SUBMIT TO: AM122

CONFERENCE: ASTRONOMICAL ADAPTIVE OPTICS SYSTEMS and APPLICATIONS
(Tyson/Lloyd-Hart, Chairs)

TITLE: "Phase Contrast Techniques for Wavefront Sensing and Calibration In Adaptive Optics"

AUTHOR: E. E. Bloemhof and J. K. Wallace
Jet Propulsion Laboratory, California Institute of Technology
4800 Oak Grove Drive, MS 171-113
Pasadena, CA 91109 USA
Ph.: (818) 393-6678; FAX: (818) 393-4357
eeb@huey.jpl.nasa.gov

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Abstract

The wavefront sensor is the most critical component of an adaptive optics system. Most systems use one of a small number of alternatives, notably the Shack-Hartmann or the curvature sensor. These are sensitive to the first and second derivative of the wavefront phase, respectively. In this paper, we explore a novel adaptation of the phase-contrast technique developed for microscopy by Zernike to measure phase directly, and show that it is potentially useful in astronomical adaptive optics, both for closed-loop wavefront sensing and for the off-line calibration of the system PSF. The phase-contrast WFS should enjoy an advantage in lower read noise, as well as a natural match to the piston-type deformable mirror actuators commonly in use with most current Shack-Hartmann systems. It appears possible to implement versions with the relatively broad spectral bandwidth necessary for astronomical applications, and to adapt them with minimal modification to existing AO system architectures.

KEYWORDS: adaptive optics, wavefront sensing, phase contrast

Biography:

Eric Bloemhof received a Ph.D. in Physics from UC Berkeley in 1984, in infrared instrumentation and astrophysics. From 1984 to 1994 he worked at the Harvard-Smithsonian Center for Astrophysics on VLBI and astronomical instrumentation, including fabrication of superconducting tunnel junctions and SIS receivers. At Caltech, he participated in the development of adaptive optics for the 5 meter telescope at Palomar Observatory, and he has been at JPL since 2001, working on a ground-based testbed for the Space Interferometry Mission.