THOMAS BIFANO
Director, Boston University Photonics Center
Professor Mechanical Engineering Department
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Education

Duke University Mechanical Engineering & Materials Science, BS, 1980
Duke University Mechanical Engineering & Materials Science, MS, 1983
North Carolina State University, Mechanical Engineering, Ph.D.1988
Dissertation: "Ductile Regime Grinding of Brittle Materials," Thomas A. Dow, advisor

Appointments

Director, Boston University Photonics Center, 2006-present
Professor and Chair, Manufacturing Engineering Dept., Boston University, 1999-2006
Professor, Mechanical Engineering Dept., Boston University, 1999-present
Chief Technical Officer, Boston Micromachines Corp., Cambridge, MA, 1999-present
President, Prism Corporation, Boston, MA, 1995-2000
Associate Professor, Aerospace/Mechanical Eng., Boston University, 1994-1999
Assistant Professor, Aerospace/Mechanical Eng., Boston University; 1988-1994

Research

Microelectromechanical Systems (MEMS); Optomechanical devices; Deformable mirrors; Manufacturing of optical components; Adaptive optics

Patents, Awards, Honors

2022 U.S. Patent (#11,226,474) Reverberation microscopy systems and methods
2020 U.S. Patent (#10,678,037) Reverberation microscopy systems and methods
2019 U.S. Patent (#10,175,476) Solid immersion microscopy system with DM
2018 U.S. Patent (#10,018,817) AO for imaging through highly scattering media
2013 BU College of Engineering Distinguished Scholar Award
2011 U.S. Patent (#7,929,195) MEMS Based Retroreflector
2010 R&D 100 Award: (MEMS)-based Adaptive-Optics Optical Coherence Tomography
2009 Bepi Colombo Prize, for achievements in research, innovation, and tech. transfer
2007 R&D 100 Award: Adaptive Optics Scanning Laser Ophthalmoscope (MAOSLO)
2005 U.S. Patent (#6,929,721) Ion modification of residual stress gradients in thin films
2004 U.S. Patent (#6,705,345) Micro valve arrays for fluid flow control
2003 R&D 100 Award: MEMS-based adaptive optics phoropter (MAOP)
2003 U.S. Patent (#6,529,311) MEMS-based spatial-light modulator
1998 U.S. Patent (#5,783,371) Process for manufacturing optical data storage disk
1997 U.S. Patent (#5,503,963) A new method for manufacturing optical disc stampers

Professional Service

Conference Chair, SPIE BIOS AO and Wavefront Control for Biosystems, 2015-present
Member, Army Science Board, 2011-2014
Board of Advisors, Schott AG, 2009-2012
Board of Directors, Amer. Soc. Precision Eng., 1994-1996
Chairman 1994, 1995 Annual and Topical ASPE Conferences
Associate Editor, Journal of Micro/Nanolithography, MEMS, and MOEMS 2006-
Associate Editor, Int'l J. Mfg. Science and Production 2002-2004

Associate Editor, SME J. Manufacturing Processes 2000-2004
SPIE Technical program Chair, MEMS Adaptive Optics I-IX, 2004-2013

University Service

Director, Boston University Photonics Center, 2006-present
Member, University Strategic Planning Task Force, 2019-2021
Member, University Center Directors Committee, 2015-present
Member, Research and Scholarly Activities Committee, 2015-present
Chair, University Research Council, 2008-2011
Chair, Dean Search Committee, College of Engineering, 2005-2006
Chair, Provost's Faculty Advisory Committee on Photonics, 2005-2006
Chair, Faculty Council, Appt., Tenure, and Promotion Policy Comm., 2003-2004
Director, Precision Engineering Research Laboratory (BU-PERL), 1990-present
Presidential University Graduate Fellowship Committee 1994-1999
Director, Aerospace/Mechanical Eng. graduate programs, 1988-1991
Faculty advisor to engineering residence hall (Claflin 11), 1990-1995
Faculty advisor to "In Achord," BU a cappella singing group, 1993-1998

Activity Highlights

Director, **Boston University Photonics Center.** Dr. Bifano directs this core facility and academic center of excellence comprised of fifty faculty members and fifteen staff members from eight academic departments. He leads Center programs for education, scholarly research, and technology development. He manages a state-of-the-art facility that includes more than a dozen special-purpose and shared research laboratories and a large business innovation center.

Co-founder and Chief Technical Officer, **Boston Micromachines Corporation,** a university spin-off company that was formed to commercialize micromachined deformable mirror technology initially developed in the Bifano laboratory.

Journal Publications

Haber, A. & Bifano, T. Dual-update data-driven control of deformable mirrors using Walsh basis functions. Journal of the Optical Society of America A **39**, 459-469, (2022).

Rodríguez, C., Chen, A., Rivera, J. A., Mohr, M. A., Liang, Y., Natan, R. G., Sun, W., Milkie, D. E., Bifano, T. G., Chen, X. & Ji, N. "An adaptive optics module for deep tissue multiphoton imaging in vivo," Nature Methods, [18], 1259-1264, (2021).

Haber, A., and Bifano, T. G., "General approach to precise deformable mirror control," Optics Express, [29](21): 33741-33759, (2021).

Wu, K., Zhao, X., Bifano, T. G., Anderson, S. W. & Zhang, X. "Auxetics-Inspired Tunable Metamaterials for Magnetic Resonance Imaging," Advanced Materials, 2109032, (2021).

Chen, C., Y. Huang, K. Wu, T. G. Bifano, S. W. Anderson, X. Zhao and X. Zhang, "Polarization insensitive, metamaterial absorber-enhanced long-wave infrared detector." Optics Express 28(20): 28843-28857, (2020).

Zhao, X., K. Wu, C. Chen, T. G. Bifano, S. W. Anderson and X. Zhang , "Nonreciprocal Magnetic Coupling Using Nonlinear Meta-Atoms." Advanced Science **7**(19): 2001443, (2020).

Lin, P., H. Ni, H. Li, N. A. Vickers, Y. Tan, R. Gong, T. Bifano and J.-X. Cheng, "Volumetric chemical imaging in vivo by a remote-focusing stimulated Raman scattering microscope." *Optics Express* **28**(20): 30210-30221, (2020).

Beaulieu, D. R., Davison, I. G., Kılıç, K., Bifano, T. G. & Mertz, J., Simultaneous multiplane imaging with reverberation two-photon microscopy. *Nat Methods*, (2020).

Pollock, C., Barrett, L. K., del Corro, P. G., Stange, A., Bifano, T. G. & Bishop, D. J., PWM as a Low Cost Method for the Analog Control of MEMS Devices. *J Microelectromech S* **28**, 245-253, (2019).

Shain, W. J., Vickers, N. A., Li, J., Han, X., Bifano, T. & Mertz, J., Axial localization with modulated-illumination extended-depth-of-field microscopy. *Biomed Opt Express* **9**, 1771-1782, (2018).

Ba, C., Shain, W. J., Bifano, T. G. & Mertz, J., High-throughput label-free flow cytometry based on matched-filter compressive imaging. *Biomed Opt Express* **9**, 6145-6153, (2018).

Shain, W. J., Vickers, N. A., Negash, A., Bifano, T., Sentenac, A. & Mertz, J., Dual fluorescence-absorption deconvolution applied to extended-depth-of-field microscopy. *Optics Letters* **42**, 4183-4186, (2017).

Shain, W. J., Vickers, N. A., Goldberg, B. B., Bifano, T. & Mertz, J., Extended depth-of-field microscopy with a high-speed deformable mirror. *Optics Letters* **42**, 995-998, (2017).

Li, J., Bifano, T. G. & Mertz, J., Widefield fluorescence microscopy with sensor-based conjugate adaptive optics using oblique back illumination. *Journal of Biomedical Optics* **21**, 121504-121504, (2016).

Imboden, M., Chang, J., Pollock, C., Lowell, E., Akbulut, M., Morrison, J., Stark, T., Bifano, T. G. & Bishop, D. J., High-Speed Control of Electromechanical Transduction: Advanced Drive Techniques for Optimized Step-and-Settle Response of MEMS Micromirrors. *IEEE Control Systems* **36**, 48-76, (2016).

Sinefeld, D., Paudel, H. P., Ouzounov, D. G., Bifano, T. G. & Xu, C., Adaptive optics in multiphoton microscopy: comparison of two, three and four photon fluorescence. *Opt Express* **23**, 31472-31483, (2015).

Paudel, H. P., Taranto, J., Mertz, J. & Bifano, T., Axial range of conjugate adaptive optics in two-photon microscopy (vol 23, pg 20849, 2015). *Opt Express* **23**, 27635-27635, (2015).

Mertz, J., Paudel, H. & Bifano, T. G., Field of view advantage of conjugate adaptive optics in microscopy applications. *Appl Optics* **54**, 3498-3506, (2015).

Li, J., Beaulieu, D. R., Paudel, H., Barankov, R., Bifano, T. G. & Mertz, J., Conjugate adaptive optics in widefield microscopy with an extended-source wavefront sensor. *Optica* **2**, 682-688, (2015).

Vigil, K., Lu, Y., Yurt, A., Cilingiroglu, T. B., Bifano, T. G., Ünlü, M. S. & Goldberg, B. B., Integrated Circuit Super-Resolution Failure Analysis with Solid Immersion Lenses. *Electronic Device Failure Analysis* **16**, 26-32, (2014).

Lu Y, Bifano T, Unlu S, Goldberg B, "Aberration compensation in aplanatic solid immersion lens microscopy," *Optics Express*, [21], 28189-28197, (2013).

Paudel HP, Stockbridge C, Mertz J, Bifano T, "Focusing polychromatic light through strongly scattering media," *Opt. Express*, [21], 17299-17308, (2013).

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Tripathi S, Paxman R, Bifano T, Toussaint KC, "Vector transmission matrix for the polarization behavior of light propagation in highly scattering media," Opt. Express, [20], 16067-16076, 2012.

Lu Y, Stockbridge CR, Hoffman SM, Bifano TG, "Variable zoom system with aberration correction capability," Journal of Modern Optics, 1-7, 2012

Goldberg BB, Yurt A, Lu Y, Ramsay E, Koklu FH, Mertz J, Bifano TG, Ünlü MS, "Chromatic and spherical aberration correction for silicon aplanatic solid immersion lens for fault isolation and photon emission microscopy of integrated circuits," **Microelectronic Reliability**, [51], 1637-1639, 2011

Bifano T, "Adaptive imaging: MEMS deformable mirrors," **Nature Photonics**, [5], 21-23, 2011

Diouf A, Stewart JB, Cornelissen SA, Bifano TG, "Development of Through-Wafer Interconnects for MEMS Deformable Mirrors," **International Journal of Optomechatronics**, [4], 237 - 245, 2010

Vogel C, Tyler G, Lu Y, Bifano T, Conan R, Blain C, "Modeling and parameter estimation for point-actuated continuous-facesheet deformable mirrors," **J. Opt. Soc. Am. A,** [27], A56-A63, 2010

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Diouf, A. Reimann, G. and Bifano, T., "Fabrication of implantable microshunt using a novel channel sealing technique," **J. Micro/Nanolith. MEMS MOEMS [7],** pp. 030501-1:3, 2008

Stewart, J. B., Diouf, A., Zhou, Y. and Bifano, T. G. , "Open-loop control of a MEMS deformable mirror for large-amplitude wavefront control," **J. Opt. Soc. Am. A** [24], pp. 3827-3833, 2007

Stewart J.B., Bifano T.G., Cornelissen S., Bierden P., Levine B. M., Cook T., "Design and development of a 331-segment tip-tilt-piston mirror array for space-based adaptive optics," **Sensors and Actuators A- Physical** [138] pp. 230-238, 2007

Biss, D. P., Sumorok, D., Burns, S. A., Webb, R. H., Zhou, Y., Bifano, T. G.,Côté, D., Veilleux, I., Zamiri, P., and Lin, C. P., "In vivo fluorescent imaging of the mouse retina using adaptive optics," **Opt. Lett**. [32], pp. 659-661, 2007

Chen, F., Cohen, H.I., Bifano, T.G., Castle, J., Fortin, J., Kapusta, C., Mountain, D.C., Zosuls, A., Hubbard, A.E., "A hydromechanical biomimetic cochlea: Experiments and models," **J. Acoust. Soc. Am. [119**], pp.394-405, 2006

Miller, M. H, Perrault, J. A., Parker, G. G., Bettig B. P., and Bifano T. G., "Simple models for piston-type micromirror behavior," **J. Micromech. Microeng. [16]** pp. 303–313, 2006

Santiago, LP, Bifano, T. G**.,** "Management of R&D projects under uncertainty: multidimensional approach to managerial flexibility," **IEEE Trans Eng Mgmt** 52(2):269-80, 2004

Collier, J., Wroblewski, D., and Bifano, T., "Development of a rapid-response flow-control system using MEMS microvalve arrays," **J. Microelectromechanical Systems, [13]**(6), pp. 912-922, 2004

Webb, R., Albanese, M., Zhou, Y., Bifano, T., and Burns, S., "A stroke amplifier for deformable mirrors," **Applied Optics, [43]**12, pp. 5330-5333, 2004

Lee, H., Miller, M. H., and Bifano, T. G., "CMOS chip planarization by chemical mechanical polishing for a vertically stacked metal MEMS integration." **J. Micromech. Microeng., [14]** 1, pp. 108-115, 2004

Bifano, T. G., Johnson,, H. T, Bierden, P. and Mali, R. K., "Elimination of Stress-Induced Curvature in Thin-Film Structures" **J. Microelectromechanical Systems, [11]**, pp 592-597, 2002

Perreault, J. A., Bifano, T. G., Levine, B.M., and Horentein, M., "Adaptive optic correction using microelectromechanical deformable mirrors," **Optical Engineering [41]**3, pp. 561-566, 2002

Horenstein, M., Pappas, S., Fishov, A.*, and Bifano, T.G., "Electrostatic Micromirrors for Subaperturing in an Adaptive Optics System," **Journal of Electrostatics,** Vol. 54, pp. 321-332, 2002

Weyrauch T., Vorontsov M. A., Bifano T. G., Hammer J. A., Cohen M., and Cauwenberghs G., "Microscale adaptive optics: wavefront control with a μ-mirror array and a VLSI stochastic gradient descent controller," **Applied Optics, [40]** 24 pp. 4243-4253, 2001

Shanbhag, P. M., Feinberg, M.R., Sandri, G., Horenstein, M. N., and Bifano, T.G., "Ion-Beam Machining of Millimeter Scale Optics," **Applied Optics, [39]** 4 pp. 599 - 611, 2000

Horenstein. M. N., Perreault, J. and Bifano, T. G., "Differential Capacitive Position Sensor for Planar MEMS Structures with Vertical Motion." **Sensors and Actuators (80)**, pp 53-61, 2000

Mali, R. K., Bifano, T. and Koester, D. A., "Design-based approach to planarization in multilayer surface micromachining," **J. Micromech. Microeng**. **[9]** pp. 294–299, 1999

Horenstein, M., Bifano, T.G., Pappas, S., Perreault J., and Krishnamoorthy-Mali, R., "Real Time Optical Correction Using Electrostatically Actuated MEMS Devices." **Journal of Electrostatics,** Vol. 46, pp. 91-101, 1999

Bifano, T. G., Perreault, J., Mali, R. K., and Horenstein, M. N., "Microelectromechanical Deformable Mirrors," **Journal of Selected Topics in Quantum Electronics, [5]**, pp. 83-90, 1999

Bifano, T. G., Krishnamoorthy, R., Caggiano, H., and Welch, E., "Fixed-Load Electrolytic Dressing with Bronze-Bonded Grinding Wheels," **ASME J. Manufacturing, [121]**, pp. 20-27, 1999

Vandelli, N, Wroblewski, D. E., Velonis, M., and Bifano, T. G., "Development of a MEMS Microvalve Array for Fluid Flow Control," **J. Micrelectromechanical Systems, [7]**, pp. 395-403, 1998

Bifano, T. G., Mali, R., Perreault, J., Dorton, K., Vandelli, N, Horentein, M., and Castanon, D., "Continuous membrane, surface micromachined silicon deformable mirror," **Optical Engineering [36]**5, pp. 1354-1360, 1997

Bifano, T. G., Caggiano, H., and Bierden, P., "Precision Manufacture of Optical Disc Master Stampers," **J. Precision Eng'g [20]**1, pp. 53-62, 1997

Bifano, T. G., and Bierden, P., "Fixed Abrasive Grinding of Brittle Hard Disk Substrates," **Intl. J. of Machine Tools[37]**7, pp. 935-946, 1997

Horenstein, M.N., Bifano, T.G., Mali, R. K., Vandelli, N., "Electrostatic Effects in Micromachined Actuators for Adaptive Optics," **Journal of Electrostatics [42]** , pp. 69-82, 1997

Krishnamoorthy, R., Bifano, T. G., Vandelli, N., and Horenstein, M., "Development of MEMS deformable mirrors for phase modulation of light," **Optical Engineering [36]**2, pp. 542-548, 1997

Scagnetti, P. A., Bifano, T. G., Nagem, R. J., and Sandri, G. vH., "Simulation of Micro-Indentation Using Molecular Dynamics Modeling," **ASME J. of Applied Mechanics**, **[63]**, pp. 450-453, 1996

Drueding, T., Bifano, T. G., and Fawcett, S. C., "Contouring Algorithm for Ion Figuring," **J. Precision Eng'g**, **[17]**1, pp. 10-21, 1995

Drueding, T. W., Wilson, S., Fawcett, S. C., and Bifano, T. G., "Contouring Algorithm for Ion Figuring," **Optical Engineering**, **[34]**12, pp. 3565-3571, 1995

Bifano, T. G. Kahl, W. K., and Yi, Y., "Fixed-Abrasive Grinding CVD Silicon Carbide Mirrors," **J. Precision Eng'g**, **[16]**2, pp. 109-116, 1994

Fawcett, S. C., Bifano, T. G., and Drueding, T., "Neutral Ion Figuring of Chemically vapor Deposited Silicon Carbide," **Optical Engineering**, **[33]**3, pp. 967-974, 1994

Bifano, T. G., Golini, D., and DePiero, D., "Chemomechanical Effects in Ductile-Regime Machining of Glass," **J. Precision Eng'g**, **[15]**4, pp. 238-247, 1993

Bifano, T. G., and Hosler, J., "Precision Grinding of Ultra-Thin Quartz Wafers," **ASME J. Eng'g for Industry [115]**3, pp. 258-262, 1993

Bifano, T. G., and Yi, Y. "Acoustic Emission as an Indicator of Material-Removal Regime in Glass Microgrinding," **J. Precision Eng'g [14]**4, pp. 219-228, 1992

Scattergood, R. O., Srinivasan, S., Bifano, T. G., and Dow, T. A., "R-Curve Effects for Machining and Wear of Ceramics," **Ceram. Acta [3]**4-5, pp. 53-64, 1991

Bifano, T. G., and Fawcett, S. C., "Specific Grinding Energy as an In-Process Control Variable for Ductile-Regime Grinding," **J. Precision Eng'g [13]**4, pp. 256-262, 1991

Bifano, T. G., Dow, T. A., and Scattergood, R. O., "Ductile-Regime Grinding: A New Technology for Machining Brittle Materials," **ASME J. Eng'g for Industry [113]**2, pp. 184-189, 1991

Blake, P., Bifano, T. G., Dow, T. A., and Scattergood, R. O., "Precision Machining of Ceramic Materials," **Amer. Ceramic Soc. Bulletin [67]**6, pp. 1038-1044, 1988

Bifano, T. G., and Dow, T. A., "Real Time Control of Spindle Runout," **Optical Engineering [24]**5, pp. 888-892, 1985

Conference Publications

P. Lin, H. Ni, H. Li, Y. Tan, N. Vickers, T. Bifano, and J.-X. Cheng, Volumetric chemical imaging in vivo by a deformable mirror-based remote-focusing stimulated Raman scattering microscope (SPIE BiOS). SPIE 11656, (2021).

Lin, P., Ni, H., Li, H., Deng, F., Vickers, N. A., Tang, Y., Bifano, T. G. & Cheng, J.-X. Volumetric stimulated Raman imaging with a high-speed deformable mirror *SPIE* 10890 (2019).

Chen, I. A., Sun, W., Liang, Y., Milkie, D., Bifano, T. & Ji, N. An add-on adaptive optical module for laser scanning microscopy SPIE 10502 (2018).

Sinefeld, D., Paudel, H. P., Wang, T., Wang, M., Ouzounov, D. G., Bifano, T. G. & Xu, C. Nonlinear adaptive optics: aberration correction in three photon fluorescence microscopy for mouse brain imaging, in *SPIE BiOS.* 7, SPIE, **10073** (2017).

Shain, W., Goldberg, B., Bifano, T. & Mertz, J. Matched-Filter Compressive Imaging using a Deformable Mirror for Label-Free Flow Cytometry, in *Imaging and Applied Optics 2017 (3D, AIO, COSI, IS, MATH, pcAOP).* ITu4E.1, Optical Society of America, (San Francisco, California, (2017).

Bifano, T. G., Kubby, J. & Gigan, S. Adaptive Optics and Wavefront Control for Biological Systems III, in *Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series.* **0073**, February 1, 2017).

Sinefeld, D., Wang, T. Y., Wang, M. R., Paudel, H. P., Bifano, T. G. & Xu, C., Three-Photon Fluorescence Adaptive Optics for In-Vivo Mouse Brain Imaging. *Conf Laser Electr*, (2016).

Mertz, J., Li, J., Beaulieu, D., Paudel, H. P., Barankov, R. & Bifano, T. G. Adaptive optics without guide stars (Conference Presentation), 97170F-97170F-97171, **9717** (2016).

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Shain, W., Paudel, H., Eichmann, S. L., Kanj, M., Bifano, T. & Goldberg, B. Adaptive multi-photon imaging of subsurface nanoparticle flow in porous rock, in *Adaptive Optics: Analysis, Methods & Systems.* AOM4B. 5, Optical Society of America, Arlington, VA, (2015).

Shain, W., Paudel, H., Bifano, T. G. & Goldberg, B. 3-D Fluorescent Imaging of Fluid Flow in Rock, in *Bulletin of the American Physical Society.* **60**, Boston, MA, (2015).

Mertz, J. C., Li, J., Paudel, H. & Bifano, T. G. Field of view advantage of conjugate compared to pupil adaptive optics, in *Novel Techniques in Microscopy.* NW3C. 3, Optical Society of America, (Vancouver, Canada), (2015).

Mertz, J. C., Li, J., Beaulieu, D. R., Paudel, H., Barankov, R. & Bifano, T. Wide-field adaptive optics without guide stars, in *Laser Science: Computational Optical Imaging I.* LM2H. 4, Optical Society of America, (San Jose, CA), (2015).

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Bifano, T. G., Kubby, J. & Gigan, S., Proceedings of SPIE MEMS Adaptive Optics VIII Introduction. *Mems Adaptive Optics Viii* **8978**, (2014).

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Bifano T, Stockbridge C, Lu Y, Moore J, Hoffman S, Tousssaint K, Paxman R, "Focusing through dynamic disordered media using a MEMS spatial light modulator," *Computational Optical Sensing and Imaging, Optical Society of America*, CTu4B.5, (2012).

Bifano T, Lu Y, Stockbridge C, Berliner A, Moore J, Paxman R, Tripathi S, Toussaint K, "MEMS spatial light modulators for controlled optical transmission through nearly opaque materials," San Francisco, California, USA, SPIE, [8253], 82530L-82539, (2012).

Cornelissen SA, Bifano TG, Bierden PA, "MEMS deformable mirror actuators with enhanced reliability," San Francisco, California, USA, SPIE, [8253], 825306-825307, (2012).

Sun W, Lu Y, Stewart JB, Bifano TG, Lin CP, "Critical considerations of pupil alignment to achieve open-loop control of MEMS deformable mirror in nonlinear laser scanning fluorescence microscopy," San Francisco, California, USA, SPIE, [8253], 82530H-82537, (2012).

Lu Y, Ramsay E, Stockbridge CR, Yurt A, Koklu FH, Bifano TG, Unlu MS, Goldberg BB, "Spherical aberration correction in aplanatic solid immersion lens imaging using a MEMS deformable mirror," 23rd European Symposium on the Reliability of Electron Devices, Failure Physics and Analysis (ESREF) Cagliari, ITALY Date: OCT 01-05, (2012).

Mendillo CB, Hicks BA, Cook TA, Bifano TG, Content DA, Lane BF, Levine BM, Rabin D, Rao SR, Samuele R, Schmidtlin E, Shao M, Wallace JK, Chakrabarti S, "PICTURE: a sounding rocket experiment for direct imaging of an extrasolar planetary environment," Space Telescopes and Instrumentation 2012: Optical,

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Zhou Y, Bifano T, Lin C, "Adaptive optics two-photon scanning laser fluorescence microscopy," MEMS Adaptive Optics V, San Francisco, CA, SPIE, [7931], H1-8, (2011).
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Bifano T, "Shaping light: MOEMS deformable mirrors for microscopes and telescopes," MEMS Adaptive Optics IV, San Francisco, California, USA, SPIE, [7595], 759502-759508, (2010).
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Diouf A, Bifano TG, Stewart JB, Cornelissen S, Bierden P, "Through-wafer interconnects for high degree of freedom MEMS deformable mirrors," MEMS Adaptive Optics IV, San Francisco, California, USA, SPIE, [7595], 75950N-75912, (2010).
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