlimann 1 1.1 introduction 1 1.2 stimulated emission 1 1.2.1 absorption 3 **femtosecond laser pulses: linear properties, manipulation ...** - femtosecond laser pulses: linear properties, manipulation, generation and measurement matthias wollenhaupt, andreas assion and thomas baumert\* universität kassel, fachbereich naturwissenschaften, institut für physik and center for interdisciplinary nanostructure science and technology (cinsat) content 1. introduction 2. **femtosecond laser pulses - home - springer** - the first chapter simply recalls the basic laser principles necessary to understand the generation process of ultrashort pulses. the second chapter is a brief introduction to the basics behind the experimental problems generated by ultrashort laser pulses when they travel through different optical devices or samples. **principles of physics of femtosecond laser - researchgate** - principles of physics of femtosecond laser 9 femto-laser "femto" is a prefix of the international system of units that stands for  $10^{-15}$ , a millionth of a billionths symbol **optical characterization facility coordinator institute ...** - how to prepare a femtosecond pulse i femtosecond laser pulses are usually fourier transform-limited pulses  $\Delta\omega\Delta t \approx 2\pi\Delta\omega \approx 2\pi/\Delta t$  large spectral bandwidth for short pulses  $\Delta\lambda \approx \lambda^2 / (c\Delta t)$   $\Delta\lambda \approx 21$  nm for 100 fs pulses with  $\lambda_0 = 800$  nm wavelength fs pulse ns pulse large bandwidth limits the choice of the laser active medium (broad-band materials only, **modeling crater formation in femtosecond-pulse laser ...** - modeling crater formation in femtosecond-pulse laser damage from basic principles robert a. mitchell,\* douglass w. schumacher, and enam a. chowdhury department of physics, the ohio state university, 191 w. woodruff ave, columbus, oh 43210 **refractive surgery feature story comparing femtosecond lasers - visumax femtosecond laser system (carl zeiss meditec, inc., dublin, ca)**. a meaningful comparison requires some basic concepts of femtosecond laser physics and tissue interactions, 3-5 important aspects of which are reviewed in this article. basic principles how short is ultrashort? the definition of a femtosec- **designing for femtosecond pulses - femtosecond fiber laser ...** - 200-1100-00 femtosecond fiber laser 5 a. seed laser - low power the seed laser is an essential requirement for any femtosecond laser system, as it's the source of the femtosecond pulses. calmar's seed lasers utilize a saturable absorber to deliver excellent stability and reliability, with turnkey operation. **femtosecond optical frequency comb: principle, operation ...** - precision laser spectroscopy. these fields have been developing largely independently since the birth of the laser, reaching remarkable levels of performance. on the ultrafast frontier, pulses of only a few cycles long have been produced, while in optical spectroscopy, the precision and resolution have reached one part in  $10^{14}$ . although these ... **femtosecond laser induced functional microstructures in glass** - femtosecond laser induced functional microstructures in glass jan. 11th, 2010 ... principles describing the known behavior of energy and matter that predominate at the atomic scale. ... 800 nm, 120fs laser-pulses femtosecond laser induced microstructures. **femtosecond laser spectroscopy - springer** - femtosecond laser spectroscopy ix 9. optimal control of atomic, molecular and electron dynamics with tailored femtosecond laser pulses tobias brixner, thomas pfeifer, gustav gerber matthias wollenhaupt and thomas baumert 1. 2. introduction one-parameter control on prototypes: atoms and dimers in the gas phase 2.1 control in the perturbative ... **femtosecond laser cavity characterization - intech - open** - femtosecond laser cavity characterization 3 in section 4, the pulse repetition rate was carefully measured in order to evaluate the cavity length. the internal photo diode as well as an external fast avalanche photo diode were used to measure the pulse train. the difference between the mode locking peak intensity and the **review article femtosecond pulse shaping using spatial ...** - production of extremely short pulses. femtosecond solid-state laser technology has now advanced to the point that pulses below 6 fs can be generated directly from the laser. 8-14 equally important, the use of solid-state gain media has also led to simple, turn-key femtosecond lasers, and many researchers are now setting their sights on practical **femtosecond ti:sapphire amplifier - del mar photonics** - femtosecond confocal multipass ti:sapphire amplifier the confocal multipass amplifier has been designed as an effective device for amplification of femtosecond pulses in different active media. our unique design features two confocally placed concave mirrors of different radii of curvature **femtosecond laser microfabrication of 3d photonic structures** - laser pulses, can be induced at wavelengths to which the materials are perfectly transparent in the linear regime. thus, it is possible to deliver radiation into the bulk of materials without linear losses. in sequential femtosecond direct laser writing (dlw), laser beams are tightly focused, and nonlinear absorption is induced at the focal **first-principles electron dynamics control simulation of ...** - first-principles electron dynamics control simulation of diamond under femtosecond laser pulse train irradiation this article has been downloaded from iopscience. **selective two-photon microscopy with shaped femtosecond pulses** - when the laser is off, was subtracted. the movies show images obtained as the spectral phase is scanned and are displayed with false color to highlight changes in intensity. fig. 1.

schematic experimental setup for selective two-photon microscopy. femtosecond laser pulses are compressed and sent to the pulse shaper. **first-principles calculations of the electron dynamics ...** - this letter presents first-principles calculations of nonlinear electron-photon interactions in crystalline ... a femtosecond pulse laser can easily achieve very high ... in which single laser train burst consisting of two pulses is applied. each of the pulse is a gaussian wave packet, 800 nm, 16 fs, ... **a case study of a bilateral femtosecond laser injury** - a case study of a bilateral femtosecond laser injury paper #904 leon n. mcclin1 ... safety principles to avoid eye injury[1]. ultrashort lasers, lasers with a pulse duration of less than a nanosecond (nsec), are increasingly available and are ... ability to generate ultrashort pulses. **laser processing of tungsten powder with femtosecond laser ...** - laser irradiation of dispensed tungsten powder layers with grain sizes smaller than 1  $\mu\text{m}$  was investigated using high-repetition femtosecond laser systems. laser processing was performed line by line with repetition rates 1 mhz and varying parameters such as laser power, processing up to speed, number of scans and pressure. in addition to the ... **control of ultrafast electron dynamics with shaped ...** - control of ultrafast electron dynamics with shaped femtosecond laser pulses: from atoms to solids matthias wollenhaupt1, tim bayer1 and thomas baumert2 1carl von ossietzky universität oldenburg, institut für physik, carl-von-ossietzky-straße 9-11, d-26129 oldenburg germany, **multimodal ultrafast spectroscopy system based on a 35 ...** - respectively, while the pulses have become shorter. lasers with 25 fs pulse width and 5-7 mj energy at 1 khz repetition rate are commercially available. however, amplified femtosecond lasers remain complex and expensive. due to this reason, the trend in ultrafast spectroscopy labs is to use such a laser for multiple experiments by dividing the ... **development of ultrashort pulse lasers for ultrafast ...** - principles and advantages of broad-band time-resolved spectroscopy that can provide both electronic relaxation and vibrational dynamics are explained. in the following sections 5 and 6, ultrashort visible pulse laser and ultrashort ultraviolet (uv) laser, respectively, both based on parametric processes, are discussed. **ultrashort laser pulses & chemical physics** - how to prepare a femtosecond pulse i femtosecond laser pulses are usually fourier transform-limited pulses  $\Delta\omega \cdot \Delta t \approx 2\pi$   $\Delta\omega \approx 2\pi/\Delta t$  large spectral bandwidth for short pulses  $\Delta\lambda \approx \lambda^2/(c\Delta t)$   $\Delta\lambda \approx 21$  nm for 100 fs pulses with  $\lambda 0 = 800$  nm wavelength fs pulse ns pulse the need for large bandwidth limits the choice of the laser active medium (broad-band materials **fairy lights in femtoseconds: aerial and volumetric ...** - the principles and design parameters of femtosecond-laser-based volumetric displays. we explore a less harmful, high-resolution, adaptable laser-based volumetric display using a femtosecond laser and an sldm cond, we introduce this setup we designed in rd, we give examples of applications. finally, we conduct experiments on **nonlinear optical techniques for thz pulse generation and ...** - this chapter, the principles of time-domain thz spectroscopy and time-domain thz imaging using nonlinear optical techniques for thz pulse generation and detection are briefly discussed. section 2.2 describes the principles of generation and detection of thz-frequency radiation by optical rectification of femtosecond laser pulses **all optical histology : serial ablation and multiphoton ...** - all optical histology : serial ablation and multiphoton imaging of neuronal tissue with femtosecond laser pulses philbert s. tsai1, beth friedman2, agustin i. ifarraguerri8, beverly d. thompson9, varda lev-ram3, chris b. schaffer1, qing xiong5, roger y. tsien3-6, jeffrey a. squier10 and david kleinfeld1,6,7 departments of physics1, neurosciences2, pharmacology3, chemistry and biochemistry4 ... **development of frequency resolved optical gating (frog ...** - development of frequency resolved optical gating (frog) system for the temporal characterization of femtosecond pulses mentor: guillaume m. laurent overview: our capacity to observe and control fundamental physical processes at the atomic level has surged since the advent of ultra-fast femtosecond laser sources with pulse duration matching ... **femtosecond pulse shaping adds a new dimension to mass ...** - electronics. based on these general principles, we proceed to show results using 8 bit binary-shaped pulses. femtosecond pulses have a broad bandwidth, which was divided in eight bins where the phase in each bin can be set to 0 or  $\pi$ , allowing 256 different phase shapes. to determine , a sequence of 256 bi- **introduction - department of physics and astronomy** - introduction . the electric field of a monochromatic plane wave is given by ... in laser pulses this test function is the pulse signal coming from laser because the test function cannot be synthesized in short time scale. hence, for this case, the correlation function is called ... - femtosecond laser pulses: principles & experiments by c ... **optical fiber based ultrashort pulse multispectral ...** - nonlinear optical microscopy (nlom) utilizing femtosecond laser pulses has become a proven tool for intravital imaging of living tissues[1] since its first demonstration[2] nearly two decades ago. high peak intensities associated with femtosecond laser pulses focused through high numerical aperture (na) objective lenses **anisotropy modulations of femtosecond laser pulse induced ...** - anisotropy modulations of femtosecond laser pulse induced periodic surface structures on silicon by adjusting double pulse delay weina han, 1 lan jiang, xiaowei li,1,\* qingsong wang, hao li, and yongfeng lu2 1laser micro/nano-fabrication laboratory, school of mechanical engineering, beijing institute of technology, beijing 100081, china **fairy lights in femtoseconds: aerial and volumetric ...** - fairy lights in femtoseconds: aerial and volumetric graphics rendered by focused femtosecond laser combined with computational holographic fields yoichi ochiai1\* kota kumagai2\* takayuki hoshi3 jun rekimoto4 satoshi hasegawa2 yoshio hayasaki2 1university of tsukuba 2utsunomiya university 3nagoya institute of technology 4the university of tokyo ... **polarization behavior of femtosecond laser written optical ...** - polarization behavior of femtosecond

laser written optical waveguides in ti:sapphire jing bai,<sup>1,2</sup> guanghua cheng,<sup>1,\*</sup> xuewen long,<sup>1,2</sup> yishan wang,<sup>1</sup> wei zhao,<sup>1</sup> guofu chen,<sup>1</sup> razvan stoian,<sup>3</sup> and rongqing hui<sup>4</sup> 1state key laboratory of transient optics and photonics, xi'an institute of optics and precision mechanics, chinese academy of sciences, xi'an 710119, china

**femtosecond optical pulse shaping and processing** - since the advent of the laser over thirty years ago, there has been sustained interest in the quest to generate ultrashort laser pulses in the picosecond (10<sup>-12</sup> second) and femtosecond (10<sup>-15</sup> second) range. over the last several years progress has been spectacular. pulses on the **femtosecond fluorescence spectroscopy based on the optical ...** - principles and realization of a kerr gate on the femtosecond time scale, fluorescence spectra are often recorded by means of an optical gate (see figure 1a). an optical gate cuts temporal slices out of the fluorescence decay. the timing of this "cutting" is controlled by a delay stage which sets the time interval **d pulse energy stabilization of a femtosecond laser pulse chain** - pulse energy stabilization of a femtosecond laser pulse chain a stabilization system was designed and implemented in order to reduce the power fluctuations of a ti:sapphire ultrafast laser at lund laser center, lund university. this laser produces a train of femtosecond laser pulses. an active stabilization system was designed **synchronization of two spectra-physics pro amplifiers for ...** - the delay between two amplified pulses by delaying one of the replicas. the repetition rate of the oscillator is around 80 mhz, which means every seed pulse is inherently separated by around 12 ns. as a result, we can introduce a time delay ... femtosecond laser pulses: principles and experiments. 2nd ed. (2004). 4. **control of chemical reactions using shaped femtosecond ...** - using shaped femtosecond pulses by xin zhu the possibility that chemical reactions may be controlled by tailored femtosecond laser pulses has inspired recent studies that take advantage of their short pulse duration, comparable to intramolecular dynamics, and high peak intensity to fragment and ionize molecules. **physical aspects of femtosecond surgical laser for ...** - physical aspects of femtosecond surgical laser for refractive surgery tammo ripken laser zentrum hannover e.v. ... use ultra short laser pulses to dissect corneal tissue, whereas interaction process for ... two obvious principles can be used: pulse shortening and strong focussing. **femtosecond laser photo-response of ge sb s films** - femtosecond direct-writing using laser pulses with both khz and mhz repetition rate pulses is well established as a method of fabricating photonic structures in amorphous materials such as silica, phosphate, and chalcogenide glasses [1-7]. **what is the ideal femtosecond laser for lasik?** - five femtosecond laser platforms are currently commercially available for creating lasik flaps. each of these platforms operates on similar principles. the patient lies down, an interface is applied to the cornea, and laser pulses are delivered to the superficial cornea. the laser pulses produce cavitation bubbles **plasma mediated ablation of biological tissues with ...** - subpicosecond laser pulses. experimental results suggest that subpicosecond plasma mediated ablation can be employed as a tool for precise laser microsurgery of various tissues. i. introduction plasma optical breakdown is the only mechanism of laser energy deposition in transparent and low absorbing tissues. **microfluidic cell counter with embedded optical fibers ...** - microfluidic cell counter with embedded optical fibers fabricated by femtosecond laser ablation and anodic bonding dawn schaefer,<sup>1,\*</sup> emily a. gibson,<sup>2,3</sup> evan a. salim,<sup>4,5</sup> amy e. palmer,<sup>2</sup> ralph jimenez,<sup>2,5</sup> and jeff squier<sup>1</sup> 1department of physics, colorado school of mines, golden, colorado, 80401, usa **journal of physics d: applied physics topical review open ...** - this review is devoted to the study of ultrafast laser ablation of solids and liquids. the ablation of condensed matter under exposure to subpicosecond laser pulses has a number of peculiar properties which distinguish this process from ablation induced by nanosecond and longer laser pulses. **low-threshold two-photon pumped zno nanowire lasers** - the excitation pulses were produced by an optical parametric amplifier (topas, coherent) pumped with the amplification stage of a ti:sapphire laser (libra, 1 khz, 80 fs, coherent inc.) with the tunable output wavelength ( $\lambda_{exc}$ ) near 700 nm. trpl characterization of two-photon pumped zno nanowires was **quantum multiscale modeling of electron dynamics and ...** - mechanisms, which are critical in laser micro/nano fabrication. in this study, the first-principles calculations and plasma model are used to theoretically investigate the changes of localized transient electron dynamics and the corresponding material properties during femtosecond laser pulse trains ablation of fused silica. theoretical results ... **applications of ultrafast wavefront rotation in highly ...** - phase of femtosecond laser pulses. the basic principles are explained qualitatively from different points of view, the experimental evidence obtained so far is summarized, and the perspectives opened by these effects are discussed. keywords: attosecond pulses, high-harmonic generation, ultrafast measurements,

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