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Complex Light and Optical Forces IV

**Enrique J. Galvez
David L. Andrews
Jesper Glückstad**
Editors

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Contents

vii	Conference Committee
ix	Introduction

SESSION 1 NEW COMPLEX LIGHT BEAMS

- 7613 02 **Generation of structured beams in large-Fresnel number degenerate cavities and beam transformation with orbital angular momentum (Invited Paper)** [7613-01]
T. H. Lu, National Taiwan Normal Univ. (Taiwan); Y. C. Lin, Y. F. Chen, K. F. Huang, National Chiao Tung Univ. (Taiwan)
- 7613 03 **Selective excitation of high-order laser modes and its application to vortex array laser beam generation (Invited Paper)** [7613-02]
S.-C. Chu, National Cheng-Kung Univ. (Taiwan); K. Otsuka, Tokai Univ. (Japan)
- 7613 04 **Optical twisters: beams having twists in both phase and amplitude (Invited Paper)** [7613-03]
V. R. Daria, Australian National Univ. (Australia); D. Palima, J. Glückstad, Technical Univ. of Denmark (Denmark)
- 7613 05 **Stokes polarimetry of a hybrid vector beam from a spun elliptical core optical fiber** [7613-04]
G. Milione, H. I. Sztul, R. R. Alfano, The City College of New York (United States)

SESSION 2 COMPLEX LIGHT GENERATION

- 7613 06 **Optical singularities induced in a nematic-cell by carbon nanotubes (Invited Paper)** [7613-05]
V. Ponevchinsky, Institute of Physics (Ukraine); A. I. Goncharuk, F. D. Ovcharenko Institute of Biocolloidal Chemistry (Ukraine); V. I. Vasil'ev, Institute of Physics (Ukraine); N. I. Lebovka, F. D. Ovcharenko Institute of Biocolloidal Chemistry (Ukraine); M. S. Soskin, Institute of Physics (Ukraine)
- 7613 07 **Generic dark hollow beams using negative cones chemically etched in fiber tips** [7613-06]
N. K. Viswanathan, G. M. Philip, Y. V. Jayasurya, Univ. of Hyderabad (India)
- 7613 08 **Orbital angular momentum experiments with broadband few cycle pulses** [7613-07]
A. Richter, Max-Born-Institute for Nonlinear Optics and Ultrafast Spectroscopy (Germany) and FernUniv. of Hagen (Germany); M. Bock, Max-Born-Institute for Nonlinear Optics and Ultrafast Spectroscopy (Germany); J. Jahns, FernUniv. of Hagen (Germany); R. Grunwald, Max-Born-Institute for Nonlinear Optics and Ultrafast Spectroscopy (Germany)

SESSION 3 OPTICAL FORCES

- 7613 09 **The electrodynamic mechanisms of optical binding (Invited Paper)** [7613-08]
D. L. Andrews, L. Dávila Romero, Univ. of East Anglia (United Kingdom)

- 7613 0A **Non-conservative forces in optical tweezers and Brownian vortexes** [7613-09]
B. Sun, A. Y. Grosberg, D. G. Grier, New York Univ. (United States)
- 7613 0B **Fast and precise measurements of particle charge with optical trapping electrophoresis** [7613-10]
F. Beunis, Ghent Univ. (Belgium) and ICFO-Institut de Ciències Fotoniques (Spain); F. Strubbe, B. Verboven, K. Neyts, Ghent Univ. (Belgium); D. Petrov, ICFO-Institut de Ciències Fotoniques (Spain) and ICREA-Institució Catalana de Recerca i Estudis Avançats (Spain)
- 7613 0D **NanoTracker: force-sensing optical tweezers for quantitative single-molecule nanomanipulation** [7613-12]
H. A. Eggert, J. van Mameren, A. Wozniak, T. Jaehnke, JPK Instruments AG (Germany)

SESSION 4 TOPOLOGICAL PHASES AND EFFECTS

- 7613 0E **Observation of linear, nonlinear and singular behavior of the Pancharatnam-Berry phase (Invited Paper)** [7613-13]
T. van Dijk, H. F. Schouten, W. Ubachs, Free Univ. (Netherlands); T. D. Visser, Free Univ. (Netherlands) and Delft Univ. of Technology (Netherlands)
- 7613 0F **Geometric phases in higher-order transverse optical modes** [7613-14]
S. J. M. Habraken, G. Nienhuis, Leiden Univ. (Netherlands)
- 7613 0G **New polarization singularities of partially coherent light beams** [7613-15]
M. S. Soskin, Institute of Physics (Ukraine); P. V. Polyanskii, Chernivtsi National Univ. (Ukraine)

SESSION 5 PROPAGATION IN MEDIA

- 7613 0I **Propagation of a hybrid vector polarization beam in a uniaxial crystal** [7613-17]
G. Milione, H. I. Sztul, R. R. Alfano, The City College of New York (United States)
- 7613 0J **Rotational frequency shift in cylindrical vector beam due to skew rays in few-mode optical fibers** [7613-18]
N. K. Viswanathan, V. V. G. K. Inavalli, Univ. of Hyderabad (India)
- 7613 0K **Singular trajectories: space-time domain topology of developing speckle fields** [7613-19]
V. Vasil'ev, M. S. Soskin, Institute of Physics (Ukraine)

SESSION 6 QUANTUM EFFECTS

- 7613 0L **Quantum imaging and orbital angular momentum (Invited Paper)** [7613-20]
J. Leach, B. Jack, J. Romero, D. Ireland, S. Franke-Arnold, Univ. of Glasgow (United Kingdom); S. Barnett, Univ. of Strathclyde (United Kingdom); M. Padgett, Univ. of Glasgow (United Kingdom)
- 7613 0N **Imaging spatial-helical mode interference of single photons** [7613-22]
E. J. Galvez, E. Johnson, B. J. Reschovsky, L. E. Coyle, A. Shah, Colgate Univ. (United States)

SESSION 7 OPTICAL MANIPULATION

- 7613 0O **On- and off-axis binding and induced circulation in counter-propagating beam traps (Invited Paper)** [7613-23]
J. M. Taylor, G. D. Love, Durham Univ. (United Kingdom)
- 7613 0P **Geometric configurations and perturbative mechanisms in optical binding** [7613-24]
L. Dávila Romero, D. L. Andrews, Univ. of East Anglia (United Kingdom)
- 7613 0Q **Optical forces in biophotonics: transfection and cell sorting** [7613-25]
W. A. Ertmer, Laser Zentrum Hannover e.V. (Germany) and Leibniz Univ. Hannover (Germany); H. Meyer, R. Lorbeer, G. Bergmann, C. Krämer, H. Lubatschowski, Laser Zentrum Hannover e.V. (Germany); H. M. Escoboar, I. Nolte, Univ. of Veterinary Medicine Hannover (Germany); A. Heisterkamp, Laser Zentrum Hannover e.V. (Germany) and Leibniz Univ. Hannover (Germany)
- 7613 0R **Integrated platform based on high refractive index contrast waveguide for optical guiding and sorting** [7613-26]
B. S. Ahluwalia, O. G. Hellesø, Univ. of Tromsø (Norway); A. Z. Subramanian, J. S. Wilkinson, Univ. of Southampton (United Kingdom); J. Chen, X. Chen, Vestfold Univ. College (Norway)

SESSION 8 COMPLEX LIGHT IN FREE SPACE

- 7613 0T **Velocity of optical Airy beams** [7613-28]
H. I. Sztul, G. Milione, R. R. Alfano, The City College of New York (United States)
- 7613 0U **Collinear non-diffracting beams: classification and properties** [7613-29]
B. S. Ahluwalia, Univ. of Tromsø (Norway); W. M. Lee, Univ. of St. Andrews (United Kingdom)
- 7613 0V **Noise-reduction in fringe patterns based on the empirical mode decomposition** [7613-30]
W.-H. Su, C.-K. Lee, C.-W. Lee, National Sun Yat-Sen Univ. (Taiwan)

POSTER SESSION

- 7613 0X **Creating optical vortex modes with a single cylinder lens** [7613-33]
H. Sridhar, M. G. Cohen, J. W. Noé, Stony Brook Univ. (United States)

Author Index

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Session Chairs

- 1 New Complex Light Beams
Enrique J. Galvez, Colgate University (United States)
- 2 Complex Light Generation
David L. Andrews, University of East Anglia Norwich (United Kingdom)
- 3 Optical Forces
Marat S. Soskin, Institute of Physics (Ukraine)
- 4 Topological Phases and Effects
Wolfgang A. Ertmer, Leibniz Universität Hannover (Germany)
- 5 Propagation in Media
Taco D. Visser, Technische Universiteit Delft (Netherlands)
- 6 Quantum Effects
Marat S. Soskin, Institute of Physics (Ukraine)
- 7 Optical Manipulation
David L. Andrews, University of East Anglia Norwich (United Kingdom)
- 8 Complex Light in Free Space
Enrique J. Galvez, Colgate University (United States)

Introduction

The present volume contains the proceedings of Complex Light and Optical Forces IV. This conference was the largest of our sequence, featuring 29 presentations. As is typical for these conference series the presentations consisted of an interesting variety of problems, all revolving around the common theme of complex light and fundamental issues related to manipulation with light.

The articles in these proceedings are representative of the presentations. They highlight important developments in the field with presentations in the generation and characterization of new light forms: hollow beams generated by etched fibers (Viswanathan et al.); hybrid vector beams generated by spun fibers (Milione et al.); non-diffracting beams (Ahluwalia and Lee); singular field patterns by passage through carbon nanotubes (Ponevchinsky et al.); new modes carrying vortex arrays (Chu and Otsuka), and Lissajous modes (Lu et al.) generated by open-frame laser cavities; helical beams in both amplitude and phase via spatial light modulators (Daria et al.); the propagation features of Airy beams (Sztul et al.); new methods of mode transformations (Sridhar et al.); orbital modes of few-cycle light pulses (Richter et al.); and noise reduction in imaging (Su et al.). At the heart of many of these light forms were optical singularities and their propagation through optical media (Milione et al.) and their dynamics via the creation and annihilation of singularities (Vasilev and Soskin), and the observation of new polarization singularities (Soskin and Polanskii).

We devoted a session to geometric phase, a ubiquitous feature of optical beam propagation, that appear in the space of trajectories (Viswanathan and Inavalli), the space of states of polarization (van Dijk et al.) and the space of high-order spatial modes (Habraken and Nienhuis). A session on quantum effects highlighted the increasing relevance of complex light in fundamental tests of quantum mechanics and quantum imaging (Leach et al., Galvez et al.).

The conference had important discussions about manipulation with light and optical forces, highlighted by presentations on optical binding from both theoretical (Andrews and Romero, Romero and Andrews) and experimental (Taylor and Love) perspectives. New developments in manipulation were presented: transfection and sorting of biological species with light (Ertmer et al.); optical guiding with waveguides (Ahluwalia et al.); optical trapping electrophoresis (Beunis et al.); manipulation with nonconservative forces in optical tweezers (Sun et al.); and particle tracking in optical tweezers (Eggert et al.).

In summary, these proceedings give a glimpse of the richness of breadth and depth in studies involving new complex light forms and innovative ways to exert optical forces.

**Enrique J. Galvez
David. L. Andrews
Jesper Glückstad**