

Fundamental Research Papers 1988- Present

1988

Regenerative amplification in Alexandrite of pulses from specialized oscillators	P. Bado, M. Pessot, J. Squier, G.A. Mourou, D.J. Harter	IEEE J. Quant. Elect. Vol. 24, No. 6, pp. 1167-1171	An alexandrite regenerative amplifier, used to amplify the output of various specialized oscillators, is described...
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1992

Characterization of ultrashort pulse formation in passively mode-locked fiber lasers	M. Hofer, M.H. Ober, F. Haberl, M.E. Fermann	IEEE J. Quant. Elect. Vol. 28, No. 3, pp. 720-728	Pulse formation in an all-solid-state passively mode-locked neodymium glass fiber laser is investigated by employing characterization techniques in the time, optical, and ...
Real-time picosecond electro-optic oscilloscope technique using a tunable semiconductor laser	A. Galvanauskas, J.A. Tellefsen, A. Krotkus, M. Oberg, B. Broberg	Appl. Phys. Lett. Vol. 60, No. 2, pp. 145-147	The feasibility of using a tunable semiconductor laser for real-time electro-optic measurements of picosecond electrical signals is demonstrated. The method is based ...
Recent advances in ultrashort optical pulse shaping for high-speed communications	A.M. Weiner, V.L. DaSilva, M.E. Fermann, D.E. Leaird, E.G. Paek, D.H. Reitze, Y. Silberberg, D.A. Smith	1992 LEOS Conf. Proc. pp. A41-A42	In wavelength-division multiplexed optical communications, the different wavelengths are neither controlled nor exploited, e.g., because the various wavelengths are ...

1993

42 fs pulse generation from a mode-locked fiber laser started with a moving mirror	M.H. Ober, M. Hofer, M.E. Fermann	Opt. Lett. Vol. 18, No. 5, pp. 367-369	Passive mode locking initiated with a moving mirror is demonstrated in a neodymium fiber laser for what is to ...
Generation of femtosecond optical pulses with nanoJoule energy from a diode laser and fiber based system	A. Galvanauskas, P. Blixt, J.A. Tellefsen	App. Phys. Lett. Vol. 63, No. 13, pp. 1742-1744	Linearly chirped, subnanosecond optical pulses, emitted at an arbitrary repetition rate by a fast-tuned monolithic diode laser, were compressed down to 600 fs by group- ...
Generation of pulses shorter than 200 fs from a passively mode-locked Er fiber laser	M.E. Fermann, M.J. Andrejco, Y. Silberberg, A.M. Weiner	Opt. Lett. Vol. 18, No. 1, pp. 48-50	The generation of stable bandwidth-limited pulses as short as 180 fs with pulse energies as high as 100 pJ is demonstrated with a passively mode-locked Er fiber. ...
Passive mode locking in Erbium fiber laser with negative group delay	M.E. Fermann, M.J. Andrejco, M.L. Stock, Y. Silberberg, A.M. Weiner	Appl. Phys. Lett. Vol. 62, No. 9, pp. 910-912	100 fs pulses are generated in passively mode-locked erbium fiber lasers with small negative group-velocity dispersion. The pulses are obtained at a pump power ...
Shaping of ultrashort optical pulses by using an integrated acousto-optic tunable filter	M.E. Fermann, V. da Silva, D.A. Smith, Y. Silberberg, A.M. Weiner	Opt. Lett. Vol. 18, No. 18, pp. 1505-1507	Reshaping of ultrashort optical pulses at 1.53 μm by using an integrated acousto-optic tunable filter is reported. Control of the optical pulse shape is accomplished by ...
Synchronous mode locking using pump-induced phase modulation	M. Stock, L.-M. Yang, M.J. Andrejco, M.E. Fermann	Opt. Lett. Vol. 18, No. 18, 1993, pp. 1529-1531	Synchronous mode locking using phase modulation directly from the pump laser is demonstrated for what is to our knowledge the first time. A synchronously mode-locked ...

1994

All-fiber source of 100 nJ subpicosecond pulses	M.E. Fermann, A. Galvanauskas, D. Harter	Appl. Phys. Lett. Vol. 64, No. 11, pp. 1315-1317	Chirped pulse amplification of a stretched pulse passively mode-locked erbium fiber laser is demonstrated. The two-stage all-fiber amplifier system delivers 800-fs pulses ...
Carrier relaxation in InGaAs heterostructures	G. Sucha, S.R. Bolton, D.S. Chemla, D.L. Sivco, A.Y. Cho	App. Phys. Lett. Vol. 65, No. 12, pp. 1486-1488	We present time-resolved measurements of carrier dynamics in bulk and quantum wells InGaAs, using differential absorption spectroscopy. We find that the ...

1994 (Continued)

Environmentally stable Kerr-type mode-locked Erbium fiber laser producing 360 fs pulses	M.E. Fermann, L.-M. Yang, M.L. Stock, M.J. Andrejco	Opt. Lett. Vol. 19, No. 1, pp. 43-45	We demonstrate an environmentally stable Kerr-type mode-locked Erbium fiber laser producing 360-fs near-bandwidth-limited pulses. Environmentally stable ...
High-power amplification of femtosecond optical pulses in a diode-pumped fiber system	A. Galvanauskas, M.E. Ferman, D. Harter	Opt. Lett. Vol. 19, No. 16, pp. 1201-1203	We report a compact all-diode-laser-pumped Erbium-doped fiber system consisting of an environmentally stable Kerr-type mode-locked fiber oscillator and a fiber amplifier. ...
Hybrid diode-laser fiber-amplifier source of high-energy ultrashort pulses	A. Galvanauskas,	Opt. Lett. Vol 19, No. 14, pp.1043-1045	We demonstrate what we believe is the first compact laser system for generating ultrashort microJoule-energy optical pulses. Linearly chirped pulses from monolithic tunable ...
Ultrafast dynamics of the optical mode of a 1.5 micron multiple quantum well optical amplifier	D. Botkin, S. Weiss, G. Sucha, D.S. Chemla, J.M. Wiesenfeld	Appl. Phys. Lett. Vol. 64, No. 21, pp. 2861-2863	Time-resolved measurements of the mode profile of semiconductor multiple quantum well amplifiers reveal ultrafast dynamic changes which contribute to the ...
Ultrashort pulse sources based on single-mode rare-earth-doped fibers	M. E. Fermann	J. Appl. Phys. B Vol. 58, No. 3, pp. 197-209	An overview of ultrashort-pulse sources based on single-mode rare-earth-doped fibers is given. A wide range of pulse-generation schemes comprising mode-locked fiber ...

1995

All-fiber femtosecond pulse amplification circuit using chirped Bragg gratings	A. Galvanauskas, M.E. Fermann, D. Harter, K. Sugden, I. Bennion	App. Phys. Lett. Vol. 66, No.9, pp.1053-1055	In-fiber chirped Bragg gratings are used as stretchers and compressors for distortionless amplification of femtosecond pulses in chirped pulse amplification system. It is shown ...
Compact ultrahigh-power laser systems	A. Galvanauskas	Proc. SPIE Vol. 2377, pp. 117-126	Compact sources of high energy ultrashort pulses are described. Femtosecond and picosecond optical pulses ...
Controllable dual-wavelength operation of a femtosecond Neodymium fiber laser	M.H. Ober, G. Sucha, M.E. Fermann	Opt. Lett. Vol. 20, No. 2, pp. 195-197	Simultaneous asynchronous mode locking of two wavelengths in a Nd ³⁺ -doped fiber laser is reported. The laser operates simultaneously at wavelengths of 1.060 ...
Environmentally stable high-power soliton fiber lasers that use chirped fiber Bragg gratings	M.E. Fermann, K. Sugden, I. Bennion	Opt. Lett. Vol. 20, No. 15, pp. 1625 - 1627	Environmentally stable high-power Erbium fiber soliton lasers are constructed by Kerr or carrier-type mode locking. We obtain high-energy pulses by using relatively short ...
Femtosecond pulse amplification in cladding-pumped fibers	J.D. Minelly, A. Galvanauskas, M.E. Fermann, D. Harter, J.E. Caplen, Z.J. Chen, D.N. Payne	Opt. Lett. Vol. 20, No. 17, pp. 1797 - 1799	Femtosecond pulse amplification in a cladding-pumped fiber amplifier is demonstrated for the first time to our knowledge. Using a cladding-pumped Erbium-doped ...
Generation of 10 nJ picosecond pulses from a modelocked fiber laser	M.E. Fermann, K. Sugden, I. Bennion	Elect. Lett. Vol. 31, No. 3, pp. 194-195	Wavelength-tunable very high power soliton fibre lasers are constructed using chirped fibre Bragg gratings. Near-bandwidth limited pulses with widths of 4.0 ps and pulse ...
High-power Neodymium soliton fiber laser that uses a chirped fiber grating	M. Hofer, M.H. Ober, R. Hofer, M.E. Fermann, G. Sucha, D. Harter, K. Sugden, I. Bennion, C.A.C. Mendonca, T.H. Chiu	Opt. Lett. Vol. 20, No. 16, pp. 1701-1703	The use of a highly chirped fiber Bragg grating for dispersion compensation in a self-starting passively modelocked Neodymium soliton fiber laser is for the first ...
High-power soliton fiber laser based on pulse width control with chirped fiber Bragg gratings	M.E. Fermann, K. Sugden, I. Bennion	Opt. Lett. Vol. 20, No. 2, pp. 172 - 174	Chirped fiber Bragg gratings control the pulse width and energy in Kerr mode-locked Erbium fiber soliton lasers. We create high-energy pulses by providing large amounts of ...
Period-doubling and quasi-periodicity in additive-pulse mode-locked lasers	G. Sucha, S.R. Bolton, S. Weiss, D.S. Chemla	Opt. Lett. Vol. 20, No. 17, pp. 1794-1796	We have observed period doubling and quasi-periodicity in an additive-pulse mode-locked F-center laser. Experiments show that period doubling is often present even though ...
Widely tunable femtosecond Neodymium fiber laser	M.H. Ober, M. Hofer, R. Hofer, G.A. Reider, G.D. Sucha, M.E. Fermann, D. Harter, C.A.C. Mendonca, T.H. Chiu	Opt. Lett. Vol. 20, No. 22, pp. 2303-2305	Continuous tuning of a mode-locked Nd ³⁺ fiber laser over 75 nm is reported. This wide tuning range, which extends over more than twice the FWHM gain bandwidth of ...

1996

A new method for rapid temporal scanning of ultrafast lasers	G. Sucha, M.E. Fermann, D.J. Harter, M. Hofer	IEEE J. Select. Top. Quant. Elect. Vol. 2, No. 3, pp. 605-621	Using an identical pair of passively mode-locked fiber lasers, we demonstrate a new method of temporal scanning by periodically varying the cavity length of one ...
Alexandrite-pumped Alexandrite regenerative amplifier for femtosecond pulse amplification	A. Hariharan, M.E. Fermann, M.L. Stock, D.J. Harter, J. Squier	Opt. Lett. Vol. 21, No. 2, pp. 128-130	We demonstrate a regenerative amplifier incorporating Alexandrite as the gain medium that is pumped by an Alexandrite laser. Temperature-altered gain permitted ...
Broad-area diode-pumped 1 W femtosecond fiber system	A. Galvanauskas, M.E. Fermann, D. Harter, J.D. Minelly, G.G. Vienne, J.E. Caplen	1996 CLEO Tech. Digest, pp. 495-496	High-average-power 310-fs pulses were obtained with an all-fiber chirped pulse amplification (CPA) system. Both the oscillator and the power amplifier are based on Er/Yb ...
Cladding pumped passive harmonically mode-locked fiber laser	M.E. Fermann, J.D. Minelly	Opt. Lett. Vol. 21, No. 13, pp. 970-972	A passive harmonically mode-locked fiber laser cladding pumped by a broad-area diode-laser array is described. Harmonic mode locking is obtained in a frequency range ...
Cladding-pumped passively mode-locked fiber laser generating femtosecond and picosecond pulses	M.E. Fermann, D. Harter, J.D. Minelly, G.G. Vienne	Opt. Lett. Vol. 21, No. 13, pp. 967- 969	Passively mode-locked fiber lasers cladding pumped by broad-area diode-laser arrays are described. With a dispersion-compensated Erbium-Ytterbium fiber ...
Femtosecond watt-level fiber amplification circuits	A. Galvanauskas	1996 LEOS Conf. Proc. Vol. 1, pp. 127-128	Direct amplification of femtosecond optical pulses in single-mode fibers is limited to subnanoJoule output energies. This limitation, which is due to strong nonlinear effects at ...
Injection of ultrafast regenerative amplifiers with low energy femtosecond pulses from an Er-doped fiber laser	A. Hariharan, D.J. Harter, T.S. Sosnowski, S. Kane, D. Du, T.B. Norris, J. Squier	Opt. Comm. Vol. 132, No. 5-6, pp. 469-473	A very compact, low-noise and stable frequency-doubled Er-fiber laser system has been used to injection-seed a 10 Hz and a 250 kHz Ti:Sapphire regenerative amplifier ...
Monolithic polarization-insensitive passively mode-locked fiber laser	M. Hofer, M.H. Ober, R. Hofer, G.A. Reider, K. Sugden, I. Bennion, M.E. Fermann, G. Sucha, D. Harter, C.A.C. Mendonca, T.H. Chiu	1996 OFC Conf. Proc. pp. 4-5	Fiber lasers have by now become popular sources for short optical pulses. Triggered by the need for compact sources for telecommunication: turn-key operation with somewhat complex packages has recently been achieved. The ...
Nanosecond-to-picosecond pulse compression with fiber gratings in a compact fiber-based chirped pulse amplification system	A. Galvanauskas, P.A. Krug, D. Harter	Opt. Lett. Vol. 21, No. 14, pp. 1049-1051	A chirped, 12-cm-long fiber Bragg grating with 10-nm spectral bandwidth was employed in place of a conventional diffraction grating pair compressor in a ...
Nonlinear effects in femtosecond pulse amplification using chirped fiber gratings	S. Radic, G.P. Agrawal, A. Galvanauskas	1996 OFC Conf. Proc. pp. 225 -226	The objective of this paper is to investigate, both theoretically and experimentally, the limits on maximum pulse energy from a fiber-grating-based all-fiber system ...
Synchronization of environmentally coupled, passively mode-locked fiber lasers	G. Sucha, M. Hofer, M.E. Fermann, F. Haberl, D. Harter	Opt. Lett. Vol. 4, No. 19, pp. 1570-1572	We have synchronized a pair of femtosecond, passively mode-locked Er-doped fiber lasers by active adjustment of the cavity length of one laser with an electronic servo. ...

1997

A monolithic Gallium Arsenide interval timer IC with integrated PLL clock synthesis having 500-ps single shot resolution	S. Nati, I. Kyles	IEEE J. Solid-state Circ. Vol. 32, No. 9, pp. 1350-1356	A Gallium Arsenide (GaAs) integrated circuit for measuring single shot time intervals with 500-ps resolution has been designed, fabricated, and tested. The circuit contains a ...
Cladding-pumped fiber laser amplifier system generating 100 μJ energy picosecond pulses	J.D. Minelly, A. Galvanauskas, D. Harter, J.E. Caplen, L. Dong	1997 CLEO Conf. Proc. Vol. 11, pp. 475 -476	Though the first demonstration of femtosecond pulse generation directly from fiber lasers goes back to 1990, fiber lasers are just now being established as ...

1997 (Continued)

Effect of confinement on energy-dependent dephasing in heterostructures	S.R. Bolton, S. Bar-Ad, G. Sucha, D.S. Chemla	Phys. Rev. B Vol. 55, No. 23, p.15768	To study the effects of confinement by quantum-well potential discontinuities on excitonic dephasing, we performed a spectrally and temporally resolved study ...
Engineerable compression of ultrashort pulses by use of second-harmonic generation in chirped-period-poled Lithium Niobate	M.A. Arbore, A. Galvanauskas, D. Harter, M.H. Chou, M.M. Fejer	Opt. Lett. Vol. 22, No. 17, pp. 1341-1343	We demonstrate the use of an aperiodic quasi-phase-matching (QPM) grating to generate second-harmonic pulses that are stretched or compressed relative to ...
Fiber lasers for ultrafast optics	M.E. Fermann, A. Galvanauskas, G. Sucha, D. Harter	J. Appl. Phys. B Vol. 65, No. 2, pp. 259-275	The current status of a fiber-based ultrafast technology is reviewed. Pulse generation techniques capable of producing femtosecond pulses are discussed. Here we ...
Fiber-laser-based femtosecond parametric generator in bulk periodically poled LiNbO ₃	A. Galvanauskas, M.A. Arbore, M.M. Fejer, M.E. Fermann, D. Harter	Opt. Lett. Vol. 22, No. 2, pp. 105-107	A diode-pumped system for optical parametric generation of wavelength-tunable femtosecond pulses is demonstrated. It comprises an Er-doped fiber mode- ...
Frequency doubling of femtosecond Erbium-fiber soliton lasers in periodically poled Lithium Niobate	M.A. Arbore, M.M. Fejer	Opt. Lett. Vol. 22, No. 1, pp. 13-15	We report efficient frequency doubling of passively mode-locked femtosecond Erbium-fiber lasers. Quasi-phase-matched second-harmonic generation in periodically ...

1998

A new Magnesium alloy for automotive powertrain applications	A. Luo, T. Shinoda	SAE Tech. Paper 980086	New magnesium alloys based on Mg-Zn-Al-Ca quaternary system (ZAC alloys) have been developed by IMRA America, Inc. The 200-hour creep extension of the new ...
Chirped-pulse-amplification circuits for fiber amplifiers, based on chirped-period quasi-phase-matching gratings	A. Galvanauskas, D. Harter, M.A. Arbore, M.H. Chou, M.M. Fejer	Opt. Lett. Vol. 23, No. 21, pp. 1695-1697	A new type of compact chirped-pulse-amplification circuit for high-power amplification of femtosecond pulses in an optical fiber is demonstrated. This circuit is based on a ...
Compact, reliable fiber laser systems for industrial applications	A. Galvanauskas, D.J. Harter, M.E. Fermann, A. Hariharan	Proc. SPIE Vol. 3269, pp. 26-35	A number of compact, diode-pumped sources of femtosecond optical pulses have been demonstrated by combining fiber and electric-field-poled Lithium Niobate ...
Effects of cavity topology on the nonlinear dynamics of additive-pulse mode-locked lasers	G. Sucha, D.S. Chemla, S.R. Bolton	JOSA B Vol. 15, No. 12, pp. 2847-2853	We study the effect of cavity topology on the nonlinear dynamics of additive-pulse mode-locked (APM) lasers configured in the Fabry-Perot and Michelson geometries ...
Effects of confinement on carrier dynamics in In _{0.47} Ga _{0.53} As heterostructures	S.R. Bolton, G. Sucha, D. Chemla	Phys. Rev. B Vol. 58, No. 24, pp. 16326-16332	To study the effects of confinement by quantum-well potential discontinuities on ultrafast carrier dynamics, we performed pump-broadband probe studies of a series of ...
Efficient Q-switched Ti:Er:LiNbO ₃ waveguide laser	H. Suche, T. Oesselke, J. Pandavenes, R. Ricken, K. Rochhausen, W. Sholer, S. Balsamo, I. Montrosset, K.K. Wong	Elect. Lett. Vol. 34, No. 12, pp. 1228-1230	Diode-pumped Q-switched Ti:Er:LiNbO ₃ waveguide lasers have been developed with a monolithically integrated folded Mach-Zehnder type modulator of high extinction ratio as ...
Engineerable femtosecond pulse shaping by second-harmonic generation with Fourier synthetic quasi-phase-matching gratings	G. Imeshev, A. Galvanauskas, D. Harter, M.A. Arbore, M. Proctor, M.M. Fejer	Opt. Lett. Vol. 23, No. 11, pp. 864-866	We describe a pulse-shaping technique that uses second-harmonic generation with Fourier synthetic quasi-phase-matching gratings. We demonstrate both amplitude and ...
Frequency doubling of Er-doped multimode fiber compressor-amplifiers	M.E. Fermann, A. Galvanauskas, D. Harter	1998 CLEO Tech. Digest pp. 189-190	We have demonstrated an efficient 5 times pulse compressor for medium power pulses in doped and undoped multimode (MM) fibers for the first time to our ...
High-energy femtosecond pulse amplification in a quasi-phase-matched parametric amplifier	A. Galvanauskas, A. Hariharan, D. Harter, M.A. Arbore, M.M. Fejer	Opt. Lett. Vol. 23, No. 3, pp. 210-212	A new type of solid-state femtosecond amplifier is demonstrated that is based on quasi-phase-matched parametric amplification. Such gain media are different ...

1998 (Continued)

High-energy high-average-power femtosecond fiber system using a QPM-grating pulse compressor	A. Galvanauskas, M.E. Fermann, M.A. Arbore, J.D. Minelly, J.E. Caplen, M.M. Fejer, D. Harter	1998 CLEO Tech. Digest p. 364	We demonstrate a simple and compact chirped pulse amplification (CPA) circuit for boosting both the accessible powers and energies from a femtosecond fiber amplifier. ...
High-power 100-fs pulse generation by frequency doubling of an Erbium-Ytterbium-fiber master oscillator power amplifier	M. Hofer, M.E. Fermann, A. Galvanauskas, D. Harter, R.S. Windeler	Opt. Lett. Vol. 23, No. 23, pp. 1840-1842	Frequency doubling of an Erbium-Ytterbium-fiber master-oscillator-power-amplifier system is demonstrated. Simultaneous amplification and pulse compression in ...
High-power side-pumped passively mode-locked Er-Yb fiber laser	M. Hofer, M.E. Fermann, L. Goldberg	IEEE Phot. Tech. Lett. Vol. 10, No. 9, pp. 1247-1249	A side-pumped double-clad Er-Yb fiber laser passively mode-locked with a saturable absorber is demonstrated for the first time. Pumped with a power of 1 W from a broad...
High-power single-mode fiber amplifiers using multimode fibers	M.E. Fermann, A. Galvanauskas, D. Harter, J.D. Minelly, J.E. Caplen	1998 OFC Tech. Digest pp. 39-40	As the optical power levels extractable from current single-mode (SM) fiber amplifiers are reaching regions where optical nonlinearities become significant, even under CW ...
Microlaser pumped, engineerable bandwidth parametric chirped-pulse amplifier using electric-field-poled LiNbO ₃	A. Galvanauskas, A. Hariharan, D. Harter, M.A. Arbore, M.M. Fejer	1998 CLEO Tech. Digest pp. 16-17	We have demonstrated the use of periodically poled LiNbO ₃ as a practical diode-pumped parametric gain medium for ultrashort pulse amplification. The essential advantage is ...
Noise considerations for ultrafast measurements	G. Sucha	1998 LEOS Conf. Proc. Vol. 1, pp. 223-224	The effects of timing jitter of modelocked lasers are considered with regard to ultrafast measurement systems. To evaluate performance, a new time-domain method is ...
Robust high-power and wavelength-tunable femtosecond fiber system based on engineerable PPLN devices	A. Galvanauskas, M.E. Fermann, M.A. Arbore, M.M. Fejer, J.D. Minelly, J.E. Caplen, K.K. Wong, D. Harter	Nonlin. Opt. 1998 Conf. Proc. pp. 265-267	Here we report a robust high-power, high-repetition rate and wavelength-tunable femtosecond laser system based on optical parametric generation and a compact fiber ...
Single-mode excitation of multimode optical fibers with ultrashort pulses	M. E. Fermann	Opt. Lett. Vol. 23, No. 1, pp. 52-54	Single-mode excitation of step-index multimode fibers with light sources with short temporal coherence lengths is demonstrated. Multimode fiber designs with reduced ...
Time-domain jitter measurement of ultrafast fiber lasers	G. Sucha, M.E. Fermann, D.J. Harter	1998 CLEO Tech. Digest pp. 188-189	The recent development of ultra low-noise mode-locked fiber lasers with nearly quantum-limited timing jitter promises great advancements in the realm of high-...
Use of volume chirped Bragg gratings for compact high-energy chirped pulse amplification circuits	A. Galvanauskas, A. Heaney, T. Ergodan, D. Harter	1998 CLEO Tech. Digest p. 362	We present the first experimental demonstration of using a volume chirped Bragg grating for ultrashort pulse stretching and recompression in a compact CPA arrangement. ...

1999

1.5 μm pulse shaping by degenerate type II DFG with QPM gratings	G. Imeshev, M.M. Fejer, A. Galvanauskas, D. Harter	1999 CLEO Tech. Digest p. 190	Manipulation of the temporal shape of ultrashort optical pulses is important for many applications. Here we ...
Amplification in 1.2 - 1.7 μm communication window using OPA in PPLN waveguides	A. Galvanauskas, K.K. Wong, K. El Hadi, M. Hofer, M.E. Fermann, D. Harter, M.H. Chou, M.M. Fejer	Elect. Lett. Vol. 35, No. 9, pp. 731-733	Highly nonlinear (up to ~ 2000 % / W) parametric amplifiers in periodically-poled LiNbO ₃ waveguides are presented. High optical gain (up to 90 dB) in the whole transmission ...
CW passive mode-locking evolved from Q-switch mode-locking in Erbium doped fiber lasers	M. Jiang, G. Sucha, M.E. Fermann, D. Harter	1999 CLEO Tech. Digest pp. 440-441	We report a new mode-locking mechanism, where the use of a two-photon absorber in addition to a saturable absorber allows for CW mode- locking mechanism, ...
Fiber lasers in ultrafast optics	M.E. Fermann, G.D. Sucha, A. Galvanauskas, M. Hofer, D.J. Harter	Proc. SPIE Vol. 3616, pp. 14-24	The current status of ultrafast fiber lasers is discussed. Recent advances in optical fiber designs as well as improved saturable absorbers have greatly improved the ...

1999 (Continued)

Low-noise amplification of high-power pulses in multimode fibers	M. Hofer, M.E. Fermann, A. Galvanauskas, D. Harter, R.S. Windeler	IEEE Phot. Tech. Lett. Vol. 11, No. 6, pp. 650-652	Low-noise amplification of high-power pulses in multimode Erbium/Ytterbium-doped fibers is demonstrated. The use of multimode fiber amplifiers allows to overcome the peak ...
Nonlinearly limited saturable-absorber mode locking of an Erbium fiber laser	M. Jiang, G. Sucha, M.E. Fermann, J. Jimenez, D. Harter, M. Dagenais, S. Fox, Y. Hu	Opt. Lett. Vol. 24, No. 15, pp. 1074-1076	We describe an Erbium fiber laser that is passively mode locked by a novel, precision antireflection-coated semiconductor saturable-absorber mirror that ...
Passively mode-locked multi-mode fiber laser	M. Hofer, M.E. Fermann, A. Galvanauskas, R.S. Windeler	1999 CLEO Tech. Digest p. 222	Fiber amplifiers and lasers based on multimode (MM) fibers have recently allowed a great increase in the pulse peak ...
Portable THz system and its applications	M. Li, X.-C. Zhang, G.D. Sucha, D.J. Harter	Proc. SPIE Vol. 3616, pp. 126-135	Industrial applications of THz techniques require compact and reliable systems. We have designed and constructed two portable THz systems integrated with femtosecond, ...
Pulse-resolved measurements of subharmonic oscillations in a Kerr-lens mode-locked Ti:Sapphire laser	S.R. Bolton, R.A. Jenks, C.N. Elkinton, G. Sucha	JOSA B Vol. 16, No. 2, pp. 339-344	We made pulse-resolved observations of subharmonic oscillations in the pulse train of a Kerr-lens mode-locked Ti:Sapphire laser. Pulse-resolved beam profiles ...
Sub-THz transmission spectroscopy in liquids using a stand-alone compact unit	G.C.Cho, M. Tani, J. Wegener, X.-C. Zhang	1999 LEOS Conf. Proc. Vol. 2, pp. 576-577	We present a compact THz measurement system in a portable size integrated with a femtosecond fiber laser. We demonstrate the feasibility of application of this portable ...
Tunable Er ³⁺ fiber femtosecond source amplified to W-level average power at 1.03 - 1.06 μm in Yb ³⁺ fiber	M.E. Fermann, A. Galvanauskas, M.L. Stock, K.K. Wong, D. Harter, L. Goldberg	1999 CLEO Tech. Digest p. CPD9/1	A Raman-shifted and frequency-doubled high-power Er ³⁺ fiber soliton laser for seeding an efficient high-power Yb ³⁺ fiber femtosecond amplifier chain is demonstrated. ...
Ultra-wide tunable Er soliton fiber laser amplified in Yb-doped fiber	M.E. Fermann, A. Galvanauskas, M.L. Stock, K.K. Wong, D. Harter, L. Goldberg	Opt. Lett. Vol. 24, No. 20, pp. 1428-1430	A Raman-shifted and frequency-doubled high-power Er-fiber soliton laser for seeding an efficient high-power Yb fiber femtosecond amplifier is demonstrated. The ...

2000

100 μJ and 5.5 W Yb-fiber femtosecond chirped pulse amplifier system	G.C.Cho, A. Galvanauskas, M.E. Fermann, M.L. Stock, D. Harter	2000 CLEO Tech. Digest p. 118	We have demonstrated the first all-fiber high-energy/power coherent pulse amplifier system based on Yb-doped fibers. MicroJoule femtosecond pulses have been obtained ...
Bit error rate performance of ultrashort-pulse optical CDMA detection under multi-access interference	S. Shen, A.M. Weiner, G.D. Sucha, M.L. Stock	Electr. Lett. Vol. 36, No. 21, pp. 1795-1797	The first system measurement on the bit error rate performance of an ultrashort-pulse optical CDMA channel under multi-access interference is reported. Effective ...
Compact THz-radiation source consisting of bulk semiconductor, a mode-locked fiber laser and a 2-T permanent magnet	S. Ono, T. Tsukamoto, M. Sakai, Z. Liu, H. Ohtake, N. Sarukura, S. Nishizawa, A. Nakanishi, M. Yoshida	Rev. Sci. Instr. Vol. 71, No. 2, pp. 554-556	A compact THz-radiation source using an InAs semiconductor is demonstrated with a turn-key femtosecond fiber laser as an excitation source and a ...
Generation and propagation of high-power parabolic pulses in optical fibers	M.E. Fermann, B.C. Thomsen, J.M. Dudley, J.D. Harvey	2000 CLEO Tech. Digest pp. 21-22	We have verified that high power parabolic pulses as generated in high gain, normal dispersion fiber amplifiers, can be propagated over substantial fiber ...
Generation of diffraction-limited femtosecond beams using spatially-multimode nanosecond pump sources in parametric chirped pulse amplification systems	A. Galvanauskas, A. Hariharan, F. Raksi, K.K. Wong, D. Harter, G. Imeshev, M.M. Fejer	2000 CLEO Tech. Digest pp. 394-395	We have shown that spatially multimode output from a large core fiber amplifier can be efficiently converted into a diffraction-limited amplified signal beam by using ...
Generation of narrow-band Terahertz radiation via optical rectification of femtosecond pulses in periodically poled Lithium Niobate	Y.-S. Lee, T. Meade, V. Perlin, H. Winful, T.B. Norris, A. Galvanauskas	Appl. Phys. Lett. Vol. 76, No. 18, pp. 2505-2507	We demonstrate a promising technique for generating narrow-band Terahertz electromagnetic radiation. Femtosecond optical pulses are propagated through a ...

2000 (Continued)

Highly efficient, low-noise Yb femtosecond fiber source	M.E. Fermann, M.L. Stock, A. Galvanauskas, A. Hariharan, G. Sucha, D.J. Harter, L. Goldberg	2000 CLEO Tech. Digest pp. 83-84	With the recent availability of Raman-shifted, widely tunable Er fiber laser pulse sources, the direct injection of Yb fiber amplifiers with femtosecond pulses from a ...
High-power compact ultrafast fiber laser	M.E. Fermann, M.L. Stock, A. Galvanauskas, D.J. Harter	Proc. SPIE Vol. 3942, pp. 194-200	High-power compact ultrafast pulse sources based on optical fiber lasers are discussed. The optical efficiency of fiber-based ultrafast pulse sources is optimized by the ...
Narrow-band THz waveforms from optical rectification of femtosecond optical pulses in periodically poled Lithium Niobate	T.B. Norris, Y.-S. Lee, I. Meade, M. DeCamp, C. Herne, V. Perlin, H. Winful, A. Galvanauskas	2000 CLEO Tech. Digest pp. 656-657	We demonstrate a method for generation of narrow bandwidth THz fields by optical rectification, a nonlinear interaction between a 150-femtosecond optical pulse ...
Propagation and compression of high power parabolic pulses generating a high gain Yb:doped fiber amplifier	M.E. Fermann et al.,	2000 LEOE Tech. Digest p. 1	The amplification of ultrashort pulses to high powers in optical fiber amplifiers is usually associated with severe pulse distortion due to optical wave-breaking, limiting ...
Self-similar propagation and amplification of Parabolic pulses in optical fibers	M.E. Fermann, V.I. Kruglov, B.C. Thomsen, J.M. Dudley, J.D. Harvey	Phys Rev. Lett. Vol. 84, No. 26, pp. 6010-6013	Ultrashort pulse propagation in high gain optical fiber amplifiers with normal dispersion is studied by self-similarity analysis of the nonlinear Schrödinger equation ...
Temperature dependence of narrow-band terahertz generation from periodically poled Lithium Niobate	Y.-S. Lee, T. Meade, M. DeCamp, T.B. Norris, A. Galvanauskas	Appl. Phys. Lett. Vol. 77, No. 9, pp. 1244-1246	Femtosecond optical pulses are used to generate narrow-band Terahertz wave forms via optical rectification in a periodically poled Lithium Niobate crystal. By cooling ...
THz generation and detection using 1550-nm pulses from a fiber laser	M. Li, G. Sucha, P.-Y. Han, A. Galvanauskas, D. Harter, X.-C. Zhang	2000 CLEO Tech. Digest pp. 559-560	We have demonstrated THz emission and detection using a 1550-nm fiber laser. The phase-matching condition of DAST and GaAs were studied, as well as the electro- ...
Ultrafast fiber lasers: alternative light sources for industrial material processing	G. Sucha, H. Endert	Proc. SPIE Vol. 4088, pp. 201-204	The development of ultrashort pulse laser technology will have a strong impact on the advancement of laser machining. Ultrashort laser pulses can reduce the ...
Ultrafast pulse sources based on multi-mode optical fibers	M.E. Fermann, A. Galvanauskas, M. Hofer	Appl. Phys. B Vol. 70, No. 7, pp. 13-23	Ultrafast pulse sources based on multi-mode optical fibers are discussed. High-power passively mode-locked fiber lasers based on multi-mode rare-earth-doped optical ...
Ultrashort-pulse second-harmonic generation with longitudinally nonuniform quasi-phase-matching gratings: pulse compression and shaping	G. Imeshev, M.A. Arbore, M.M. Fejer, A. Galvanauskas, M. Fermann, D. Harter	JOSA B Vol. 17, No. 2, pp. 304-318	We present a theory of ultrashort-pulse second-harmonic generation (SHG) in materials with longitudinally nonuniform quasi-phase-matching (QPM) gratings. ...

2001

THz-radiation emitter and receiver system based on a 2T permanent magnet, 1040 nm compact fiber laser and pyroelectric thermal receiver	H. Ohtake, Y. Suzuki, N. Sarukura, S. Ono, T. Tsukamoto, A. Nakanishi, S. Nishizawa, M.L. Stock, M. Yoshida, H. Endert	Jpn. J. Appl. Phys. Vol. 40, No. 11B, pp. L1223-L1225	Thermal receiver detectable terahertz (THz) radiation is generated from InAs irradiated with a 1040 nm, 80 fs, 180 mW, 48-MHz-repetition-rate mode-locked fiber laser in ...
Generation of dual-wavelength pulses by frequency doubling with quasi-phase-matching gratings	G. Imeshev, M.M. Fejer, A. Galvanauskas, D. Harter	Opt. Lett. Vol. 26, No. 5, p. 268-270	We demonstrate generation of two synchronized picosecond pulses at different wavelengths near 778 nm by frequency doubling of a femtosecond pulse. We use ...
Generation of high-energy femtosecond pulses in multimode-core Yb-fiber chirped-pulse amplification systems	A. Galvanauskas, G.C. Cho, A. Hariharan, M.E. Fermann, D. Harter	Opt. Lett. Vol. 26, No. 12, pp. 935-937	220-fs pulses with energies of ~100 microJ have been generated by use of two different configurations of diode-pumped Yb-fiber chirped-pulse amplification systems. ...
Millijoule femtosecond all-fiber system	A. Galvanauskas, Z. Sartania, M. Bischoff	2001 CLEO Tech. Digest pp. 1-2	We have demonstrated the first all-fiber chirped pulse amplification (CPA) system producing milliJoule-range ultrashort-pulses. Peak powers achieved of ~3 MW in ...

2001 (Continued)

Mode-scalable fiber based chirped pulse amplification systems	A. Galvanauskas	IEEE J. Quant. Elect. Vol.7, No. 4, pp. 504 -517	A new generation of compact and robust ultrashort pulse lasers is currently emerging based on rare-earth doped fiber gain media. This paper reviews the development ...
Novel emitter and receiver system for THz radiation consisting of a 2-T permanent magnet, a 1040-nm compact fiber laser, and a room-temperature-operating thermal receiver	S. Ono, T. Tsukamoto, Y. Suzuki, H. Ohtake, N. Sarukura, A. Nakanishi, S. Nishizawa, M.L. Stock, M. Yoshida	2001 CLEO Tech. Digest p. 105	There has been a strong need for a compact, intense, easily adjusted THz-radiation emitter and a timing-adjustment-free receiver. Recently, we demonstrated a compact THz-radiation source consisting of a small ...
Pulse shaping by difference-frequency mixing with quasi-phase-matching gratings	G. Imeshev, M. M. Fejer, A. Galvanauskas, D. Harter	JOSA B. Vol. 18, No. 4, p. 534	We present a theory of ultrashort-pulse difference-frequency generation (DFG) with quasi-phase-matching (QPM) gratings in the undepleted-pump, unamplified-...
Tunable narrow-band Terahertz generation from periodically poled Lithium Niobate	Y.-S. Lee, T. Meade, T.B. Norris, A. Galvanauskas	Appl. Phys. Lett. Vol. 78, No. 23, pp. 3583-3585	We describe a technique for generating tunable narrow-band Terahertz radiation via optical rectification in periodically-poled Lithium Niobate. Frequency tuning ...
Ultra-broadband IR continuum generation and its phase measurement using cross-correlation FROG	L. Xu, X. Gu, M. Kimmel, P. O'She, R. Trebino, A. Galvanauskas	2001 CLEO Tech. Digest pp. 198-200	Ultrashort laser pulse technology plays an important role in the fields of physics, chemistry, biology, etc. The shorter the pulse, the faster the time scales that become ...

2002

1-THz bandwidth C- and L-band optical sampling with a bit rate agile timebase	R.L. Jungerman, G. Lee, O. Buccafusca, Y. Kaneko, N. Itagaki, R. Shioda, A. Harada, Y. Nihei, G. Sucha	IEEE Phot. Tech. Lett. Vol. 14, No. 8, pp. 1148-1150	A fast optical sampling system operating over a wide range of wavelengths and modulation bit rates is needed for characterizing high-speed communications signals. ...
Novel ultrashort pulse fiber lasers and their applications	H. Endert, A. Galvanauskas, G.D. Sucha, R.S. Patel	Proc. SPIE Vol. 4426, pp. 483-488	The development of ultrashort pulse laser technology will have a strong impact on the advancement of laser machining. Ultrashort laser pulses can reduce the ...
Novel ultrashort pulse fiber lasers for micromachining applications	H. Endert, A. Galvanauskas, G. Sucha, R. Patel, M. Stock	RIKEN Rev. Vol. 43, pp. 23-27	The development of ultrashort pulse laser technology will have a strong impact on the advancement of laser machining. Ultrashort laser pulses can reduce the ...

2003

Temporal pulse shaping using fiber laser technology: nano-scaling for flexible industrial laser material processing	R.S. Patel, M.L. Stock, Z. Sartania, J.M. Bovatsek, A.Y. Arai, H. Endert	Proc. SPIE Vol. 4830, pp. 352-356	On the basis of highly efficient Yb: fiber amplifiers, a new technology platform for compact and nearly maintenance-free laser sources from the femtosecond to the ...
New fiber lasers with temporal pulse shaping of nanosecond pulses for tailoring flexible laser material processing for microelectronics production	M.L. Stock, H. Endert, R.S. Patel	SPIE Proc. Vol. 4977, pp. 38-45	Using an innovative approach based on Yb: fiber amplifiers and pre-shaped pulsed diode seeders, a unique laser source with tunable pulse duration and ...
New versatile femtosecond fiber lasers	G. Sucha, H. Endert, M. Bischoff	SPIE Proc. Vol. 4978, pp. 21-31	Rare-earth doped fiber lasers provide a versatile technology platform for ultrafast laser systems, providing new flexibility in wavelength and timing ...
Terahertz imaging with nanometer resolution	H.-T. Chen, R. Kersting, G.C. Cho	Appl. Phys. Lett. Vol. 83, No. 15, pp. 3009-3012	We report on the application of scanning near-field optical microscopy for Terahertz imaging. We demonstrate a spatial resolution of 150 nm for 2.0 THz pulses. Our ...
Time-tailored laser pulses: a new approach for laser micromachining and microfabrication processing	M.L. Stock, H. Endert, R.S. Patel	SPIE Proc. Vol. 4984, pp. 202-209	We describe novel designs for production of laser pulses from the nanosecond to the femtosecond regime which allow optimization to specific material processing ...

2004

220 nJ 1.10 ps pulses from an Er fiber chirped pulse amplification system based on compression in photonic band gap fiber	G. Imeshev, I. Hartl, M.E. Fermann	2004 LEOS Tech. Digest Vol. 2, pp. 729-730	An all-fiber Er chirped pulse amplification (CPA) system based on a large-mode-area (LMA) amplifier delivering 220 nJ, 1.10 ps, linearly-polarized pulses is reported. ...
An optimized Er gain band all-fiber chirped pulse amplification system	G. Imeshev, I. Hartl, M.E. Fermann	Opt. Exp. Vol. 12, No. 26, pp. 6508-6514	We demonstrate an all-fiber Er chirped pulse amplification (CPA) system based on compression in photonic band gap fiber (PBGF) that produces 570 fs pulses with 312 nJ ...
Chirped pulse amplification using a nonlinearly-chirped fiber Bragg grating matched to the Treacy compressor	G. Imeshev, I. Hartl, M.E. Fermann	Opt. Lett. Vol. 29, No. 7, pp. 679-681	We demonstrate a fiber chirped pulse amplification system that uses an engineered nonlinearly chirped fiber Bragg grating stretcher dispersion matched to the Treacy ...
Formulation of time-domain algorithm for fiber Bragg grating simulation and reconstruction	L. Dong, S. Fortier	IEEE J. Quant. Elect. Vol. 40, No. 8, pp. 1087-1098	A time-domain algorithm for fiber Bragg grating simulation is formulated. It provides a time-domain equivalent to the well-known spectral-domain transfer matrix algorithm for ...
Frequency metrology with a turnkey all-fiber system	T.R. Schibli, K. Minoshima, F.-L. Hong, H. Inaba, A. Onae, H. Matsumoto, I. Hartl, M.E. Fermann	Opt. Lett. Vol. 29, No. 21, pp. 2467-2469	The repetition rate and carrier-envelope phase offset frequencies of a turnkey, all-fiber-based continuum generator were phase locked to a Hydrogen maser. The ...
Identification of a resonant imaging process in apertureless near-field microscopy	H.-T. Chen, S. Kraatz, G.C. Cho, R. Kersting	Phys. Rev. Lett. Vol. 93, No. 26, pp. 267401-267404	We report on apertureless near-field microscopy in the far infrared. We identify a configurational resonance of the scanning tip-surface system to be the dominating ...
Laser ablation threshold and etch rate comparison between the ultrafast Yb fiber-based FCPA laser and a Ti:Sapphire laser for various materials	J.M. Bovatsek, L.Shah, A.Y. Arai, Y. Uehara	Proc. SPIE Vol. 5662, pp. 661-666	Ti:Sapphire lasers remain the most widely used ultrafast laser. However, precise optical alignment and environmental control are necessary for continuous, long-term stable ...

2005

230-kW peak power femtosecond pulses from a high power tunable source based on amplification in Tm-doped fiber	G. Imeshev, M.E. Fermann	Opt. Exp. Vol. 13, No. 19, pp.7424-7431	We report for the first time an all-fiber laser system that generates tunable Watt-level femtosecond pulses at around 2 μm without an external pulse compressor ...
An optimized Er all-fiber chirped pulse amplification system producing 570-fs, 310-nJ pulses	G. Imeshev, I. Hartl, M.E. Fermann	2005 CLEO Tech. Digest Vol. 3, pp. 1653-1655	We report an all-fiber CPA system based on pulse stretching in dispersion-engineered FBG and compression in photonic band gap fiber (PBGF). We analyze the ...
Apertureless Terahertz near-field microscopy	G.C. Cho, H.-T. Chen, S. Kraatz, N. Karpowicz, R. Kertsing	Semicond. Sci. Technol. Vol. 20, No. 7, pp. S286-S292	Terahertz near-field microscopy may serve as a novel tool to measure the high-frequency permittivity of dielectric surfaces on submicrometre semiconductor surfaces. ...
Breaking the limit of maximum effective area for robust guided single-mode propagation in optical fibres	W.S. Wong, X. Peng, J.M. McLaughlin, L. Dong	Opt. Lett. Vol. 30, No. 21, pp. 2855-2857	We propose and demonstrate a novel approach in optical fiber design in which the optical waveguide is formed by a ring of large air holes surrounding a solid Silica core. ...
High energy femtosecond Yb cubicon fiber amplifier	L. Shah, Z. Liu, I. Hartl, G. Imeshev, G. Cho, M.E. Fermann	Opt. Exp. Vol. 13, No. 12, pp. 4717-4722	The generation of cubicon pulses from an Yb fiber chirped pulse amplification system at pulse energies up to 200 μJ is demonstrated. After pulse compression 650 fs pulses ...
High energy fiber chirped pulse amplification system based on cubicons	Z. Liu, L. Shah, I. Hartl, G.C. Cho, M.E. Fermann	2005 CLEO Tech. Digest Vol. 3, pp. 1650-1652	The generation of stretched 20 pJ pulses with 200 kW peak power is demonstrated in an in-line Yb fiber chirped pulse amplification system at a repetition rate of 50 kHz. ...
High power tunable femtosecond pulse source based on amplification in Tm fiber	G. Imeshev, M.E. Fermann, S.D. Jackson	2005 CLEO Tech. Digest Vol. 1, pp. 683-685	We demonstrate a tunable (1930 - 2018 nm and 965 - 1009 nm) femtosecond source based on amplification in Tm fiber. Average powers of 1.8 W and 530 mW are ...

2005 (Continued)

Integrated self-referenced frequency-comb laser based on a combination of fiber and waveguide technology	I. Hartl, G. Imeshev, M.E. Fermann, C. Langrock, M.M. Fejer	Opt. Exp. Vol. 13, No. 17, pp. 6490-6496	An optically integrated self-referenced frequency comb laser is demonstrated. The system consists of a passively-modelocked Er-fiber laser, a butt-coupled periodically ...
Long-term carrier envelope phase locking of a PM fiber frequency comb source	I. Hartl, L. Dong, M.E. Fermann, T.R. Schibli, A. Onae, F.-L. Hong, H. Inaba, K. Minoshima, H. Matsumoto	2005 OFC Tech. Digest Vol. 5	The carrier envelope phase of a polarization-maintaining fiber frequency comb laser is stabilized for long periods of time using near orthogonal fast and slow controls of ...
MHz-rate ultrafast fiber laser for writing of optical waveguides in Silica glasses	L. Shah, F. Yoshino, A. Arai, S. Eaton, H. Zhang, S. Ho, P.R. Herman	Proc. SPIE Vol. 5714, pp. 253-260	Direct waveguide writing with femtosecond lasers can be divided into two general categories based upon the type of lasers used: amplified systems that emit high pulse ...
Reliable, high-repetition rate, femtosecond, microJoule fiber lasers for precision applications	M.L. Stock, G.D. Sucha, J. Bovatsek, T. Yamamoto, A. Arai	Proc. SPIE Vol. 5714, pp. 63-72	As applications demanding microJoule level pulses at "real-time" rates of delivery increase, and the expectations in terms of long-term, reliable, high quality performance ...
Temperature dependence of Ytterbium-doped fiber amplifiers	X. Peng, L. Dong	JOSA B Vol. 25, No. 1, pp. 126-130	We characterized the temperature response of a ytterbium (Yb) system by measuring its temperature-dependent emission and absorption spectra and deriving ...
Terahertz microscopy with submicrometre resolution	R. Kersting, H.-T. Chen, N. Karpowicz, G.C. Cho	J. Opt. A Vol. 7, No. 2, pp. S184-189	We present a terahertz near-field microscope which may serve as a contactless probe for identifying the dielectric properties of individual quantum systems. Terahertz ...
Thermal heating effects in writing optical waveguides with 0.1 – 5 MHz repetition rate	S. Eaton, F. Yoshino, L. Shah, A. Arai, H. Zhang, S. Ho, P.R. Herman	Proc. SPIE Vol. 5713, pp. 35-42	High-repetition rate (>200 kHz) ultrafast lasers drive novel heat accumulation processes attractive for rapid writing of low loss optical waveguides in transparent glasses. ...
Ultra-compact dispersion compensated femtosecond fiber oscillators and amplifiers	I. Hartl, G. Imeshev, L. Dong, G.C. Cho, M.E. Fermann	2005 CLEO Tech. Digest Vol. 3, pp. 1641-1643	Dispersion-compensated fully integrated Er and Yb femtosecond fiber oscillators are described. Yb MOPAs produce 100 fs pulses at repetition rates of 60 MHz ...
Writing optical waveguides with a 0.1 - 5 MHz repetition rate femtosecond fiber laser	S. Eaton, H. Zhang, P.R. Herman, F. Yoshina, L. Shah, A.Y. Arai	2005 CLEO Tech. Digest Vol. 3, pp. 2174-2176	A novel femtosecond Yb-fiber laser with variable repetition rate of 0.1 to 5 MHz is shown to control the onset of heat accumulation effects instrumental in forming ...

2006

170 MHz spaced, self-referenced fiber-frequency-comb	I. Hartl, M.E. Fermann, C. Langrock, M.M. Fejer	2006 CLEO Tech. Digest pp. 1-2	An optically integrated frequency-comb-system based on a passively-mode locked, fCEO-locked Er:soft-glass-fiber-laser and a PPLN-waveguide phase-sensor is ...
Bend-resistant fundamental mode operation in Ytterbium-doped leakage channel fibers with effective areas up to 3160 μm^2	L. Dong, J. Li, X. Peng	Opt. Exp. Vol. 14, No. 24, pp. 11512-11519	We report fundamental mode operation in ytterbium-doped leakage channel fibers with effective areas up to 3160 μm^2 . These fibers are bend-resistant. Lasers with slope ...
Fiber chirped pulse amplification system for micromachining	A. Arai, J. Bovatsek, F. Yoshino, Z. Liu, G.C. Cho, L. Shah, M.E. Fermann, Y. Uehara	Proc. SPIE Vol. 6343, p. 63430S	Chirped Pulse Amplification (CPA) is widely used for generating high-energy femtosecond pulses. This is most commonly done with a solid-state Ti:Sapphire crystal ...
Fiber-laser frequency combs with subHertz relative linewidths	W. Swann, J.J. McFerran, I. Coddington, N.R. Newbury, I. Hartl, M.E. Fermann, P.S. Westbrook, J.W. Nicholson, K.S. Feder, C. Langrock, M.M. Fejer	Opt. Lett. Vol. 31, No. 21, pp. 3046-3048	We investigate the comb linewidths of self-referenced, fiber-laser-based frequency combs by measuring the heterodyne beat signal between two independent ...

2006 (Continued)

Fluorescence and Raman microscopy of waveguides fabricated using kHz and MHz repetition rate femtosecond lasers	W.J. Reichman, D.M. Krol, L. Shah, F. Yoshino, A. Arai, S.M. Eaton, P.R. Herman	2006 CLEO Tech. Digest pp. 1-2	Waveguides were fabricated in fused Silica using kHz and MHz repetition rate femtosecond lasers. Raman and fluorescence microscopy showed increases in ...
High energy-high repetition rate fiber laser system for precision micromachining with fundamental and second harmonic wavelengths	F. Yoshino, J. Bovatsek, A. Arai, Y. Uehara, Z. Liu, G. Cho	JLMN Vol. 1, No. 3, pp. 258-263	Interest in femtosecond laser micromachining has been growing for applications that require precise material removal or modification over very small features. Flat ...
High power femtosecond fiber chirped pulse amplification system for high speed micromachining	L. Shah, M.E. Fermann	JLMN Vol. 1, No. 3, pp. 176-180	The need for improved precision in a wide variety of micromachining applications has driven scientific interest in ultrashort pulse lasers. Despite numerous ...
High power frequency upconversion of ultra-fast fiber amplifiers	I. Hartl, L. Shah, Z. Liu, G. Imeshev, G. Cho, M.E. Fermann	2006 CLEO Tech. Digest pp. 1-2	Recent work in frequency-conversion of pulsed fiber-amplifiers is reviewed. Design criteria of frequency converters for fiber sources in operating the wavelength ...
High power source of THz radiation based on orientation-patterned GaAs pumped by a fiber laser	G. Imeshev, M.E. Fermann, K.L. Vodopyanov, M.M. Fejer, X. Yu, J.S. Harris, D. Bliss, C. Lynch	Opt. Exp. Vol. 14, No. 10, pp. 4439-4444	We demonstrate a new source of frequency-tunable THz wave packets based on parametric down-conversion process in orientation-patterned GaAs (OP-GaAs) that ...
High-power ultra-fast fiber amplifiers	L. Shah	2006 CLEO Tech. Digest pp. 1-2	We review high power and high energy ultrafast fiber amplifiers. An Yb-fiber chirped pulse amplification system employing cubicon pulses producing sub-650 fs pulses ...
Integrated fiber-frequency comb using a PPLN waveguide for spectral broadening and CEO phase detection	I. Hartl, M.E. Fermann, C. Langrock, M.M. Fejer, J.W. Nicholson, D.J. DiGiovanni	2006 CLEO Tech. Digest pp. 1-2	A fully integrated self-referenced Er-fiber frequency-comb system without the use of highly nonlinear or microstructured fiber is demonstrated. We use a single ...
Large effective mode area fibers for high power lasers and amplifiers	L. Dong, W.S. Wong, X. Peng	2006 LEOS Tech. Digest pp. 1-2	New progress for novel design for achieving large effective mode area fibers while maintaining single mode operation for fiber lasers and fibre amplifiers is addressed in the ...
Micromachining with a 50 W 50 μ J sub-picosecond fiber laser system	L. Shah, M.E. Fermann, J.W. Dawson, C.P.J. Barty	Opt. Exp. Vol. 14, No. 25, pp. 12546-12551	A 50 W sub-picosecond fiber chirped pulse amplification system generating 50 μ J pulses at a repetition rate of 1 MHz is demonstrated. As required for precision high ...
Optimized precision micromachining using commercially-available, high-repetition rate, microJoule, femtosecond fiber lasers	M. Stock, L. Shah, B. Liu, M. Yoshida, F. Yoshino, J. Bovatsek, A. Arai	Proc. SPIE Vol. 6108, p. 61080Q	Fiber lasers offer an excellent technology base for production of an industrial-quality tool for precision microfabrication, answering the need to expand the ...
P-type behavior in nominally undoped ZnO thin films by oxygen plasma	Y.J. Zeng, Z.Z. Ye, W.Z. Xu, J.G. Lu, H.P. He, L.P. Zhu, B.H. Zhao, Y. Che, S.B. Zhang	Appl. Phys. Lett. Vol. 88, No. 26, pp. 262103-262105	We report on intrinsic p-type ZnO thin films by plasma-assisted metal-organic chemical vapor deposition. The optimal results give a resistivity of 12.7 Ω cm, a Hall ...
Self-assembled periodic sub-wavelength structures by femtosecond laser direct writing	W. Yang, E. Bricchi, P.G. Kazansky, J. Bovatsek, A.Y. Arai	Opt. Exp. Vol. 14, No. 21, pp. 10117-10124	Self-assembled, sub-wavelength periodic structures are induced in fused silica by a tightly focused, linearly polarized, femtosecond laser beam. Two different types ...
Differential absorption spectroscopy for gas monitoring at sub-millimeter wavelengths	P.Y. Han, G. Sucha, D. Harter, A. Galvanauskas, M. Li, X.-C. Zhang	2006 IRMMW-THz Conf. Digest p. 312	A differential absorption spectroscopic system is developed for gas monitoring at sub-millimeter wavelengths. Tunable, narrowband terahertz (THz) pulse trains are generated ...
Study on the Hall-effect and photoluminescence of N-doped p-typed ZnO thin films	Y.J. Zeng, Z.Z. Ye, W.Z. Xu, B. Liu, Y. Che, L.P. Zhu, B.H. Zhao	Mat. Lett. Vol. 61, No. 1, pp. 41-44	N-doped, p-type ZnO thin films have been grown by plasma-assisted metal-organic chemical vapor deposition method. The results under optimized growth conditions ...

2006 (Continued)

Three-dimensional micromachining inside transparent materials using femtosecond laser pulses: new applications	J. Bovatsek, A. Arai, C.B. Schaffer	2006 CLEO Tech. Digest pp. 1-2	At high repetition rate, nonlinear absorption of tightly-focused femtosecond pulses produces a point-like heat source that can be located inside a transparent material, ...
Tunable 0.8 - 3.5 THz source based on fiber-laser pumped orientation-patterned GaAs	K. Vodopyanov, G. Imeshev, M.E. Fermann, J. Schaar, M.M. Fejer, X. Yu, J.S. Harris, D. Bliss, D. Weyburne	2006 CLEO Tech. Digest pp. 1-2	We demonstrate a μ W-level broadly tunable THz source based on parametric down-conversion in orientation-patterned GaAs pumped by femtosecond pulses from ...
Ultrafast high energy amplifiers beyond the B-integral limit	L. Shah, Z. Liu, I. Hartl, G. Imeshev, G. Cho, M.E. Fermann	Proc. SPIE Vol. 6102, p. 61020Z	High average power single-mode fiber lasers have attracted significant attention as alternatives to conventional solid state lasers owing to their relative ...
Ultrashort pulse micromachining with the 10- μ J FCPA fiber laser	J.M. Bovatsek, A.Y. Arai, F. Yoshino, Y. Uehara	Proc. SPIE Vol. 6102, p. 61021	IMRA's ultrashort pulse fiber laser products continue to evolve to expand the application scope. The latest prototype FCPA produces pulses with less than 500-fs ...

2007

Amphoteric Phosphorus doping for stable p-type ZnO	A. Allenic, W. Guo, Y.B. Chen, M.B. Katz, G.Y. Zhao, Y. Che, Z.D. Hu, B. Liu, S.B. Zhang, X.Q. Pan	Adv. Mat. Vol. 19, no. 20, pp. 3333-3337	The role of dislocations in stable p-type phosphorus-doped ZnO epitaxial films is investigated. It is shown that good p-type conductivity is always associated with a ...
Cavity-enhanced similariton Yb-fiber laser frequency comb: 3×10^{14} W/cm ² peak intensity at 136 MHz	I. Hartl, T.r. Schibli, A. Marcinkevicius, D.C. Yost, D.D. Hudson, M.E. Fermann, J. Ye	Opt. Lett. Vol. 32, No. 19, pp.2870-2872	We report on a passive cavity-enhanced Yb-fiber laser frequency comb generating 230 MW of peak power (3 kW of average power) at a 136 MHz pulse repetition rate. ...
Compact 50W ultrashort pulse fiber laser for precision and high-speed material processing	L. Shah, M.E. Fermann, J.W. Dawson, C.P.J. Barty	Proc. SPIE Vol. 6453, p. 64530Z	We have previously demonstrated ultrashort pulse amplification in fiber systems beyond the B-integral limit. Here we report on recent experiments to increase the ...
Er- and Yb-doped fiber laser frequency combs and their applications	I. Hartl, M.E. Fermann	2007 LEOS Tech. Digest pp. 161-162	Progress in femtosecond fiber laser based frequency combs is reviewed. Recent examples of Er-fiber frequency combs with sub-Hz relative comb tooth linewidths and ...
Fabrication of Sb-doped p-type ZnO thin films by pulsed laser deposition	X. Pan, Z. Ye, J. Li, X. Gu, Y. Zeng, H. He, L. Zhu, Y. Che	Appl. Surf. Sci. Vol. 253, No. 11, pp. 5067-5069	P-Type ZnO thin films have been realized via monodoping antimony (Sb) acceptor by using pulsed laser deposition. The obtained films with the best electrical properties ...
Fabrication of p-type ZnMgO films via pulsed laser deposition method by using Li as dopant source	X. Pan, Z. Ye, J. Li, Y. Zeng, X. Gu, L. Zhu, B. Zhao, Y. Che	Appl. Surf. Sci. Vol. 253, No. 14, pp. 6060-6062	p-Type Zn _{0.9} Mg _{0.1} O thin films have been realized via monodoping of Li acceptor by using pulsed laser deposition. The Li-doped Zn _{0.9} Mg _{0.1} O thin films ...
Fiber frequency combs	I. Hartl, M.E. Fermann	Proc. SPIE Vol. 6453, p. 645313	Optical frequency comb systems have received much attention in recent years due to their enormous potential in optical frequency metrology and optical frequency ...
Fundamental-mode operation in polarization-maintaining Ytterbium-doped fiber with an effective area of 1400 μ m ²	X. Peng, L. Dong	Opt. Lett. Vol. 32, No. 4, pp.358-360	We report, for the first time to our knowledge, fundamental-mode operation in polarization-maintaining ytterbium-doped fiber with an effective area of 1400 μ m ² and ...
Generation of octave-spanning spectra inside reverse-proton-exchanged periodically poled Lithium Niobate waveguides	C. Langrock, M.M. Fejer, I. Hartl, M.E. Fermann	Opt. Lett. Vol. 32, No. 17, pp. 2478-2480	We demonstrate simultaneous octave-level spectral broadening and carrier-envelope-offset sensing of mode-locked Er- and Yb-doped femtosecond fiber laser using ...
High-power ultrashort-pulse fiber amplifiers	L. Shah, M.E. Fermann	IEEE J. Select. Top. Quant. Elect. Vol. 22, No. 3, pp. 552-558	Fiber laser technology is leading a revolution in ultrashort-pulse lasers and their applications. Unlike conventional ultrashort-pulse bulk solid-state laser systems, ultrafast ...

2007 (Continued)

Investigation on ultraviolet photoconductivity in p-type ZnO thin films	Y.J. Zeng, Z.Z. Ye, Y.F. Lu, J.G. Lu, W.Z. Xu, L.P. Zhu, B.H. Zhao, Y. Che	Chem. Phys. Lett. Vol. 441, No. 1-3, pp. 115-118	The authors report on comparative study on ultraviolet (UV) photoconductivity of p-type ZnO:N films and n-type ZnO epilayer. As compared with the ZnO epilayer, the ...
Leakage channel optical fibers with large effective area	L. Dong, X. Peng, J. Li	JOSA B Vol. 24, No. 8, pp. 1689-1697	Leakage channel fibers, where few air holes form a core, can be precisely engineered to create large leakage loss for higher-order modes, while maintaining negligible ...
Microstructure and properties of epitaxial antimony-doped p-type ZnO films fabricated by pulsed laser deposition	W. Guo, A. Allenic, Y.B. Chen, X.Q. Pan, Y. Che, Z.D. Hu, B. Liu	Appl. Phys. Lett. Vol. 90, p. 242108	Antimony-doped p-type ZnO films epitaxially grown on (001) sapphire substrates were fabricated by pulsed laser deposition at 400 – 600 °C in 5.0×10^{-12} Torr Oxygen ...
Nanoparticle generation in ultrafast pulsed laser ablation of Nickel	B. Liu, Z. Hu, Y. Che, Y. Chen, X. Pan	Appl. Phys. Lett. Vol. 90, No. 4, p. 044103	The process of particle generation during ultrafast pulsed laser ablation of Nickel is investigated. Two types of particles with different sizes depending on the laser ...
Octave-level spectral broadening in RPE PPLN waveguides	C. Langrock, M.M. Fejer, I. Hartl, M.E. Fermann	2007 CLEO Tech. Digest pp. 1-2	We demonstrate octave-level spectral broadening of mode-locked Er- and Yb-doped femtosecond fiber lasers inside constant-period and chirped RPE PPLN waveguides. ...
Robust single mode operation in 50 μm Ytterbium-doped leakage channel fibers	L. Dong, X. Peng, J. Li	Proc. SPIE Vol. 6453, p. 645316	Leakage channel fibers, where several air holes form a core, can be precisely engineered to create large leakage loss for higher order modes, while maintain negligible ...
Self-referenced Yb-fiber-laser frequency comb using a dispersion micromanaged tapered holey fiber	P. Pal, W.H. Knox, I. Hartl, M.E. Fermann	Opt. Exp. Vol. 15, No. 19, pp.12161-12166	We demonstrate a fully stabilized frequency comb in the 1 μm spectral region based on an Yb-fiber oscillator and a cladding pumped chirped pulse Yb-fiber amplifier whose ...
Synthesis and properties of p-type nitrogen-doped ZnO thin films by pulsed laser ablation of a Zn-rich Zn ₃ N ₂ target	A. Allenic, W. Guo, Y.B. Chen, G.Y. Zhao, X.Q. Pan, Y. Che, Z.D. Hu, B. Liu	J. Mat. Res. Vol. 22, No. 8, pp. 2339-2344	Epitaxial ZnO thin films doped uniformly with nitrogen at 10^{20} atoms/cm ³ were fabricated by pulsed laser ablation of a Zn-rich Zn ₃ N ₂ target. The films grown at 300 °C and ...
Ultrafast pulsed laser ablation for synthesis of nanocrystals	B. Liu, Z. Hu, Y. Che, Y. Chen, K. Sun, X. Pan	Proc. SPIE Vol. 6645, p. 66450R	We have performed a systematic study of nanoparticle generation using near infrared ultrafast pulsed laser ablation. The materials we have studied include metal, ...
ZnMgO quantum dots grown by low-pressure metal organic chemical vapor deposition	Y.J. Zeng, Z.Z. Ye, Y.F. Lu, J.G. Lu, L. Sun, W.Z. Xu, L.P. Zhu, B.H. Zhao, Y. Che	Appl. Phys. Lett. Vol. 90, No. 1, p. 012111	The authors report on reproducible growth of ZnMgO quantum dots (QDs) by a metal organic chemical vapor deposition method. Mg is introduced into ZnO QDs, as ...

2008

All glass endless single mode photonic crystal fibers	L. Dong, H.A. McKay, L. Fu	Opt. Lett. Vol. 33, No. 21, pp.2440-2442	Endless single-mode fibers, which remain single mode over their entire range of guidance, are, to the best of our knowledge, the first reported unique application of ...
Analytical solution for nonlinear waveguide equation under Gaussian mode approximation	L. Dong	Proc. SPIE Vol. 6873, p. 68730V	Critical power, nonlinear guided stationary mode and transient dynamics in nonlinear waveguides are studied analytically. Under Gaussian mode approximation, ...
Approximate treatment of the nonlinear waveguide equation in the regime of nonlinear self-focus	L. Dong	J. Lightwave Tech. Vol. 26, No. 20, pp. 3476 - 3485	The nonlinear waveguide equation is studied quasi-analytically for insights into the effect of waveguide designs. Equations governing stationary mode and ...
Bend performance of leakage channel fibers	T.-W. Wu, L. Dong, H. Winful	Opt. Exp. Vol. 16, No. 6, pp. 4278-4285	Bend loss of the first three modes of leakage channel fibers with various designs are studied using finite element method. It is found that very low bend loss at small bend ...

2008 (Continued)

Efficient supercontinuum generations in silica suspended core fibers	L. Fu, B.K. Thomas, L. Dong	Opt. Exp. Vol. 16, No. 24, pp.19629-19642	We have experimentally studied supercontinuum generations in highly nonlinear suspended core Silica fibers as alternatives to photonic crystal fibers. Octave- ...
Fiber laser based hyperspectral sources	M.E. Fermann, I. Hartl	Laser Phys. Lett. Vol. 5, No. 1, pp. 11-21	Hyperspectral sources spanning from the XUV to the THz spectral range based on high power ultrafast fiber lasers are reviewed. With advances in large core and ...
Growth of ZnO nanoparticles and nanorods with ultrafast pulsed laser deposition	B. Liu, Z. Hu, Y. Che, A. Allenic, K. Sun, X. Pan	Appl. Phys. A Vol. 93, No. 3, pp. 813-818	In this work, we study the application of ultrafast pulsed laser deposition (PLD) in ZnO nanomaterial synthesis, including nanoparticles and nanorods. PLD using long ...
Highly nonlinear suspended core Silica fibers	L. Dong, B.K. Thoms, L. Fu	Opt. Exp. Vol. 16, No. 21, pp.16423-16430	Suspended-core fibers are systematically studied. We show that confinement loss in suspended-core fibers can be effectively reduced by an increase of air-cladding ...
Micromachining with a high repetition rate femtosecond fiber laser	F. Yoshino, L. Shah, M.Fermann, A. Arai, Y. Uehara	JLMN Vol. 3, No. 3, pp. 157-162	Industrial micromachining applications with ultrashort pulse lasers are often difficult to make practical due to the lack of robustness of the laser and the slow processing speed ...
Optical frequency comb with submilliHertz linewidth and more than 10 W average power	T.R. Schibli, I. Hartl, D.C. Yost, M.J. Martin, A. Marcinkevicius, M.E. Fermann, J. Ye	Nature Phot. Vol. 2, pp. 355-359	Growing demands for high average and peak powers in extreme nonlinear optics, attosecond-pulse and extreme ultraviolet comb generation experiments can find a ...
Single-mode optical fibers with record core diameters	H. McKay, L. Fu, L. Dong	2008 ECOC Tech. Digest pp. 1-2	Strictly single-mode fibres with record core-diameters of 82 μm @ 1 μm and 130 μm @ 1.55 μm are demonstrated. They have parabolic index difference of $\sim 6 \times 10^{-5}$...
Structural modifications in Er-Yb doped phosphate glass induced by femtosecond laser waveguide writing	L.B. Fletcher, J.J. Witcher, W.J. Reichman, J. Bovatsek, A. Arai, D.M. Krol	Proc. SPIE Vol. 6881, p. 688111	Strictly single-mode fibres with record core-diameters of 82 μm @ 1 μm and 130 μm @ 1.55 μm are demonstrated. They have parabolic index profile with record low index ...
Temperature dependence of Ytterbium-doped fiber amplifiers	X. Peng, L. Dong	JOSA B Vol. 25, No. 1, pp. 126-130	We characterized the temperature response of a Ytterbium (Yb) system by measuring its temperature-dependent emission and absorption spectra and deriving ...
Terahertz near-field microscopy	R. Kersting, F.F. Bueersgens, G. Acuna, G.C. Cho	Adv. Solid State Phys. Vol. 47, pp. 203-222	We report on apertureless Terahertz (THz) microscopy and its application for semiconductor characterization. Extreme subwavelength resolutions down to 150 nm are ...

2009

200-fs, 2-mJ pulses from 1-kHz Yb^{3+} , Na^+ : CaF_2 cryogenic amplifier	G. Andriukaitis, A. Pugzlys, L. Su, R. Li, W.J. Lai, P.B. Phua, A. Marcinkevicius, M.E. Fermann, L. Giniunas, R. Danielius, A. Baltuska	2009 CLEOE-EQEC Tech. Digest p. 1	By merging Yb fiber oscillator and cryogenically cooled DPSS Yb^{3+} , Na^+ : CaF_2 RA we have generated 195-fs 2-mJ pulses at a 1-kHz repetition rate. Amplification ...
All glass large core leakage channel fibers	L. Dong, T.-W. Wu, H.A. McKay, L. Fu, J. Li, H.G. Winful	IEEE J. Select. Top. Quant. Elect. Vol. 15, No. 1, pp. 47-53	Leakage channel fibers (LCFs) have demonstrated their ability to significantly extend the effective mode area of a fundamental mode while maintaining robust single-mode ...
Diffraction-limited output from multi-core fibers using coherent beam combination and a diffractive optical element	A. Ruehl, I. Hartl, A. Marcinkevicius, H.A. McKay, L. Dong, M. Fermann	2009 CLEOE-EQEC Tech. Digest p. 1	The authors suggest a solution to both problems by implementing a novel mode-coupling free multi-core design based on large core fibers, which enables the ...
Epitaxial ZnO films on (111) Si substrates with Sc_2O_3 buffer layers	W. Guo, M.B. Katz, C.T. Nelson, T. Heeg, D.G. Schlom, B. Liu, Y. Che, X.Q. Pan	Appl. Phys. Lett. Vol. 94, p. 122107	Epitaxial (0001) ZnO films were grown on (1 1 1) Si substrates using epitaxial (1 1 1) Sc_2O_3 buffer layers. The quality of the ZnO epilayers is manifested by a Hall ...

2009 (Continued)

Extending effective area of fundamental mode in optical fibers	L. Dong, H.A. McKay, A. Marcinkevicius, L. Fu, J. Li, B.K. Thomas, M.E. Fermann	J. Lightwave Tech. Vol. 27, No. 11, pp.1565-1570	High power fiber lasers have become well established in many commercial realms. However, the amplification of ultrafast pulses to higher pulse energies in Ytterbium- ...
Extremely large mode area optical fibers formed by thermal stress	L. Fu, H.A. McKay, L. Dong	Opt. Exp. Vol. 17, No. 14, pp. 11782-11793	We report a strictly single-mode optical fiber with a record core diameter of 84 μm and an effective mode area of $\sim 3600 \mu\text{m}^2$ at 1 μm . We also demonstrate fundamental ...
Highly Ytterbium-doped Silica fibers with low photo-darkening	S. Suzuki, H.A. McKay, X. Peng, L. Fu, L. Dong	Opt. Exp. Vol. 17, No. 12, pp. 9924-9932	Phosphorus co-doping is known to reduce clustering levels of rare earth ions in Silica hosts. In this paper, Ytterbium-doped Silica fibers with $\sim 8.9 \text{ wt}\%$ Yb_2O_3 , up to ~ 4700 ...
Large effective mode area optical fibers for high-power lasers	L. Dong, J. Li, H.A. McKay, L. Fu, B.K. Thomas	Proc. SPIE Vol. 7195, p. 71950N	Leakage channel fibers have demonstrated their ability to significantly extend the effective mode area of a fundamental mode while maintaining robust single mode ...
Latest developments of ultrafast fiber laser and its material applications	G. Cho, B. Liu, L. Shah, Z. Liu, Y. Che, J. Xu	Proc. SPIE Vol. 7214, p. 72140R	We address recent fiber-based femtosecond laser technology. Specifically, fiber-chirped pulse amplifier is discussed for the enabling the concept of real-world ...
Multi-mJ, 200-fs, cw-pumped, cryogenically cooled, Yb,Na:CaF ₂ amplifier	A. Pugžlys, G. Andriukaitis, A. Baltuska, L. Su, J. Xu, H. Li, R. Li, W.J. Lai, P.B. Phua, A. Marcinkevicius, M.E. Fermann, L. Giniunas, R. Danielius, S. Alisauskas	Opt. Lett. Vol. 34, No. 13, pp.2075-2077	Using a novel (to our knowledge) broadband Yb-doped $\text{Yb}^{3+}, \text{Na}^+:\text{CaF}_2$ crystal cooled in a closed loop to 130 K we demonstrate a chirped pulse regenerative laser amplifier ...
Phase-stabilized, 1.5 W frequency comb at 2.8 to 4.8 μm	F. Adler, K.C. Cossel, M., J. Thorpe, I. Hartl, M.E. Fermann, J. Ye	Opt. Lett. Vol. 34, No. 9, pp.1330-1332	We present a high-power optical-parametric-oscillator (OPO) based frequency comb in the mid-IR wavelength region. The system employs periodically poled Lithium ...
Rapidly scanning, high resolution Yb fiber based comb-Fourier transform spectrometer	A. Ruehl, I. Hartl, M.E. Fermann	2009 CLEOE-EQEC Tech. Digest p. 1	Frequency comb technology has revolutionized many aspects of spectroscopic measurements, most recently exemplified by the introduction of multi-heterodyne ...
Spectroscopy and lasing of cryogenically cooled Yb, Na:CaF ₂	A. Pugžlys, G. Andriukaitis, D. Sidorov, A. Irshad, A. Baltuska, W.J. Lai, P.B. Phua, L. Su, J. Xu, H. Li	Appl. Phys. B Vol. 97, No. 2, pp. 339-350	Absorption, photoluminescence and cw-lasing properties of a novel Na ⁺ -codoped $\text{Yb}^{3+}:\text{CaF}_2$ laser crystal are investigated in the temperature range from 10 K to ...
Ultrafast fiber laser technology	M.E. Fermann, I. Hartl	IEEE Sel. Top. Quant. Elect. Vol. 15, No. 1, pp. 191-206	In this paper, a review of fiber laser technology as relevant for applications in ultrafast optics is given. We discuss core enabling fiber technologies, such as fiber amplifiers, ...
Ultrashort pulse laser processing of transparent materials	F. Yoshino, H. Zhang, A. Arai	JLMN Vol. 4, No. 3, pp. 212-217	Ultrashort pulse lasers can generate extremely high peak power with a modest average power. For example, a 1-W average power laser can produce pulses with a peak ...
Ytterbium-doped all glass leakage fibers with highly Fluorine-doped silica pump cladding	L. Dong, H.A. McKay, L. Fu, M. Ohta, A. Marcinkevicius, S. Suzuki, M.E. Fermann	Opt. Exp. Vol. 17, No. 11, pp. 8962-8969	All glass leakage channel fibers have been demonstrated to be a potential practical solution for power scaling in fiber lasers beyond the nonlinear limits in conventional large ...

2010

80 W, 120 fs Yb-fiber frequency comb	A. Ruehl, A. Marcikevicius, M.E. Fermann, I. Hartl	Opt. Lett. Vol. 35, No. 18, pp. 3015-3017	We report on a high-power fiber frequency comb exhibiting linear chirped-pulse amplification up to 80W and generating 120fs pulses. By proper matching of the group delay ...
Epitaxial Zn _{1-x} Mg _x O films grown on (1 1 1) Si by pulsed laser deposition	X.H. Pan, W. Guo, Z.Z. Ye, B. Liu, Y. Che, C.T. Nelson, Y. Zhang, W. Tian, D.G. Schlom, X.Q. Pan	Chem. Phys. Lett. Vol. 485, No. 4-6, pp. 363-366	Zn _{1-x} Mg _x O thin films are epitaxially grown on (1 1 1) Si substrates using intervening epitaxial Lu ₂ O ₃ buffer layers by pulsed laser deposition. Lu ₂ O ₃ buffer layer on Si ...

2010 (Continued)

Extending bandgap of air-core photonic bandgap fibers	L. Dong, B.K. Thomas, S. Suzuki, L. Fu	Proc. SPIE Vol. 7839, p. 78390S	Air-core photonic bandgap fibers offer many unique properties and are critical to many emerging applications. A notable property is the high nonlinear threshold which is ...
Mid-infrared Fourier transform spectroscopy with a broadband frequency comb	F. Adler, P. Maslowski, A. Foltynowicz, K.C. Cossel, T.C. Briles, I. Hartl, J. Ye	Opt. Exp. Vol. 18, No. 21, pp. 21862-21872	We present a first implementation of optical-frequency-comb-based rapid trace gas detection in the molecular fingerprint region in the mid-infrared. Near-real-time ...
Specialty fibers and their applications in fiber lasers	L. Dong	Proc. SPIE Vol. 7839, p. 783902	Two factors are the keys to the rapid commercial development of fiber lasers in the last decade. The first is the technology development of specialty fibers, ...
Ultrafast pulsed laser micro-deposition printing on transparent media	B. Liu, Z. Hu, Y. Che	Proc. SPIE Vol. 7590, p. 759002	Ultrafast pulsed laser ablation is employed in laser-induced backward transfer for printing on transparent media. By combining a high pulse repetition rate of 1 MHz and an ...

2011

Advanced specialty fiber designs for fiber lasers	L. Dong, H.A. McKay, B.K. Thomas, L. Fu, S. Suzuki, M. Ohta, A. Marcinkevicius	Proc. SPIE Vol. 7914, p. 791415	Progress in advanced specialty fibers is the foundation to further breakthroughs in fiber lasers. Recently, we have been working to advance several areas of developments ...
Application of femtosecond fiber lasers in material processing	A. Arai, J. Xu, J. Sohn, G.C. Cho	2011 CLEOE Tech. Digest p. 1	Since the release of the FCPA μ Jewel femtosecond fiber laser in 2004, a range of applications have been investigated. Today, the pulse energy and average ...
Broadband phase noise suppression in a Yb-fiber frequency comb	A. Cingöz, D.C. Yost, T.K. Allison, A. Ruehl, M.E. Fermann, I. Hartl, J. Ye	Opt. Lett. Vol. 36, pp. 743-745	We report a simple technique to suppress high-frequency phase noise of a Yb-based fiber optical frequency comb using an active intensity noise servo. Out-of-loop ...
Coherent Tm-fiber Raman-soliton amplifier	J. Jiang, A. Ruehl, I. Hartl, M.E. Fermann	2011 CLEOE Tech. Digest p. 1	The molecular fingerprint region from 2 - 10 μ m is currently receiving a lot of interest due to its potential for enabling the identification of many important molecules in ...
Coherent transfer over 1.1 spectral octave with a fiber frequency comb	A. Ruehl, M.J. Martin, K.C. Cossel, L. Chen, C. Benko, H. McKay, B. Thomas, L. Dong, M.E. Fermann, J.M. Dudley, I. Hartl, J. Ye	2011 CLEOE Tech. Digest p. 1	Highly coherent optical frequency combs have applications ranging from broadband spectroscopy with high sensitivity and accuracy, to the spectral dissemination of optical ...
Electrophoretic deposition of Cu-In composite nanoparticle thin films for fabrication of CuInSe ₂ solar cells	W. Guo, K. Hagedorn, B. Liu	Proc. SPIE Vol. 8104, p. 81040W	Thin films of Cu-In composite nanoparticles were produced by electrophoretic deposition in colloidal suspensions. The nanoparticles were prepared with high power pulsed ...
Fully stabilized, self-referenced Thulium fiber frequency comb	J. Jiang, C. Mohr, J. Bethge, M.E. Fermann, I. Hartl	2011 CLEOE Tech. Digest p. 1	The authors have demonstrated the first fully stabilized Tm fiber comb system. In conjunction with supercontinuum generation in the mid-IR the authors expect this system ...
Highly efficient and controllable PEGylation of Gold nanoparticles prepared by femtosecond laser ablation in water	W. Qian, M. Murakami, Y. Ichikawa, Y. Che	J. Phys. Chem. C Vol. 115, No. 47, pp. 23293-23298	This paper demonstrates a new method for fabrication of stable Gold nanoparticle-poly(ethylene glycol) (PEG) conjugates bearing a defined number of one or multiple ...
New developments in fiber-based frequency combs	A. Ruehl, I. Hartl, M.E. Fermann	IEEE Phot. Conf. pp. 435-436	Significant progress in Yb-fiber laser based frequency combs over the last few years resulted in Hz-level optical linewidths, GHz comb spacings and average powers ...
Power optimization of XUV frequency combs for spectroscopy applications	D.C. Yost, A. Cingöz, T.K. Allison, A. Ruehl, M.E. Fermann, I. Hartl, J. Ye	Opt. Exp. Vol. 19, No. 23, pp. 23483-23493	We address technical impediments to the generation of high-photon flux XUV frequency combs through cavity-enhanced high harmonic generation. These difficulties ...

2011 (Continued)

Pulse train amplitude modulation due to continuum resonances in GHz soliton fiber lasers	I. Hartl, A. Romann, T.R. Schibli, M.E. Fermann	2011 CLEOE Tech. Digest p. 1	It is well known that in lasers operating in the soliton modelocking regime, the unavoidable periodic perturbation of the average soliton pulse generates a co-propagating ...
Self-frequency shift near 2 μm in periodically poled Lithium Niobate waveguides	C.R. Phillips, J. Jiang, C. Langrock, I. Hartl, M.M. Fejer, M.E. Fermann	2011 CLEOE Tech. Digest p. 1	In this experiment, the PPLN waveguides are seeded with a coherent Raman soliton source, based on a Tm oscillator and amplifier. The pulses have a FWHM duration of 100 ...
Supercontinuum generation in quasi-phaseshifted waveguides	C.R. Phillips, C. Langrock, J.S. Pelc, M.M. Fejer, I. Hartl, M.E. Fermann	Opt. Exp. Vol. 19, No. 20, pp. 18754-18773	We numerically investigate supercontinuum generation in quasi-phase-matched waveguides using a single-envelope approach to capture second and third order nonlinear ...
Synthesis and electrophoretic deposition of composite metal nanoparticles and non-vacuum fabrication of CuInSe_2 solar cells	W. Guo, K. Hagedorn, B. Liu	Proc. SPIE Vol. 8110, p. 811009	A method of non-vacuum synthesis of CuInSe_2 (CIS) thin films is presented. The method is based on electrophoretic deposition (EPD) of Cu-In composite nanoparticles in ...
Ultrabroadband coherent supercontinuum frequency comb	A. Ruehl, M.J. Martin, K.C. Cossel, L. Chen, H. McKay, B. Thomas, C. Benko, L. Dong, J.M. Dudley, M.E. Fermann, I. Hartl, J. Ye	Phys. Rev. A Vol. 84, p. 011806	We present detailed studies of the coherence properties of an ultrabroadband supercontinuum, enabled by a comprehensive approach involving continuous-wave ...

2012

Direct frequency comb spectroscopy in the extreme ultraviolet	A. Cingöz, D.C. Yost, T.K. Allison, A. Ruehl, M.E. Fermann, I. Hartl, J. Ye	Nature Vol. 482, pp. 68-71	The development of the optical frequency comb (a spectrum consisting of a series of evenly spaced lines) has revolutionized metrology and precision spectroscopy ...
Frequency comb metrology goes extreme UV	A. Cingöz, T.K. Allison, D.C. Yost, C. Benko, A. Ruehl, M.E. Fermann, I. Hartl, J. Ye	SPIE Newsroom 10 July 2012	Extreme-nonlinear optics convert near-IR laser light into extreme-UV light, enabling high-precision spectroscopy in this unexplored region of the electromagnetic spectrum.
Frequency comb stabilization with bandwidth beyond the limit of gain lifetime by an intracavity graphene electro-optic modulator	C.-C. Lee, C. Mohr, J. Bethge, S. Suzuki, M. Fermann, I. Hartl, T. Schibli	Opt. Lett. Vol. 37, No. 15, pp. 3084-3086	Intra-cavity loss modulation enables nearly orthogonal offset-frequency control with bandwidths beyond what is possible by pump power modulation. To demonstrate ...
Octave-spanning ultrafast OPO with 2.6 - 6.1 μm instantaneous bandwidth pumped by femtosecond Tm-fiber laser	N. Leindecker, A. Marandi, R.L. Byer, K.L. Bodopyanov, J. Jiang, I. Hartl, M. Fermann, P.G. Schunemann	Opt. Exp. Vol. 20, no. 7, pp. 7046-7053	We report the extension of broadband degenerate OPO operation further into mid-infrared. A femtosecond Thulium fiber laser with output centered at 2050 nm ...
Stable Gold nanocolloids with controllable surface modification and functionalization	W. Qian, M. Murakami, Y. Ichikawa, Y. Che	SPIE Proc. Vol. 8232, p. 82320P	This paper demonstrates a new method for fabrication of stable Gold nanoparticle-poly(ethylene glycol) (PEG) conjugates with a defined number of PEG molecules. ...
Widely tunable mid-infrared difference frequency generation in orientation-patterned GaAs pumped with a femtosecond Tm-fiber system	C. Phillips, J. Jiang, C. Mohr, A. Lin, C. Langrock, M. Snure, D. Bliss, M. Zhu, I. Hartl, J. Harris, M. Fermann, M. Fejer	Opt. Lett. Vol. 37, No. 14, pp. 2928-2930	We demonstrate a mid-infrared source tunable from 6.7 to 12.7 μm via difference frequency generation (DFG) in orientation-patterned GaAs, with 1.3 mW average ...