

SPIE. DIGITAL LIBRARY

User Guide

The world's largest collection of **optics & photonics** applied research

SPIDigitalLibrary.org

The 21st century will be the century of the photon – much as the 20th century was the century of the electron.

European Technology Platform21,
2nd edition



Astronomy



Biomedical Optics



Communications



Defense & Security



Energy



Imaging



Nanophotonics

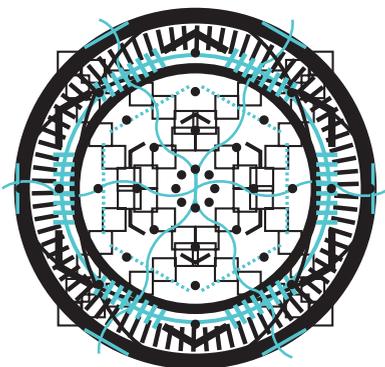


Sensors

SPIE. DIGITAL
LIBRARY

User Guide

The world's largest collection of
optics & photonics applied research



SPIEDigitalLibrary.org

The SPIE Digital Library is the world's largest collection of **optics & photonics** applied research.

With more than **400,000** papers spanning biomedicine, communications, sensors, defense and security, manufacturing, electronics, energy, and imaging, the SPIE Digital Library is the most extensive database available on optics and photonics research.

What's Available:

Proceedings

SPIE is the largest organizer of conferences, workshops, and symposia in the field of optics and photonics with over 300 conferences occurring annually. SPIE Proceedings are the rich outcome of these events, providing you with a snapshot of what's happening—right now.

Over 380,000 articles from 1962 to the present.

Technologies covered:

- Astronomy
- Biomedical Optics & Medical Imaging
- Communication & Information Technologies
- Defense & Security
- Electronic Imaging & Signal Processing
- Energy
- Lasers
- Light Sources & Illumination
- Lithography & Microelectronics
- Metrology
- Nanotechnology
- Optics
- Remote Sensing
- Sensors

Journals

Over 20,000 peer-reviewed journal articles.

Coverage back to Volume 1:

- *Optical Engineering*
- *Journal of Biomedical Optics*
- *Journal of Electronic Imaging*
- *Journal of Micro/Nanolithography, MEMS, and MOEMS*
- *Journal of Applied Remote Sensing*
- *Journal of Nanophotonics*
- *Journal of Photonics for Energy*

eBooks

Approximately 200 SPIE Press eBook Titles;

5,000 eBook Chapters.

(See page 8 for details)

Home Page

- 1. Search** – Perform a basic search using the new SPIE Optics & Photonics taxonomy, coupled with semantic technology.
- 2. Personal Account Sign-in** – See page 4 for more information.
***Institutional subscriber access does not require sign-in.** Access is triggered by IP-based authentication which occurs automatically.
- 3. Top Downloads by Technology** – View the most downloaded articles by technology.
- 4. New Content** – View the newest proceedings, journal articles, and eBooks on the SPIE Digital Library.
- 5. Featured Video** – Selected conference audio/.PPT presentations in addition to integral multimedia for journal and proceedings articles.

The screenshot shows the SPIE Digital Library home page. At the top, there is a navigation bar with the SPIE logo, a search bar (callout 1), and links for Sign in or create a personal account, Subscribe, View Cart, Contact Us, and Help. Below the navigation bar is a large banner image with the text "The world's largest collection of optics & photonics applied research" and "DIGITAL LIBRARY" (callout 2). To the right of the banner is a sign-in form (callout 2) with fields for Username and Password, a Sign In button, and links for "Forgot your password?" and "Sign in via: Shibboleth". Below the banner is a section titled "Top Downloads from SPIE Journals and Proceedings" (callout 3) with a "Last Updated: August 20, 2012" note. This section lists several categories with their respective articles and dates: Astronomy (James Webb Space Telescope), Biomedical Optics & Medical Imaging (Label-free photoacoustic microscopy), Communications & Information Technology (Off-axis catadioptric fisheye wide field-of-view optical receiver), Defense & Security (Advanced imaging research and development at DARPA), Electronic Imaging & Signal Processing (Photometric limits for digital camera systems), Energy (Optical simulations of microcrystalline silicon solar cells), and Lasers (Optical simulations of microcrystalline silicon solar cells). To the right of the top downloads is a "New Content" section (callout 4) with "Papers from Defense, Security, and DSS now published" and a "New eBook: Hyperspectral Remote Sensing by Michael T. Eismann". Below that is a "Featured Video" section (callout 5) with a video player showing a presentation slide and a video player interface. At the bottom right is an "Announcements" section (callout 5) titled "SPIE Digital Library Moves to a New Platform" with details about the move to the Silverchair SCM6 platform and enhancements, including 40,000 additional articles published between 1962 and 1989.

My Account

Creating a personal account allows you to manage your user preferences:

- 1. Profile** – Create and edit your personal profile, manage content information and include a bibliography of references of all papers you've published.
- 2. Email Alerts** – Manage email alerts by publication, search topic, topical collection, and content type.
- 3. Saved Figures and Tables** – View and manage saved figures and tables.



My Account

My Profile

My Email Alerts

My Saved Figures & Tables

My Email Alerts

You are signed up to receive email alerts as described below.

Publication Alerts	Journals You currently have no active journal publication alerts. Add/Edit Journal Publication Alerts
Search Alerts	You currently have no active search alerts. NOTE: To set up such an alert, run a search and use the 'Get Alerts' link on upper right of the search results page.
Topic Collection Alerts	You currently have no active Topic Collection alerts. NOTE: To set up such an alert, go to any Topic Collection page and use the 'Get Alerts' link on upper right of the page.
Content Alerts	You currently have no active content alerts. NOTE: To set up such an alert, go to any content page that offers a 'Get Alerts' link on upper right of the page.

Site Map
HOME
PROCEEDINGS
JOURNALS
eBOOKS
TOPIC COLLECTIONS

Services
Subscribe
Alerts
Information for Librarians
Privacy Policy
Terms Of Use
Contact Us
About the Digital Library

Other Resources
SPIE.org
SPIE Membership
SPIE Career Center

Information for Authors
Books
Journals
Proceedings
Reprint Permissions
About Open Access

SPIE © 1962 - 2012. All Rights Reserved. SILVERCHAIR INFORMATION SYSTEMS

Remote Access for Institutional Subscribers

If your organization has a subscription to the SPIE Digital Library you can automatically download any article you want via IP-based authentication; you may now access the same database when you're away from your institution by **creating a personal account**.

All you need to do is create a free personal account the next time you are using the SPIE Digital Library and then sign in using the box in the upper right hand corner of the homepage. This will 'pair' you and your account with the access provided by your institution, now when you are away from work or school you will have access to the SPIE Digital Library just by signing in.

Search

1. Search by keyword from any page using the basic search box.

2. Use Advanced Search to:

- A. Search for authors
- B. Search text or figures (journals only) by publication.

Search Tips:

Simple Boolean AND or OR searches may be performed.

Example:

microscope AND fluorescence

Use quotes around search entries when searching for exact terms, phrases, article titles, etc.

Example:

"Design of a confocal fluorescence microscope"

3. View results by Best Match or Most Recently Published.

4. Filter search results by:

- A. Content Type
- B. Topic Category
- C. Date Range

5. PDF — Download the full article PDF directly from the results page.

The screenshot shows the SPIE Digital Library homepage. At the top, there is a navigation bar with links for SPIE, Sign in or create a personal account, Subscribe, View Cart, Contact Us, and Help. Below this is the SPIE Digital Library logo and a search bar containing the text "microscope AND fluorescence". A red circle with the number "1" is placed over the search bar. Below the search bar are links for HOME, PROCEEDINGS, JOURNALS, eBooks, TOPIC COLLECTIONS, and LIBRARIANS. The "Advanced Search" section is highlighted with a yellow background and a red circle with the number "2". It contains two search boxes: "Search for Authors and Editors" and "Search Text and Figures by Publication". The "Search Text and Figures by Publication" section has radio buttons for "Text Search" (selected) and "Figure Search". Below these are checkboxes for "Select Resource(s)", including "All Publications", "All Journals", "Optical Engineering", "Journal of Biomedical Optics", "Journal of Electronic Imaging", "Journal of Micro/Nanolithography, MEMS, and MOEMS", "Journal of Applied Remote Sensing", "Journal of Nanophotonics", "Journal of Photonics for Energy", "Proceedings", and "eBooks".

The screenshot shows the search results page for "microscope AND fluorescence". At the top, there is a navigation bar with links for SPIE, SPIE SIGN OUT, Subscribe, View Cart, Contact Us, and Help. Below this is the SPIE Digital Library logo and a search bar containing the text "microscope AND fluorescence". A red circle with the number "3" is placed over the search bar. Below the search bar are links for HOME, PROCEEDINGS, JOURNALS, eBooks, TOPIC COLLECTIONS, and LIBRARIANS. The search results are displayed for "microscope AND fluorescence". A red circle with the number "4" is placed over the "Filter Results" section. The "Filter Results" section has a "Content Type" filter with options for eBooks (22), Journal Articles (67), and Proceedings (1175). It also has a "Topic" filter with options for Luminescence (869), Microscopes (846), Microscopy (426), Lasers (311), Scanning (249), Photons (237), Tissues (214), and Molecules (162). Below the filters is a "Specify Date Range" section with "From" and "To" date pickers and an "Apply" button. The search results are displayed in a list format. A red circle with the number "5" is placed over the first result. The first result is a "Proceedings Article" from October 19, 2012, titled "Design of a confocal fluorescence microscope: space saving and affordable" by Christin Bechtel, Jens Knobbe, Heinrich Grüger, Hubert Lakner, and Fabian Reichert. The second result is a "Proceedings Article" from October 15, 2012, titled "Spatiotemporal focusing-based widefield multiphoton microscopy for fast optical sectioning of thick tissues" by Li-Chung Cheng, Chia-Yuan Chang, Wei-Chung Yen, and Shean-Jen Chen. The third result is a "JBO Letters" from October 22, 2012, titled "Effect of axonal micro-tubules on the morphology of retinal nerve fibers studied by second-harmonic generation" by Hyungsik Lim and John Danias. The fourth result is a "Proceedings Article" from October 15, 2012.

Proceedings Article Pages

1. Proceedings pages –

Quickly jump to browse proceedings by conference, year, volume number, or volume title.

2. Expand Page –

Expand the article column for ease of reading.

3. Author Profile –

An overview of the authors publication record, society activities, biography, etc. Links to SPIE profiles.

4. Related Content –

See related journal and proceedings articles, as well as topic collections and related jobs from the SPIE Career Center.

5. Text Size –

Adjust text size for ease of reading.

6. Tools –

See below.

SPIE Digital Library

HOME PROCEEDINGS JOURNALS eBOOKS TOPIC COLLECTIONS LIBRARIANS

Proceedings Home Browse Proceedings > by Conference By Year by Volume No. by Volume Title

SPIE Proceedings | Volume 8326 | SMO-Modeling >

Next Article >

Proceedings Article

Lens heating challenges for negative tone develop layers with freeform illumination: a comparative study of experimental vs. simulated results

Scott Halle ; Michael Crouse ; Aiqin Jiang ; Youri van Dommelen ; Tim Brunner ; Blandine Minghetti ; Matt Colburn ; Youping Zhang ; Will Conley (+) Author Affiliations

Proc. SPIE 8326, Optical Microlithography XXV, 832607 (March 1, 2012); doi:10.1117/12.916312

From Conference Volume 8326

Optical Microlithography XXV
Michael Crouse ; Aiqin Jiang ; Youri van Dommelen ; Tim Brunner ; Blandine Minghetti ; Matt Colburn ; Youping Zhang ; Will Conley
SPIE Proceedings | February 12, 2012

Abstract References

Abstract

Negative tone development (NTD) processes have been widely explored as a way to enhance the printability of dark field features such as contact holes and trenches. A key consequence of implementing NTD processes and subsequent tone reversal of dark field reticles is the significantly higher transmission of bright field masks and thus higher light intensity in the projection optics. This large increase in mask transmission coupled with the higher throughput requirements of multiple patterning and the use of freeform illumination created by source mask optimization creates a significant amount of lens heating induced aberrations that must be characterized and mitigated. In this paper, we examine the lens heating induced aberrations for high transmission reticles common to NTD using both simulations and experiments on a 193 immersion lithography tool. We observe a substantial amount of aberrations as described by even and odd order Zernike drifts during the course of a wafer exposure lot. These Zernike drifts per lot are demonstrated to have the following lithographic effects: critical dimension shifts, pitch dependent best focus shifts and image placement errors between coarse and fine patterned features. Lastly, mitigation strategies are demonstrated using various controllers and lens manipulators, including FlexWave with full Zernike control up to Z64, to substantially reduce the lens heating effects observed on-wafer.

Some tools below are only available to our subscribers or users with an online account.

PDF Email

Share Get Citation

Get Permissions Article Alerts

Slideset (.ppt)

Related Content

Customize your page view and repositioning the boxes below

Related Journal Articles

Filter By Topic >

Development of a human eye model incorporated with intraocular scattering for visual performance assessment
J. Biomedical Optics (June 29, 2012)

Role of the human lens gradient-index profile in the compensation of third-order ocular aberrations
J. Biomedical Optics (June 29, 2012)

Focusing properties of two-dimensional photonic quasicrystal flat lens at different object distances
Optical Engineering (July 27, 2012)

[+] View More

Related Proceedings Articles

Filter By Topic >

Iterative approach to joint segmentation of cellular structures
Proceedings of SPIE (February 23 2012)

Automatic contour and centerline extractions of single and bifurcated vessels in coronary angiogram
Proceedings of SPIE (February 23 2012)

Integral volumetric imaging with high resolution and smooth motion parallax

6 Tools

Available on Abstract and Article pages, these tools are available to all users with a free personal account.

PDF Email

Share Get Citation

Get Permissions Article Alerts

Slideset (.ppt)

PDF – Download the full-text PDF of the article.

Share – Bookmark and share articles quickly and easily through popular networking sites.

Get Permissions – Information and instructions on how to request reprint permission for an article.

Slideset – Download journal figures and tables in PowerPoint format where available, for Journal articles only.

Email – Email the abstract of the article to yourself, or a colleague.

Get Citation – Select one or more citations for export to your bibliographic software (endnote, Bibtek, etc.).

Article Alerts – Receive automatic email notification when a correction is posted.

Journal Article Pages

1. Journal Pages –

Quickly jump to the Journal homepage, current issue, or all issues.

For journal articles published after 2001, full text is rendered on the article page.

2. Figures and Tables –

Enlarge, save, and download figures and tables to PowerPoint.

Article Figures Tables References

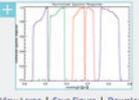
Figures

MSI in various stages of development and integration.



View Large | Save Figure | Download Slide (.ppt) | View in Article Context

MSI normalized spectral response (constellation average).



View Large | Save Figure | Download Slide (.ppt) | View in Article Context

Railroad Valley Playa, Nevada, USA_20 May 2009_RE4_red-edge band image.



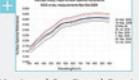
View Large | Save Figure | Download Slide (.ppt) | View in Article Context

Ivanpah Playa, California, USA_07 June 2009_RE3_red-edge band image.



View Large | Save Figure | Download Slide (.ppt) | View in Article Context

Surface spectral reflectance March-October 2009_Railroad Valley Playa.



View Large | Save Figure | Download Slide (.ppt) | View in Article Context

SPIE

SPIE SIGN OUT | Subscribe | View Cart | Contact Us | Help

SPIE Digital Library

HOME | PROCEEDINGS | JOURNALS | eBooks | TOPIC COLLECTIONS | LIBRARIANS

Journal Home | Current Issue | All Issues

Optical Engineering | Volume 51 | Issue 9 | Special Section on Terahertz and Millimeter Wave Imaging >

Special Section On Terahertz And Millimeter Wave Imaging

Image plane coded aperture for terahertz imaging

Orges Furxhi ; Eddie L. Jacobs ; Chrysanthe Preza
[+] Author Affiliations

Opt. Eng. 51(9), 091612 (0). doi:10.1117/1.OE.51.9.091612

Text Size: A A A

Article Figures References

Abstract

Abstract | Introduction | Two-Dimensional Image Plane Coded Aperture | Image Reconstruction | Implementation Of The Image Plane Coded Aperture And Imaging Setups | Results | Conclusions | References

Abstract. In the absence of detector arrays, a single pixel coupled with an image plane coded aperture has been shown to be a practical solution to imaging problems in the terahertz and sub-millimeter wave domains. The authors demonstrate two laboratory, real-time, two-dimensional, sub-millimeter wave imagers that are based on an image plane coded aperture. These active imaging systems consist of a heterodyne source and receiver pair, image forming optics, a coded aperture, data acquisition hardware, and image reconstruction software. In one of the configurations, the target is measured in transmission, while in the other it is measured in reflection. In both configurations, images of the targets are formed on the coded aperture, and linear measurements of the image are acquired as the aperture patterns change. Once a sufficient number of linearly independent measurements are obtained, the image is reconstructed by solving a system of linear equations that is generated from the aperture patterns and the corresponding measurements. The authors show that for image sizes envisioned for many current applications, this image reconstruction technique is computationally efficient and can be implemented in real time. Measurements are collected with these systems, and the reconstruction results are presented and discussed.

Introduction

Abstract | Introduction | Two-Dimensional Image Plane Coded Aperture | Image Reconstruction | Implementation Of The Image Plane Coded Aperture And Imaging Setups | Results | Conclusions | References

The interest in terahertz imaging is motivated by the ability of terahertz (THz) frequencies to penetrate most manmade materials, particularly clothing.¹⁻³ Additionally, many harmful

Some tools below are only available to our subscribers or users with an online account.

PDF | Email | Share | Get Citation | Get Permissions | Article Alerts | Slideset (.ppt)

Related Content

Customize your page view by dragging & repositioning the boxes below.

Related Journal Articles

Filter By Topic >

- Measuring the profile of a convex aspherical surface by solving a bi-objective optimization problem
Optical Engineering (July 27, 2012)
- Classifying scaled and rotated textures using a region-matched algorithm
Optical Engineering (July 27, 2012)
- Eye region-based fusion technique of thermal and dark visual images for human face recognition
Optical Engineering (July 27, 2012)

[+] View More

Related Proceedings Articles

Filter By Topic >

- Elastic registration based on matrix-valued spline functions and direct integration of landmarks and intensities
Proceedings of SPIE (February 23 2012)
- Segmentation of anatomical branching structures based on texture features and conditional random field
Proceedings of SPIE (February 23 2012)
- Pulmonary vessel segmentation

eBooks

eBooks

SPIE eBooks bring approximately 200 valuable SPIE Press titles - monographs and reference works, field guides, and tutorial texts - to researchers' desktops on the same user-friendly SPIE Digital Library platform as SPIE Proceedings and Journals. At least 15 new titles and editions are added to this collection each year.

Not all institutions subscribe to SPIE eBooks. If you are unable to access this SPIE content, you may purchase individual copies of SPIE Press titles through Barnes & Noble, eBooks.com, and Apple iBookstore.

SPIE | [SPE](#) | [Sign in or create a personal account](#) | [Subscribe](#) | [View Cart](#) | [Contact Us](#) | [Help](#)

SPIE Digital Library | [HOME](#) | [PROCEEDINGS](#) | [JOURNALS](#) | **eBOOKS** | [TOPIC COLLECTIONS](#) | [LIBRARIANS](#)

[eBooks Home](#) | [Browse eBooks >](#) | [By Author](#) | [By Title](#) | [By Year](#) | [By Series](#)

SPIE eBooks

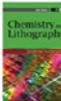
a growing collection of 165 optics and photonics titles:

- **Press Monographs:** authoritative reference works, texts, and handbooks.
- **Tutorial Texts:** works covering fundamental and emerging topics at introductory and intermediate levels.
- **Field Guides:** concise quick-reference guides to key information that students, practicing engineers, and scientists need in the lab and in the field.

New Titles

-  **Field Guide to Terahertz Sources, Detectors, and Optics**
Créidhe M. O'Sullivan, J. Anthony Murphy
-  **Basic Optics for the Astronomical Sciences**
James B. Breckinridge
-  **Hyperspectral Remote Sensing**
Michael T. Eismann

Featured Titles

-  **Chemistry and Lithography**
Uzodinma Okoroanyanwu
-  **Nanotechnology: A Crash Course**
Raúl J. Martín-Palma, Akhlesh Lakhtakia
-  **Field Guide to Binoculars and Scopes**
Paul R. Yoder Jr., Daniel Vukobratovich

Current Access Provided by:  **SPIE**

Author Spotlight



Michael T. Eismann
Air Force Research Lab.
[Author Profile](#)

Recent work: [Hyperspectral Remote Sensing](#)
Published: April 16, 2012

Publish Your Work

Thousands of people from academia, industry, and national labs publish their work with SPIE every year. Get the recognition you deserve. [Learn More.](#)

Accessing the eBooks

Institutions may subscribe to SPIE eBooks. Please contact SPIE or your librarian for information on obtaining full access to SPIE eBooks.

Individuals whose institution has not acquired SPIE eBooks may purchase and download individual chapters from SPIE eBooks here. Visit the [SPIE Bookstore](#) to purchase the complete text.

Site Map HOME PROCEEDINGS JOURNALS eBOOKS TOPIC COLLECTIONS	Services Subscribe Alerts Information for Librarians Privacy Policy Terms Of Use Contact Us About the Digital Library	Other Resources SPIE.org SPIE Membership SPIE Career Center	Information for Authors Books Journals Proceedings Reprint Permissions About Open Access 
---	---	---	---

SPIE | SPIE © 1962 - 2012. All Rights Reserved. | 

Topic Collections

View articles, eBooks and jobs by 14 topic collections with related subcategories based on the SPIE Optics and Photonics taxonomy.

Topic Collections

Astronomy

Biomedical Optics & Medical Imaging

Communication & Information Technologies

Defense & Security

Electronic Imaging & Signal Processing

Energy

Lasers

Light Sources & Illumination

Lithography & Microelectronics

Metrology

Nanotechnology

Optics

Remote Sensing

Sensors

Topic Collections

Topic Collections offer a quick and easy way to track up-to-the-minute content published by SPIE on the topics that interest you.

Astronomy

- Astrobiology
- Astronomical Detectors
- Radio & Infrared Astronomy
- Ultraviolet, X-ray & Gamma-ray Astronomy
- Astronomical Adaptive Optics
- Astronomical Spectroscopy
- Telescopes

Biomedical Optics & Medical Imaging

- Biomedical Spectroscopy & Microscopy
- Computer-aided Diagnosis & Therapy
- Medical Image Processing
- Nanobiophotonics
- Photodynamic Therapy
- Tissue Optics
- Ultrasound
- Biosensors & Microfluidics
- Endoscopy
- Molecular Imaging
- Ophthalmic Optics
- Radiology
- Tomography

Communication & Information Technologies

- Data Processing
- Information Security
- Mobile & Wireless Communications
- Optical Communications
- Visual Communications & Multimedia
- Fiber Communications
- Integrated Optics & Photonics
- Networks
- Satellite Communications

Defense & Security

- Acquisition, Tracking & Pointing
- Biological & Chemical Sensing in Defense
- Computer & Network Security
- Military Displays
- Smart & Unattended Sensors
- Unmanned Systems & Vehicles
- Atmospheric Propagation Engineering
- Biometrics
- Infrared Defense Technology
- Radar/Lidar
- THz & mm-wave Imaging

Electronic Imaging & Signal Processing

- Information Security
- Color Imaging
- Displays
- Image Processing
- Signal Processing
- 3D Imaging
- Computer Vision
- Image Analysis
- Image Sensors

Energy

- Energy Efficiency
- Hydrogen Energy
- Solar Energy
- Energy Harvesting
- Laser Energy
- LEDs & OLEDs

Lasers

- Fiber Lasers
- High Power Lasers
- Laser Systems Engineering
- Quantum & Interband Cascade Lasers
- Solid State Lasers
- Gas Lasers
- Laser Materials Processing
- Laser Induced Damage
- Semiconductor Lasers
- Ultrafast Lasers

Light Sources & Illumination

- Displays
- Liquid Crystals
- LEDs & OLEDs
- Colorimetry

Lithography & Microelectronics

- Integrated Optics & Photonics
- Maskless Lithography
- Non-optical Lithography
- Interconnects & Packaging
- MEMS/MOEMS
- Optical Lithography

+ more categories not shown here

SPIE Digital Library

SPIDigitalLibrary.org

SPIE was founded in 1955 to advance light-based technologies. Serving more than 225,000 constituents from 150 countries, the Society advances emerging technologies through interdisciplinary information exchange, continuing education, publications, patent precedent, and career and professional growth. SPIE annually organizes and sponsors approximately 25 major technical forums, exhibitions, and education programs in North America, Europe, Asia, and the South Pacific. In 2013, the Society provided more than \$8.2 million in support of education and outreach programs around the world.

Customer and Technical Support

Click HELP in the top navigation bar of SPIDigitalLibrary.org to access Frequently Asked Questions.

Contact Digital Library support

Email: SPIEDLsupport@spie.org

Telephone: 1 888 902 0894 (North America)
+1 360 685 5580 (Rest of World)

Hours: 8 am to 5 pm Pacific Time (Monday to Friday)

SPIE Headquarters

1000 20th Street • Bellingham WA 98225-0100 USA
Tel: +1 360 676 3290 • Fax: +1 360 647 1445
SPIE.org
