

EOS Topical Meeting on Diffractive Optics 2019

Jena, Germany
16-19 September 2019

Editors:

Kimmo Saastamoinen

ISBN: 978-1-5108-9397-9

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2019) by European Optical Society (EOS)
All rights reserved.

Printed with permission by Curran Associates, Inc. (2019)

For permission requests, please contact European Optical Society (EOS)
at the address below.

European Optical Society (EOS)
c/o Elina Koistinen
Länsikatu 15
FI-80110 Joensuu
Finland

Phone: 358 50 592 4693
Fax: 358 13 2637 111

koistinen@myeos.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Contents

Theory & Concepts I: Monday 9:30–11:00	1
1. Spectral expansion of the scattering response of resonant nano-structures. (Invited)	
F. Binkowski, L. Zschiedrich, P.-I. Schneider, M. Hammerschmidt, X. Garcia Santiago, F. Betz, and S. Burger	1
2. Simulation of microoptics under inhomogeneous illumination.	
M. Yousefi, T. Scharf, and M. Rossi	3
3. A k-domain method for fast propagation of electromagnetic fields through graded-index media.	
H. Zhong, S. Zhang, R. Shi, C. Hellmann, and F. Wyrowski	5
4. Scattering matrices and polarization properties of gratings in conical mounting and crossed gratings.	
L. Li	8
Gratings I: Monday 11:30–13:00	10
5. Tailored diffraction by lithographically realized nano-structures. (Invited)	
U. D. Zeitner, T. Flügel-Paul, F. Burmeister, D. Michaelis, G. Widholz, and S. Linß	10
6. Resonant grating demonstration in the inner of a cylinder.	
E. Koussi, H. Bruhier, M. Usuga, I. Verrier, N. Crespo-Monteiro, O. Parriaux, and Y. Jourlin	12
7. Customized EUV-gratings.	
M. Burkhardt, M. Steglich, D. Lehr, M. Helgert, A. Kalies, A. Pesch, and A. Gatto	14
8. Novel gratings of high dispersion and high efficiency II.	
N. Ebizuka, T. Okamoto, M. Sasaki, I. Tanaka, T. Hattori, S. Ozaki, and W. Aoki	16
Gratings II: Monday 14:00–15:30	18
9. Condensation and lasing phenomena in periodic nanoparticle lattices. (Invited)	
T. K. Hakala	18
10. Nano-structured diffraction gratings as polarizing beam splitters under vertical incidence.	
J. Wüster, Y. Bourgin, P. Feßer, and S. Sinzinger	20
11. Thermally activated resonant grating using vanadium dioxide synthetized by pulsed laser deposition.	
E. Koussi, F. Bourquard, T. Tite, D. Jamon, F. Garrelie, and Y. Jourlin	22
12. Advanced cross-disperser gratings design for LUVOIR-POLLUX spectropolarimeter.	
E. Muslimov, J.-C. Bouret, C. Neiner, M. Ferrari, and E. Hugot	24

Gratings III: Monday 16:00–17:00	26
13. High accurate measurement for the in-plane distortion of the semiconductor wafer.	26
<u>K. Otaki, H. Toba, S. Yashiki, and A. Kagiwada</u>	26
14. Systematic optimization of a lightguide coupling setup.	28
<u>S. Kunath, R. Knoth, S. Steiner, S. Zhang, C. Hellmann, and F. Wyrowski</u>	28
15. Physical-optics analysis of lightguides for AR&MR glasses.	30
<u>F. Wyrowski, C. Hellmann, S. Steiner, R. Knoth, and S. Zhang</u>	30
AR & VR: Tuesday 9:30–11:00	32
16. After 50 years in the making, have diffractives finally captured the attention of mainstream industry?. (Invited)	32
<u>B. Kress</u>	32
17. A diffractive see-through waveguide AR/VR display with up to 100° horizontal field of view.	33
<u>B. H. Kleemann</u>	33
18. Modelling and characterisation of two-dimensional pupil expansion with crossed gratings in an augmented-reality display.	35
<u>C. H. Gan, M.-E. Kleemann, A. Golos, and S. Valera</u>	35
19. A geometric waveguide and a holographic film for the head-mounted display.	37
<u>S. Zhao, Q. Song, B. Sherliker, and J. Lewis</u>	37
Theory & Concepts II: Tuesday 11:30–13:00	39
20. Planar-integrated free-space optics – old concept, new applications. (Invited)	39
<u>J. Jahns</u>	39
21. Design concept for AR lightguide devices.	41
<u>S. Steiner, C. Hellmann, R. Knoth, S. Zhang, and F. Wyrowski</u>	41
22. Numerical implementation of the homeomorphic Fourier transform and its application to physical-optics modeling.	43
<u>Z. Wang, O. Baladron-Zorita, and F. Wyrowski</u>	43
23. Classical optics, rays and waves: duality from the Feynman path integral.	45
<u>J. Babington</u>	45

Theory & Concepts III: Tuesday 14:00–15:30	47
24. Light interaction with nanoresonators: mode volume and quasi-normal mode expansion. (Invited)	
<u>P. Lalanne</u>	47
25. On the importance of homeomorphic operations in physical and geometrical optics.	
F. Wyrowski, O. Baladron-Zorita, Z. Wang, and C. Hellmann	50
26. Physical-optics anatomy of the Gouy phase shift.	
<u>O. Baladron-Zorita, Z. Wang, C. Hellmann, and F. Wyrowski</u>	52
27. Retrieving the size of deep-subwavelength objects via tunable spin-orbit interaction.	
<u>Z. Xi and H. P. Urbach</u>	54
Theory & Concepts IV: Tuesday 16:00–17:00	56
28. Concepts for modeling volume scatterers.	
<u>S.-T. Hung, Z. Wang, and F. Wyrowski</u>	56
29. Geometric phase in polarization beating of light waves.	
<u>A. Hannonen, K. Saastamoinen, L.-P. Leppänen, M. Koivurova, A. Shevchenko, A. T. Friberg, and T. Setälä</u>	58
30. Optimal design of multilayer diffractive optical elements and its application in hybrid imaging system.	
<u>S. Mao and J. Zhao</u>	60
Nanostructures: Wednesday 9:30–11:00	62
31. Semiconductor metasurfaces and applications. (Invited)	
<u>P. Ni, H. Ren, G. Briere, Y.-Y. Xie, A. De Luna Bugallo, and P. Genevet</u>	62
32. Sub-wavelength metamaterial for a finely tailored coupling coefficient within waveguides arrays.	
<u>A. Talneau, F. Hentinger, and N. Belabas</u>	64
33. A computational scheme for the characterization of 3D nanostructures using grazing-incidence X-ray fluorescence.	
<u>K. V. Nikolaev, V. Soltwisch, P. Hoenicke, F. Scholze, S. Heidenreich, J. de la Rie, S. N. Yakunin, I. A. Makhotkin, and F. Bijkerk</u>	66
34. Metolenses: field of view and aberration.	
<u>P. Lalanne</u>	68

Applications I: Wednesday 11:30–13:00	70
35. Understanding and optimization of EUV light diffraction and imaging for lithography. (Invited)	
<u>A. Erdmann</u>	70
36. Comparison of different concepts for compact cross-grating spectrometers.	
<u>M. Kraus, E. Förster, T. Höhne, V. Bagusat, D. Thomae, R. Brüning, H. Hillmer, and R. Brunner</u>	72
37. Ptychography with multiple wavelength illumination.	
<u>X. Wei and H. P. Urbach</u>	74
38. Diffractive optics encounters optical coherence tomography.	
<u>H. Ichikawa and H. Fujibuchi</u>	76
Applications II: Thursday 9:30–11:00	78
39. Non-paraxial design of diffractive optical elements and metasurfaces. (Invited)	
<u>M. A. Golub and O. Barlev</u>	78
40. Computer generated holography for lithography on curved surfaces.	
<u>D. Fischer and S. Sinzinger</u>	80
41. Towards high-speed tuning cavity resonator-integrated guided-mode resonance filters.	
<u>S. Calvez, A. Monmayrant, and O. Gauthier-Lafaye</u>	82
42. Multifocal complex-value phase zone plate for 3D focusing.	
<u>S. Gharbi Ghebjagh and S. Sinzinger</u>	84
Theory & Concepts V: Thursday 11:30–13:00	86
43. From iterative Fourier transform algorithm (IFTA) to “ray mapping” and back.	
<u>L. Yang, I. Badar, R. Knoth, C. Hellmann, and F. Wyrowski</u>	86
44. Connection of field solvers: microstructures and lenses.	
<u>R. Shi, C. Hellmann, and F. Wyrowski</u>	88
45. Customized diffuser design based on freeform lens array.	
<u>G. Zhang, K. Song, X. Yin, and K. Tian</u>	90
46. Inverse design for wavelength selective thick diffractive optical element.	
<u>Q. Song, L. A. Perez Covarrubias, Y. E. Pigeon, and K. Heggarty</u>	92

Theory & Concepts VI: Thursday 14:10–15:30	94
47. Design of a spatial shaped laser beam used for piston temperature field simulation.	
<u>S. Nie, T. Zhao, H. Xiao, and Z. Fan</u>	94
48. Second harmonic generation in arrayed bull's eye structure.	
<u>B. O. Asamoah, F. Li, K. Alam, P. Li, T. K. Hakala, G. Kang, and J. Turunen</u>	96
49. Physical-optics evaluation of BSDF for microstructures.	
<u>X. Yu and F. Wyrowski</u>	98
50. Study of Intensity distributions in the far-field region of azimuthal Walsh filters.	
<u>I. Bhattacharya</u>	100
 Poster presentations:	103
1. Broad-beam scanning exposure for fabricating gratings of large size and low stray light.	
<u>L. Zeng and D. Ma</u>	103
2. Adjoint-based optimization for diffractive beam-splitters.	
<u>D. C. Kim, A. Hermerschmidt, P. Dyachenko, and T. Scharf</u>	105
3. Wavefront folding interferometer used for spatial coherence measurement.	
<u>H. Partanen, A. Halder, M. Koivurova, T. Setälä, J. Turunen, and A. T. Friberg</u>	107
4. Transmission and lasing measurement of Si₃N₄ photonic crystal slab.	
<u>S. Mohamed, T. K. Hakala, J. Wang, and L. Shi</u>	109
5. Effect of resonance gratings on temporal coherence of optical pulses.	
<u>H. Pesonen, P. Li, T. Setälä, and J. Turunen</u>	111
6. Optical design of light shaping element beyond the paraxial approximation.	
<u>L. Yang, I. Badar, C. Hellmann, and F. Wyrowski</u>	113
7. Effective medium beam shaper.	
<u>G. Widholz, T. Flügel-Paul, and U. D. Zeitner</u>	115
 Author index	117