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C. Papaliolios

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adaptive optics; speckle imaging

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Under this grant we have developed and equipped a new optics lab for laboratory studies of the use of adaptive optics techniques. The first objective will be to perform partial, low order wavefront correction to a series of incoming distorted wavefronts that vary in time. The distortion of these incoming wavefronts will be measured with the newly acquired wavefront sensor, and low order partial correction to the wavefronts will be done with a few deformable optical elements. We will then apply our well developed speckle techniques to these partially corrected wavefronts and measure the improvement in the reconstructed images. This will be done under controlled laboratory conditions, using a photon counting camera, also acquired under this grant. We expect to characterize this combined process of adaptive optics and speckle imaging to determine whether it is a useful means of producing high resolution images under realistic data gathering conditions. Our expectations of success based on calculations done several years ago are quite high.

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The reason for combining the two techniques of image improvement (adaptive optics, and speckle imaging) is to enable us to push the imaging capabilities towards objects that are more complex, and fainter than objects currently observed. Adaptive optics techniques have been successfully demonstrated many years ago, but only for objects that are quite bright. Speckle imaging has extended the magnitude limits substantially but a further improvement is still needed to study those objects of greatest astronomical interest.

The path leading to this capability has been slow and sometimes painful, but the progress has been real and further important improvements are now within reach. Many of the problems in getting here come from the fact that state-of-the-art sensors and detectors are required. Now that we have the lab in place, we can begin to answer some of the questions we raised several years ago.

In anticipation of success with the laboratory measurements, the system we will assemble will be portable. This will enable us to test the final system on a telescope with real data, but this step will be taken only after laboratory characterization of the process is performed.

DOD EQUIPMENT LIST AFOSR-85-0076

ITEM	VENDOR	Original Budget	Actual Cost	PO Number	Amount Disbursed	Date	Outstanding Obligations
WAVEFRONT SENSOR	ADAPTIVE OPTICS;	$83,000	$108,000	S44780	72,000	10/86	36,000
& UPGRADE	DIGITAL EQUIPMENT	30,000	5,033	S32469	5,033	11/85	
			15,363	S32468	15,363	8/85	
& UPGRADE	ADAPTIVE OPTICS		50,000	S44780-1			50,000
Subtotal		$113,000	$178,396		$92,396		$86,000
PHOTON COUNTING CAMERA	ADAPTIVE OPTICS	27,000	34,000	S44782			34,000
TAPE DRIVE	S&S ELECTRONICS	5,500	5,955	S51113	5,955	12/85	
OPTICAL COM-	PLANAR OPTICS	4,900	1,402	R69907	1,402	3/85	
PONENTS	JAEGERS		1,512	T56268	1,512	3/87	
OSCILLOSCOPE	HITACHI	1,300	1,868	90168-DA	1,868	1/86	
OPTICAL TABLE	SYSTECHNICAL MANUFACTURING	10,650	5,695	T51231	5,695	1/87	
MOUNT HARDWARE	KLINGER	8,350	6,642	T56267	6,642	1/87	
STAGES & MOUNTS	PHYSITEC	6,200	548	T56269	548	1/87	
	NEWPORT		8,333	T56270	8,333	1/87;3/87	
MOTORIZED ACTUATORS(4)		8,250	0				
OPTICAL BREADBOARDS		3,150	0				
LASERS(2)	UNIPHASE	1,450	689	T56271	689	1/87	
PZT TRANSLATORS &	BURLEIGH	5,550	4,464	T64023	4,464	3/87	
HALOGEN LAMP		850	0				
ARC LAMP		1,500	0				
RAMP GENERATOR		5,200	0				
LVEM DEFORMABLE MIRROR		40,000	0				
STABILIZED LASER		6,600	0				
TOTAL TO DATE		$249,450	$249,504		$129,504		$120,000