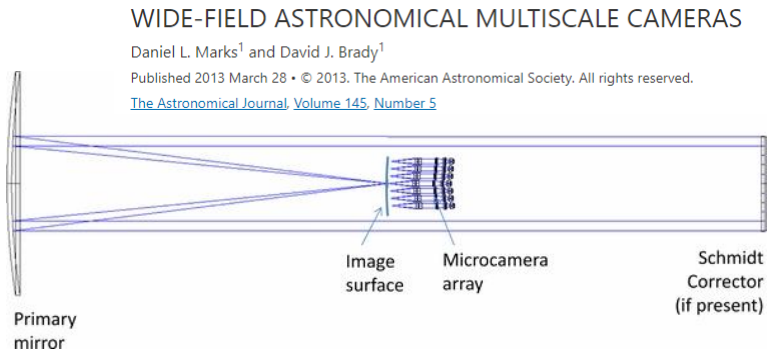
Full Sky Petapixel Optical Imaging

David Brady
djbrady@Arizona.edu

Multiscale Optics for Wide Field Sub-microradian ifov

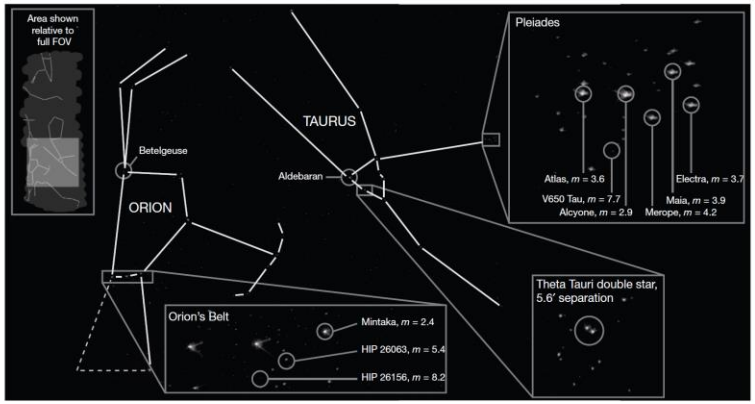
Through the DARPA AWARE program we developed multiscale optics for compact >10 gigapixel cameras

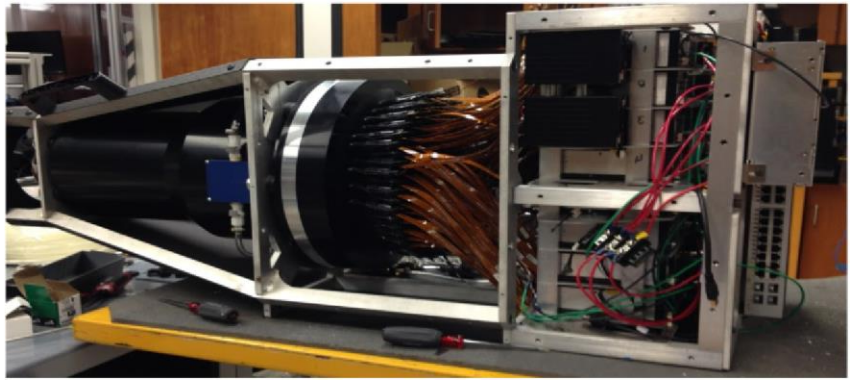


LETTER
doi:10.1038/nature11150

Multiscale gigapixel photography

D. J. Brady[1], M. E. Gehm[2], R. A. Stack[3], D. L. Marks[1], D. S. Kittle[1], D. R. Golish[2], E. M. Vera[2] & S. D. Feller[1]





AWARE 40 camera

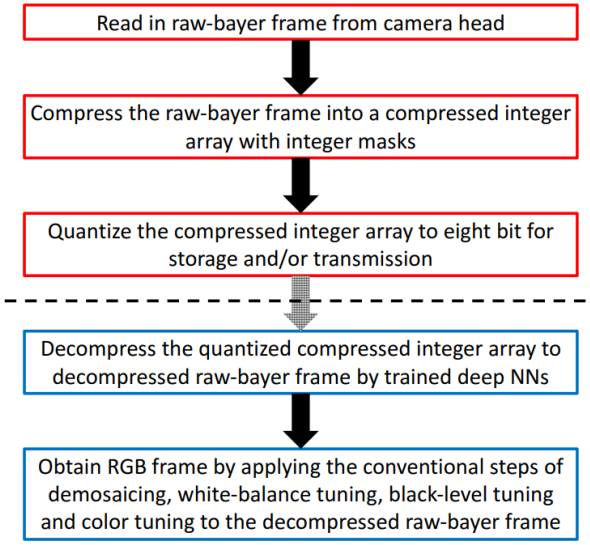
Compressive Sampling for Array Camera Power Management

SIAM J. IMAGING SCIENCES
Vol. 14, No. 1, pp. 156–177

Compressive Sampling for Array Cameras*

Xuefei Yan†, David J. Brady‡, Weiping Zhang†, Changzhi Yu†, Yulin Jiang†, Jianqiang Wang§, Chao Huang§, Zian Li†, and Zhan Ma§

Physical and electronic compressive sampling enables >100x power per resolved pixel reduction, making full sky imaging at nanoradian scale ifov feasible.



Scatter Ptychography

SCATTER PTYCHOGRAPHY

A PREPRINT

Qian Huang*
Wyant College of Optical Sciences
University of Arizona
Tucson, AZ 85721
qh38@email.arizona.edu

Zhipeng Dong
Wyant College of Optical Sciences
University of Arizona
Tucson, AZ 85721
zhipengdong@email.arizona.edu

Yuzuru Takashima
Wyant College of Optical Sciences
University of Arizona
Tucson, AZ 85721
ytakashima@optics.arizona.edu

Timothy J. Schulz
Department of Electrical and Computer Engineering
Michigan Technological University
Houghton, MI 49931
schulz@mtu.edu

David J. Brady
Wyant College of Optical Sciences
University of Arizona
Tucson, AZ 85721
djbrady@arizona.edu

March 24, 2022

ABSTRACT

Coherent illumination reflected by a remote target may be secondarily scattered by intermediate objects or materials. Here we show that phase retrieval on remotely observed images of such scattered fields enables imaging of the illuminated object at resolution proportional to $\lambda R_s/A_s$, where R_s is the range between the scatterer and the target and A_s is the diameter of the observed scatter. This resolution may exceed the resolution of directly viewing the target by the factor R_cA_s/R_sA_c, where R_c is the range between the observer and the target and A_c is the observing aperture. Here we use this technique to demonstrate $\approx 32\times$ resolution improvement relative to direct imaging[2].

1 Background

Phase retrieval consists of estimation of complex-valued fields from irradiance measurements[2, 3, 4]. Typically

Analysis of specular reflection enables tracking of space objects with resolution beyond the optical diffraction limit.