

Professional Development Grant Final Report

April 2016 deadline

“Travel to and Registration for the 2016 Joint Frontiers in Optics / Laser  
Science Meeting”

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**Restatement of professional enhancement opportunity:**

The purpose of this project was to travel to Rochester, NY and attend the Joint Frontiers in Optics and Laser Science (FiO/LS) conference. Dr. Young presented a paper titled "Generation of Ince-Gauss Laser Beams" The type of laser beams studied (e.g. Ince-Gauss beams) are of current interest for use in optical communications due to their ability to carry more information than other beams. The main objective of the project to establish a relationship between the angle of a mode converter and the ellipticity of the generated Ince-Gauss laser beam.

**Review of the professional enhancement opportunity:**

Dr. Young's primary research interest is fundamental laser physics. The annual FiO/LS is the primary meeting of the year for laser physicists. The opportunity to attend and present research at this conference was an invaluable professional experience. A few new research ideas were created as a result of discussions that occurred during the conference. Additionally, Dr. Young was made aware of particular summer research opportunities for physics students at the University of Arkansas (UA).

**Summary of experience:**

As a presenter at FiO/LS, Dr. Young received valuable feedback on her research. Other conference attendees' input and ideas related to the research project lead to ideas for Dr. Young's next research projects. As an attendee, Dr. Young benefited from attending other talks and keynote speeches as well as participating in networking opportunities.

## Conclusions:

Dr. Young is grateful to the Professional Development Grant committee for approving her use of funding and allowing her to present and participate in the premier laser and optics research conference of the year. Participating in the 2016 FiO/LS meeting proved to be a beneficial experience not only for coming up with new and improved laser physics research ideas but also exposure to physics education research.

Copy of conference nametag:



Empire Hall

JOINT FIO/LS

JTh2A • Joint Poster Session II—Continued

**JTh2A.57 E-Poster**  
**Spatial Frequency Modulated Imaging (SPIMI) in Amplitude with a Spatial Light Modulator**, Michael D. Young<sup>1</sup>, Jeffrey J. Field<sup>2</sup>, Randy Bartels<sup>3</sup>, Jeff Squier<sup>4</sup>; <sup>1</sup>Colorado School of Mines, USA; <sup>2</sup>Colorado State Univ., USA. Previous work has demonstrated modulated imaging with binary masks. We present a new microscope that provides continuous modulation with a spatial light modulator, which can modulate through multiple methods: amplitude, phase, polarization, etc.

*This presentation will be presented as an E-Poster on Screen 4 from 10:15–11:00*

**JTh2A.58**  
 Withdrawn.

**JTh2A.59**  
**Evaluation Of Transverse Aberration By Spatial Modulators**, Maria Elizabeth Percino<sup>1</sup>; <sup>1</sup>INAOE, Mexico. The evaluation process of concave surfaces, some methods used are Hartmann and Ronchi test, which use spatial modulators. This paper presented the comparison between them evaluations along the diameter perpendicular to the patterns fringes.

**JTh2A.60**  
 Withdrawn.

**JTh2A.61**  
 Withdrawn.

**JTh2A.62**  
**Relationship Between Hermite-Gaussian and Ince-Gaussian Laser Beams**, Allison Hine<sup>1</sup>, Jessica P. Conry<sup>1</sup>; <sup>1</sup>Arkansas Tech Univ., USA. We generate Ince-Gaussian (IG) laser beams from Hermite-Gaussian (HG) laser beams using an astigmatic mode converter (AMC). The relationship between the HG order, IG order and ellipticity, and the rotation of the AMC is discussed.

**JTh2A.63**  
**Photon sieve on an optical fiber tip for improved light coupling into a submicron silicon waveguide**, Ricardo Janeiro<sup>1</sup>, Raquel Flores<sup>1</sup>, Pabitra Dahal<sup>1</sup>, Jaime Viegas<sup>1</sup>; <sup>1</sup>Masdar Inst., United Arab Emirates. The superior performance over a commercial tapered fiber for light coupling at 1550 nm into a silicon waveguide has been demonstrated using a photon sieve fabricated by focused ion beam on an optical fiber tip.

**JTh2A.64 E-Poster**  
**Pico-watt radiant flux detection by smartphone**, Youngke Jung<sup>1,2</sup>, Iyil-Joon K. Doh<sup>2</sup>, Euiwon Bae<sup>2</sup>; <sup>1</sup>graduate student, USA; <sup>2</sup>Mechanical engineering, Purdue Univ., USA. We present a smartphone based analytical device for detecting sub nano-watt level of radiant flux. A 3D printed optical cradle and a new algorithm to improve SNR level is suggested. *This presentation will be presented as an E-Poster on Screen 5 from 10:15–11:00*

**JTh2A.65**  
**Twist phase-induced changes of the polarization degree and state of a stochastic electromagnetic beam**, Lin Liu<sup>1</sup>; <sup>1</sup>Soochow Univ., China. A radially polarized partially coherent twist beam propagating in uniaxial crystal have been explored based on the unified theory of coherence and polarization. The twist factor and the anisotropy induced the change of the statistical properties.

**JTh2A.66**  
**Employing the Ichikawa-Takeda's Method Applied to Irradiance Transport Equation (ITE): Filtering and Tilt Grid Analysis**, Jesús A. Arriaga Hernández<sup>1</sup>, Alejandro Cornejo Rodríguez<sup>1</sup>, Elizabeth Percino Zacarías<sup>1</sup>, Fermin S. Granados<sup>1</sup>; <sup>1</sup>INAOE, Mexico. From Irradiance Transport Equation, derived by Teague [1]. A detailed analysis was realized to the Ichikawa [2], arrangement for lens testing; the aspects studied were filters shape, period and tilt of ruling used experimentally.

**JTh2A.67**  
**Reconstruction of refractive index profile of photonic crystal fiber using intensity based optical diffraction tomography**, Jem Teresa John<sup>1</sup>, Ram M. Vasu<sup>1</sup>, Rajan Kanhirodan<sup>1</sup>; <sup>1</sup>Indian Inst. of Science, India. An iterative Gauss-Newton algorithm which uses normal derivative of intensity (without estimating phase) as the measurement, to reconstruct the cross-sectional refractive index profile of a photonic crystal fiber.

**JTh2A.68**  
**Refraction-compensating algorithm for a 3D glass structure exhibiting multiple 2D images**, Ryuji Hirayama<sup>1</sup>, Hiroataka Nakayama<sup>2</sup>, Atsushi Shiraki<sup>3</sup>, Takashi Kakue<sup>1</sup>, Tomoyoshi Shimobaba<sup>1</sup>, Tomoyoshi Ito<sup>1</sup>; <sup>1</sup>Graduate School of Engineering, Chiba Univ., Japan; <sup>2</sup>Center for Computational Astrophysics, National Astronomical Observatory of Japan, Japan; <sup>3</sup>Inst. of Management and Information Technologies, Chiba Univ., Japan. The 3D structure designed by our algorithm exhibits multiple 2D images to different directions. However, refraction at the curved surface of glasses causes the deterioration in the image quality. We proposed a refraction-compensating algorithm.

**JTh2A.69**  
**Experimental Validation of Nodal Aberration Theory with a Customized Ritchey-Chrétien Telescope**, Nan Zhao<sup>1,2</sup>, Kevin P. Thompson<sup>1,2</sup>, Jun Zhu<sup>1,4</sup>, Michael Pomerantz<sup>1,5</sup>, Jannick P. Rolland<sup>1</sup>; <sup>1</sup>The Inst. of Optics, Univ. of Rochester, USA; <sup>2</sup>Changchun Inst. of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China; <sup>3</sup>Synopsis, Inc., USA; <sup>4</sup>Tsinghua Univ., China; <sup>5</sup>Department of Mechanical Engineering, University of Rochester, USA. To experimentally validate Nodal Aberration Theory, third order spherical, coma, and astigmatism are investigated in a custom Ritchey-Chrétien telescope with precisely controlled misalignments achieved with a secondary mirror mounted on a hexapod.

**JTh2A.70**  
**Laser-induced localized photothermal conversion of vanadium into vanadium oxides**, Giwan Seo<sup>1</sup>, Jong-Bum You<sup>1</sup>, Shin ho Kim<sup>1</sup>, Bong-Jun Kim<sup>2</sup>, Kyoungsik Yu<sup>1</sup>; <sup>1</sup>Korea Advanced Inst of Science & Tech, Korea; <sup>2</sup>Mobrik Co. Ltd., Korea. In situ laser patterning by localized photothermal heating is proposed for facile fabrication of vanadium oxide devices with phase transition property. Optically-controlled resistance switching properties of the synthesized devices are investigated.

**JTh2A.71**  
 Withdrawn.

**JTh2A.72**  
**Analysis of Hollow Core De-multiplexer for Spatially Multiplexed Systems**, Syed H. Murshid<sup>1</sup>, Gregory L. Lovell<sup>1</sup>; <sup>1</sup>Florida Inst. of Technology, USA. Analysis and simulated results of hollow core, all optical de-multiplexer architecture is presented that tests the coupling efficiency of the structure as the bevel angle of the design is varied for common optical indices.

**JTh2A.73**  
**A design approach of the image mapper for the image mapping spectrometer (IMS)**, Xiaoming Ding<sup>1</sup>, Yan Yuan<sup>1</sup>, Lijuan Su<sup>1</sup>; <sup>1</sup>Beihang Univ., China. A design approach of the image mapper used in the image mapping spectrometer (IMS) is introduced to reduce the cross talk and improve the quality of the reconstructed images and spectral information.

**JTh2A.74 E-Poster**  
**Testing cylindrical lenses placing a CCD sensor inside the caustic region**, Gabriel Castillo-Santiago<sup>1</sup>, Maximino Avendaño-Alejo<sup>1</sup>; <sup>1</sup>CAADET-UNAM, Mexico; <sup>2</sup>Facultad de Ingeniería, UNAM, Mexico. A method to evaluate the shape of fast plano-convex cylindrical lenses is presented, by using null bi-Ronchi type screens, which allows to have uniform patterns at detection's plane inside the caustic region. *This presentation will be presented as an E-Poster on Screen 4 from 09:30–10:15*