tronics Research Centre, Southampton University, Southampton, S017 1BJ U.K.; E-mail: DJR@RC.SOTON.AC.UK. We review recent progress in the area of high-power fiber lasers and amplifiers and describe the development of a range of practical, widely tunable, fiber laser pumped parametric, oscillators, amplifiers and generators based on periodically poled lithium niobate operating in the important 1–5 mm spectral region.

FL2 9:30am

Programmable-controlled wavelength selectivity and scanning all-fiber traveling-wave ring lasers, Zhiguo Liu, Yi-bing Zhang, Jiang Wang, Chun-feng Ge, Tao Tang, Xiao-yi Dong, *Institute of Modern Optics, Nankai University, Tianjin 300071 China; E-mail: dongxy@sun.nankai.edu.cn.* A programmable-controlled wavelength-scanning structure is reported in this paper, which is used to tune the center wavelength of fiber Bragg grating linearly. Based on such a structure, an all-fiber traveling-wave ring laser is fabricated, the output wavelength can be selected on computer and can also be continuously scanned in the range of 5.9 nm, the linearity is up to R2 = 0.999, the wavelength interval is 0.156 nm, and the wavelength-repeated rate is 5.13×Al0£-3 nm, which is in the range of OSA measuring precision.

FL3 9:45am

Intrinsic bistability in Yb gain media at room temperature, Amos Kuditcher, Stephen C. Rand, *Division of Applied Physics, 1049 Randall Laboratory, University of Michigan, Ann Arbor, MI 48109-1120; E-mail: kuditche@umich.edu.* Nonlinear interactions between rare-earth ions in heavy-metal halide crystals have previously been shown to result in bistable luminescence at liquid helium temperatures. Here we believe we report the first observation of intrinsic switching of luminescence and transmission of a rare-earth material at room temperature—in a Yb-doped oxide glass used for planar waveguide laser applications.

FM 9:00am–12:00m Camden Lobby

Symposium on Space and Astronomical Sensing: 2 (Poster Session)

FM1

Mariner Mars 6/7 infrared spectrometer: new calibration and carbon dioxide clouds, Paul Forney, Laurel Kirkland,* *Lockheed Martin Missiles and Space, 3251 Hanover Street, Palo Alto, CA 94304; E-mail: paul.forney@lmco.com.* The Mariner Mars 6 and 7 infrared spectrometers returned high-quality spectra covering 1.9–14.4 microns, and the data set remains unique in its spectral coverage of Mars. We have performed a new calibration of the spectra using recently recovered information, and then revisited the original finding of carbon dioxide clouds in the Martian atmosphere. **Lunar and Planetary Institute*

FM2

White-light phase retrieval, J.R. Fienup, *ERIM International, P.O. Box 134008, Ann Arbor, MI 48113-4008; E-mail: fienup@erim-int.com.* On simulated Hubble Space Telescope data, we show the performance of an efficient phase-retrieval algorithm, generalized to work on images of stars with wide-band light, which can be used to determine the aberrations of the telescope. We also show the ability to reconstruct the aperture function.

FM3

Fabrication and testing of a micromachined silicon immersion grating for high-resolution infrared spectroscopy: applications to spaced-based astronomical instrumentation, Luke Keller, Daniel Jaffe, Oleg Ershov, *University of Texas at Austin, Department of Astronomy, RLM 15.308, Austin, TX 78712; E-mail: keller@astro.as.utexas.edu.* We present our method for micromachining echelle gratings onto large single-crystal silicon substrates and the results of extensive optical quality and diffraction efficiency testing. These immersion gratings will allow a factor of ~10 savings in the mass of both ground and space-based high-resolution near-infrared astronomical spectrographs.

FM4

Local fields and optical properties of multicomponent discrete medium, Alexander Ghiner, Gregory Surdutovich,* *Universidade Federal do Maranhao, Departamento de Fisica, Centro Tecnologico, Campus Universitario do Bacanga, Sao Luis, Ma 65085-040 Brazil; E-mail: ghiner@fapema.br.* Using the generalized method of integral equations we for the first time to our knowledge in molecular optics, derive the dielectric response and nonlinear susceptibilities of multicomponent discrete medium and demonstrate the applicability of Maxwell equations and validity of Extinction Theorem with the accuracy up to the third order in the discrete parameter. **UNICAMP, Brazil*

FM5

White-light interferometry using M-sequence modulation for highly sensitive and selective measurements, Akiko Hirai, Katuo Seta, Hirokazu Matsumoto, *National Research Laboratory of Metrology, 1-1-4 Umezono, Tsukuba, Ibaraki 305-8563 Japan; E-mail: hirai@nrlm.go.jp.* Novel white-light interferometry is studied by using M-sequence modulation, which is known in lidar, for measuring the surface profile with high sensitivity and effective selectivity. The experimental results by a halogen lamp show the improvement of signal-to-noise ratio compared with that of the conventional interferometry.

FN 9:00am–12:00m Camden Lobby

Symposium on Space-Based Atmospheric Sensing: 2 (Poster Session)

FN1

Coherent Doppler lidar data products from space platforms, Rod Frehlich, *University of Colorado, CIRES, Campus Box 216, Boulder, CO 80309; E-mail: rgf@cires.colorado.edu.* The performance of coherent Doppler lidar velocity estimates for various beam-scanning geometries from space platforms is determined by computer simulations of Doppler lidar signals. The performance is described by the statistical behavior of the velocity estimates using multiple lidar shots that sample a turbulent atmospheric wind field.

FN2

Maximizing coherent detection signal-to-noise ratio through atmospheric turbulence for different pixel geometries and beam profiles, Kamal Das, Mohammad A. Karim, *University of Dayton, c/o: NASA Lewis Research Center, MS 110-3, 21000 Brookpark Road, Cleveland, OH 44135; E-mail: kamal@coherent.lerc.nasa.gov.* The study of electromagnetic beam propagation in atmospheric turbulence is of considerable interest because of wide spread use of coherent lidars and imaging systems. It is normally understood that the detection mixing efficiency and signal-to-noise ratio (SNR) depend on detector geometry, beam profiles and phase-front misalignment between signal and local oscillator (LO) beams. Our present work investigates the effects of atmospheric turbulence for different LO and signal beam profiles on the equivalent area square and hexagonal detector array in heterodyne detection. This study reveals that maximizing SNR can be achieved using Gaussian beam profiles with an array of hexagonal detectors in presence of atmospheric turbulence.

FN3

Zephyr: a direct detection Doppler lidar global wind sensing mission, Bruce Gentry, C. Laurence Korb, Robert Atlas, Steven X. Li,* Huailin Chen,* *NASA Goddard Space Flight Center, Laboratory for Atmospheres, Code 912, Greenbelt, MD 20771; E-mail: Bruce.Gentry@gsfc.nasa.gov.* Zephyr is a

Friday, October 9

Shuttle mission planned for launch in March, 2001 to demonstrate tropospheric wind profiling using direct detection Doppler lidar. Winds are determined by measuring the Doppler shift from molecular and aerosol backscatter. The instrument will utilize state-of-the-art technologies in solid-state lasers, large-aperture telescopes, high-resolution etalon filters and photon-counting detectors.
Science Engineering Services Inc.

FN4

Comparison of spaceborne direct-detection Doppler lidar methods, Matthew McGill, James D. Spinhirne, *Goddard Space Flight Center, Code 912, Greenbelt, MD 20771; E-mail: mcgill@virl.gsfc.nasa.gov.* We will show spaceborne simulations of the fringe-imaging and edge technique Doppler lidar methods. Initial results show that the theoretical performance levels of the two systems are similar. Thus, other design considerations will determine which system is more practical for spaceborne use. Models and design considerations will be discussed.

FN5

High-spectral-resolution Rayleigh-Mie lidar and multiparameter measurement from space, Chiao-Yao She, *Colorado State University, Physics Department, Ft. Collins, CO 80523; E-mail: joeshe@lamar.colostate.edu.* Recent progress in lidar measurements of both atmospheric state parameters and aerosol properties using an injection-seeded YAG laser and molecular iodine filters will be reviewed. Current problems and potential improvements in view of space-based multiparameter atmospheric sensing will be discussed.

FN6

Design of a direct detection Doppler wind lidar for spaceflight, Jack A. McKay, *Remote Sensor Concepts, 3200 19th Street, NW, Washington, DC 20010; E-mail: j.a.mckay@worldnet.att.net.* A design is presented of a noncoherent detection Doppler wind lidar, dealing with a number of the difficulties of the satellite platform, including instrument compensation for spacecraft velocity, collection of adequate backscatter photons, suppression of the solar background, and maintenance of transmitter-receiver boresighting while implementing a continuous conical scan.

FN7

Retrieval of physical thickness and optical depth of boundary-layer cloud decks from space-borne lidar using asymptotic (photon-diffusion) theory, Anthony B. Davis, David M. Winker,* Robert F. Cahalan,** *Los Alamos National Laboratory, Space & Remote Sensing Science Group (NIS-2), P.O. Box 1663 (Mail Stop C-323), Los Alamos, NM 87545; E-mail: adavis@lanl.gov.* Diffusion theory is used to model a space-borne lidar's signal for dense strato-cumulus. Physical thickness asymptotically dominates the uncalibrated signal whereas cloud optical depth determines its pre-asymptotic corrections, overall photon-count, as well as any available spatial information. Validity of the retrieval scheme is assessed with LITE data.
*NASA Langley Research Center
**NASA Goddard Space Flight Center*

FN8

Elastic-scattering angular patterns from micron-sized spheres and spheroids, Yongle Pan, Stephen Holler, Steven C. Hill,* Richard K. Chang, *Department of Applied Physics, Yale University, 15 Prospect Street, New Haven, CT 06520; E-mail: richard.chang@yale.edu.* Near-backward and forward angular scattering patterns from micron-sized spheres and spheroids have been recorded. Two-dimensional angular patterns are observed to change with orientation, amount of spherodicity, particle size, refractive index, and light polarization, especially in the near-backward direction. The measured angular profiles are in qualitative agreement with the T-matrix calculations for spheroids.
Army Research Laboratory

FN9

Scintillation investigation by using fractional moments of Beckmann probability distribution, Anna Consortini, Claudia Innocenti,* *Department of Physics, University of Florence, Via S. Marta, 3, Florence, 50139 Italy; E-mail: consortini@dffs.unifi.it.* The method of fractional moments for investigating the statistics of laser scintillation in the atmosphere, already developed in the case of one-parameter distribution, is extended to the case of a two-parameter probability density function.
INFM, Italy

FO

9:00am–12:00m
Camden Lobby

Symposium on Optical Membrane Mirrors (Poster Session)

FO1

Configuration limits of initially flat electrostatically loaded membrane reflectors, Peter Washabaugh, Donal Rapp,* *The University of Michigan, 3028 FXB, Ann Arbor, MI 48109-2140; E-mail: pete@umich.edu.* The ultimate behavior of membrane reflectors is constrained by geometric and loading limits, mechanical instabilities (e.g., circumferential buckling) and electromechanical instabilities. As membranes approach small f numbers they will inherently approach some of these limits. Means to circumvent some of these instabilities will be introduced.
Jet Propulsion Laboratory, NASA

FO2

Aberrations produced by the elastic and finite-kinematic deformations of initially flat membrane reflectors, Peter Washabaugh, *The University of Michigan, 3028 FXB, Ann Arbor, MI 48109-2140; E-mail: pete@umich.edu.* The finite elastomechanical behavior of stretched membranes are described by the classical analytical results of Foppl and Dickey, and Green and Adkins. These results predict membrane surfaces that can be interpreted in terms of typical optical base functions. Pertinent nondimensional parameters that govern the Zernike coefficients are presented.

FO3

From oceans to space: the challenge and potential for membrane structures, Christopher Jenkins, *Compliant Structures Laboratory, Mechanical Engineering Department, SD School of Mines and Technology, Rapid City, SD 57701; E-mail: cjenkins@msmailgw.sdsmt.edu.* Nature embraced membrane structures for the earliest of life forms. Early human engineers used the membrane as structural elements also. The evolution of membranes as engineering structures is reviewed. Focus is then turned to modern use of membranes in space technology, with particular emphasis on membrane antennae and reflectors.

FO4

Applications of power series solutions of membrane equilibrium equations to the optical evaluation of membrane mirrors with curvature, James Wilkes, *Air Force Research Laboratory, AFRL/DEBS, 3550 Aberdeen Avenue SE, Kirtland Air Force Base, NM 87117-5776; E-mail: wilkes@plk.af.mil.* We report on applications of power series solutions of membrane equilibrium equations to the analysis and design of optical systems containing membrane mirrors as components. Such solutions for membranes subject to pre-straining appear to satisfactorily explain recent laboratory observations associated with the optical evaluation of a membrane mirror.

FO5

Development of stretchable membrane mirror technology at the University of Strathclyde, Peter Waddell, Steven Mason, Stuart McKay, Les Mair,* *University of Strathclyde, Mechanical Engineering Department, James Weir Building, 75 Montrose Street, Glasgow, NA G1 1XJ U.K.; E-mail: pwaddell@mecheng.strath.ac.uk.* This paper will track the development of stretchable membrane mirrors at the University of Strathclyde. P. Waddell,