

PROCEEDINGS OF SPIE

Nonimaging Optics: Efficient Design for Illumination and Solar Concentration XII

Roland Winston
Jeffrey M. Gordon
Editors

9–10 August 2015
San Diego, California, United States

Sponsored and Published by
SPIE

Volume 9572

Proceedings of SPIE 0277-786X, V. 9572

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Nonimaging Optics: Efficient Design for Illumination and Solar Concentration XII*, edited by Roland Winston, Jeffrey M. Gordon, Proceedings of SPIE Vol. 9572 (SPIE, Bellingham, WA, 2015) Article CID Number.

ISSN: 0277-786X

ISBN: 9781628417388

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2015, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/15/\$18.00.

Printed in the United States of America

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE. DIGITAL LIBRARY

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print. Papers are published as they are submitted and meet publication criteria. A unique citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages.

Contents

- v *Authors*
- vii *Conference Committee*
- ix *Introduction*

SESSION 1 NOVEL DESIGNS AND CORE CONCEPTS

- 9572 02 **String method of nonimaging optics from a radiation theory perspective** [9572-1]
- 9572 03 **Asymmetric design for Compound Elliptical Concentrators (CEC) and its geometric flux implications** [9572-2]
- 9572 04 **All fiber actively mode-locked fiber laser emitting cylindrical vector beam** [9572-3]
- 9572 05 **Improved and customized secondary optics for photo-voltaic concentrators** [9572-4]

SESSION 2 SOLAR CONCENTRATORS AND SYSTEMS I

- 9572 06 **Dielectric totally internally reflecting concentrator structure for vertical bifacial photovoltaic receivers** [9572-5]

SESSION 3 SOLAR CONCENTRATORS AND SYSTEMS II

- 9572 08 **Hybrid solar collector using nonimaging optics and photovoltaic components (Invited Paper)** [9572-7]
- 9572 0A **Self-tracking concentrator based on switchable transparency and rejected-ray recycling** [9572-9]
- 9572 0B **Design of a solar collector system formed by a Fresnel lens and a CEC coupled to plastic fibers** [9572-10]

SESSION 4 SOLAR CONCENTRATORS AND SYSTEMS III

- 9572 0D **Fundamentally new classes of aplanatic lenses (Invited Paper)** [9572-12]

SESSION 5 ILLUMINATION AND IRRADIATION OPTICS

- 9572 0G **Efficient color mixing through étendue conservation using freeform optics** [9572-15]

- 9572 OH **Illumination system design with multi-step optimization** [9572-16]
- 9572 OI **Light extraction method for mixing rods based in grooves with elliptical shape** [9572-17]

SESSION 6 FREEFORM OPTICS

- 9572 OK **Design of diffractive optical surfaces within the SMS design method (Invited Paper)**
[9572-19]
- 9572 OL **Exact wavefront surface refracted by a smooth arbitrary surface considering a plane wavefront incident** [9572-20]
- 9572 OM **Freeform aplanatic concentrators** [9572-21]
- 9572 ON **Non-uniformly sampled grids in double pole coordinate system for freeform reflector construction** [9572-22]
- 9572 OO **Diffraction effects in freeform optics** [9572-23]

POSTER SESSION

- 9572 OP **Development of daylighting systems with non-imaging concentrator** [9572-24]