

PROGRESS IN BIOMEDICAL OPTICS AND IMAGING

Vol. 18 No. 37

Adaptive Optics and Wavefront Control for Biological Systems III

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28–30 January 2017
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 10073

Proceedings of SPIE, 1605-7422, V. 10073

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

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Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Adaptive Optics and Wavefront Control for Biological Systems III*, edited by Thomas G. Bifano, Joel Kubby, Sylvain Gigan, Proceedings of SPIE Vol. 10073 (SPIE, Bellingham, WA, 2017) Seven-digit Article CID Number.

ISSN: 1605-7422

ISSN: 2410-9045 (electronic)

ISBN: 9781510605879

ISBN: 9781510605886 (electronic)

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

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Printed in the United States of America

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

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In an adaptive optics system, wavefront distortions are measured by a wavefront sensor, and then using an active optical element such as a deformable mirror the instantaneous wavefront distortions are corrected. On the other hand, three physical effects are observed when a light beam propagates through a turbulent atmosphere: optical scintillation, beam wandering, and fluctuations in the angle-of-arrival (AA). In wavefront sensing applications the AA fluctuations measurement is a basic step. Various wavefront sensing techniques have been developed for use in a variety of applications ranging from measuring the wave aberrations of human eyes (Lombardo & Lombardo, 2009) to adaptive optics in astronomy (Roddier, 1999). Adaptive Optical Elements and Systems. Adaptive optics corrects a wavefront by using an optical element that changes shape when an outside control signal is applied. A deformable mirror is an adaptive element with a controllable reflective surface shape. By introducing the correct mirror shape, a distorted input wavefront can be improved as illustrated in Figure 2. Figure 2: Deformable Mirror Correcting a Distorted Wavefront. The mirror shape can be derived from a set of pre-calculated or stored shapes, i.e., open loop control, or can be calculated based on feedback from a wavefront sensor and

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