



# Laboratory for Adaptive Optics at UC Santa Cruz

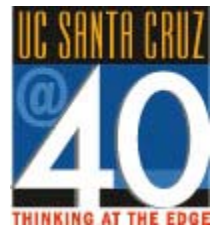
## *An Overview*

By

Daren Dillon  
Scott Severson



High Tech Maui Industry Education Exchange  
March 18, 2005



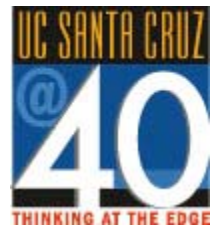


# Laboratory for Adaptive Optics



Claire Max, Principal Investigator  
Joseph Miller, co-Investigator  
Jerry Nelson, co-Investigator  
Donald Gavel, Laboratory Director

- **Funding: Gordon and Betty Moore Foundation \$9M / 6 years**
- **Purposes of the LAO**
  - **Develop Adaptive optics techniques for extremely large ground-based telescopes**
  - **Develop and build planet finder instrument using “extreme” adaptive optics techniques**
  - **Test and evaluate new components/technologies as they become available**
  - **Provide a laboratory where students and postdocs will be trained in adaptive optics hardware and software**



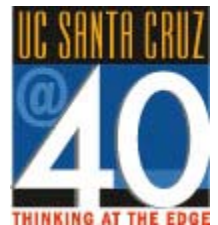


# LAO Facility

## Thimann 185 Lab, UCSC



- **Three Phase Construction - currently in Phase 2**
- **Completed facility: 1900 square foot total space**
- **Class 1000 and Class 100 Clean Room facilities**

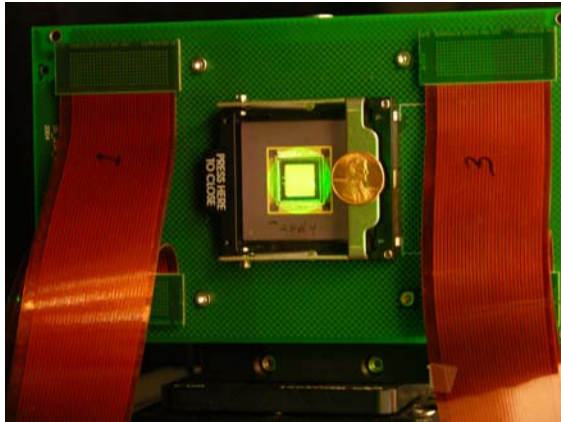




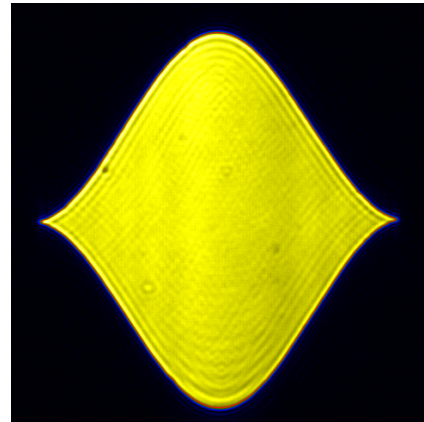
# ExAO Planet Detection



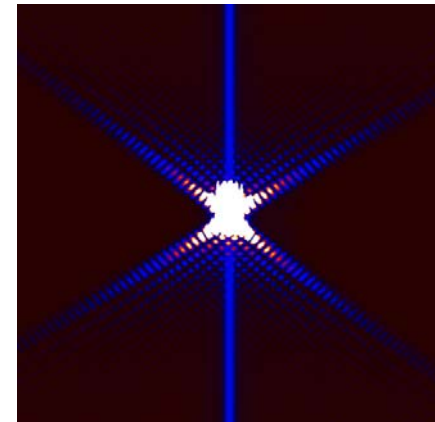
MEMs Deformable Mirror



Intensity of shaped-pupil.



Far-Field of shaped-pupil.



## Residual error

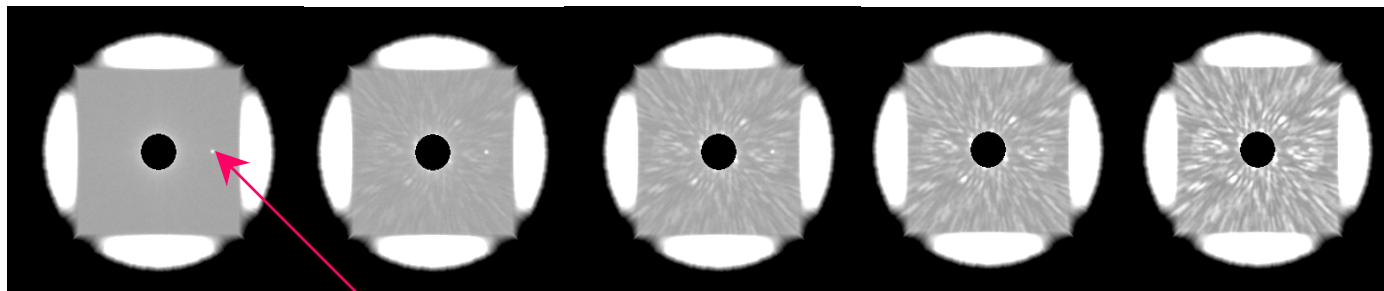
0 nm

1 nm

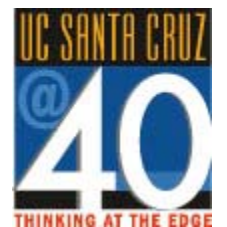
2 nm

3 nm

5 nm

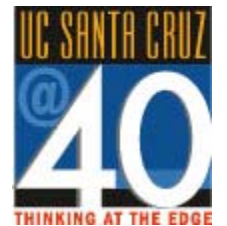
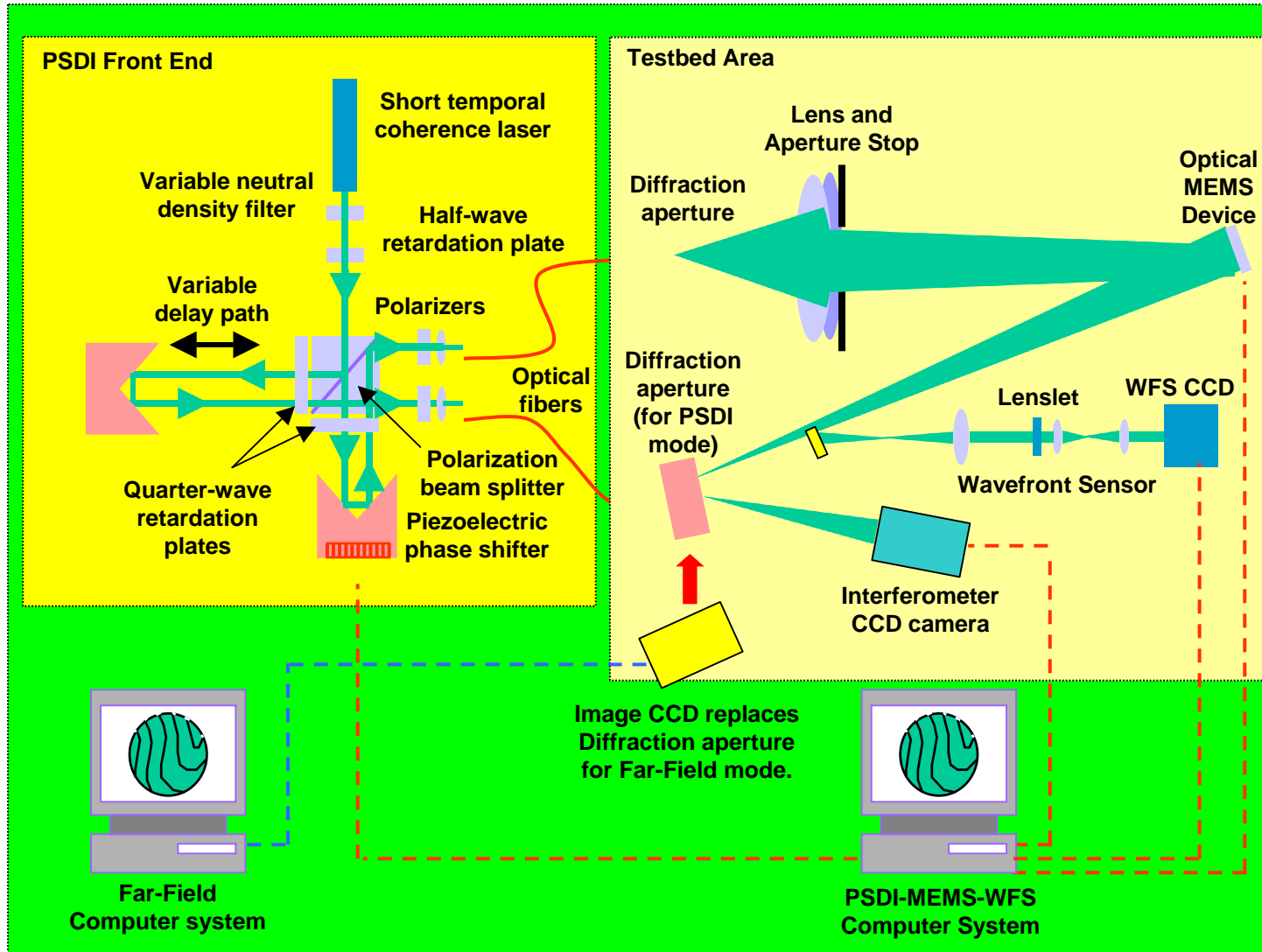


Simulated 8 Jupiter-mass planet



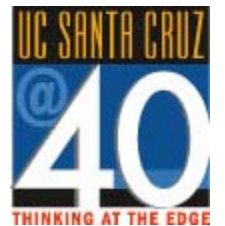
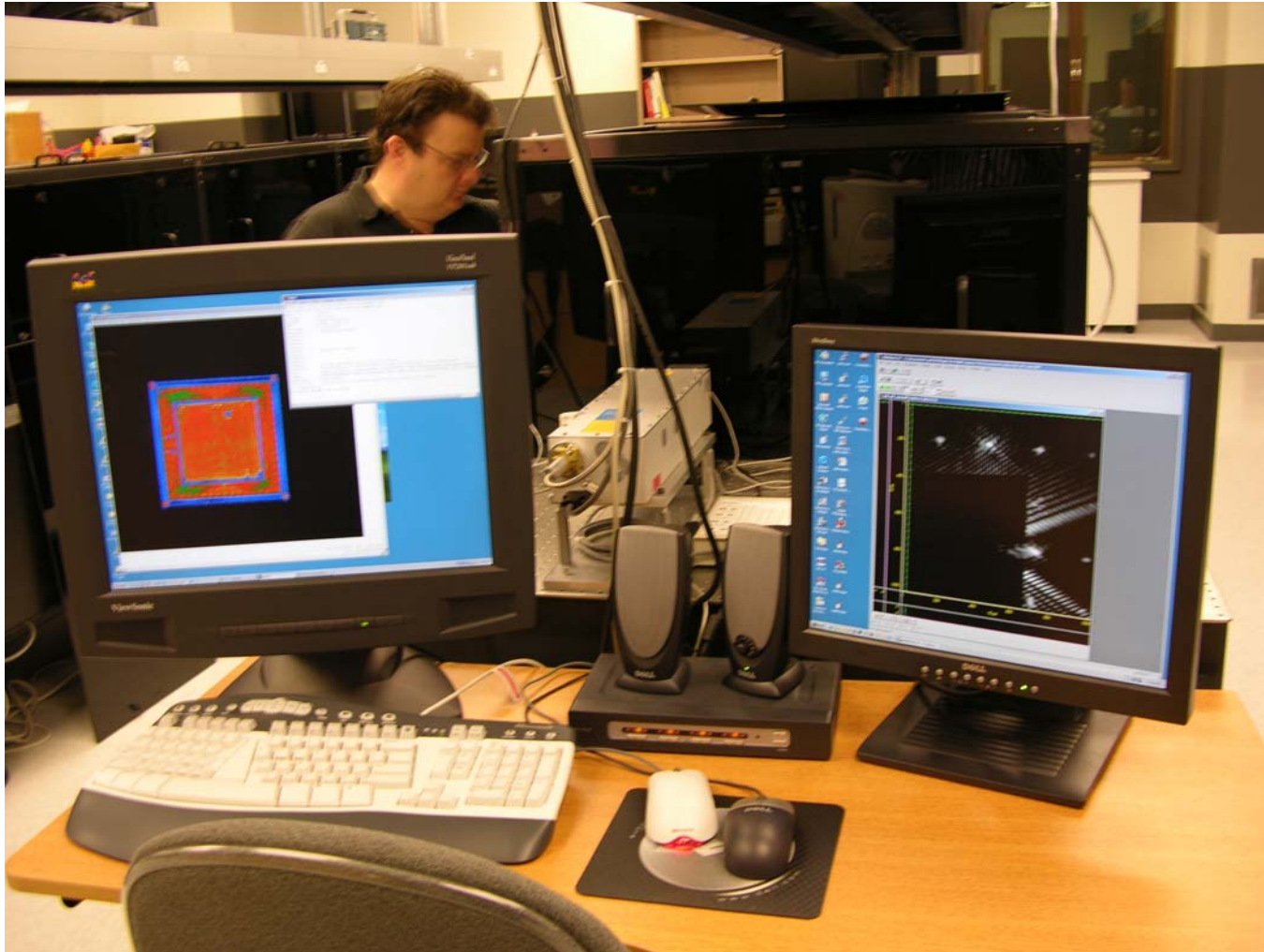


# ExAO testbed layout



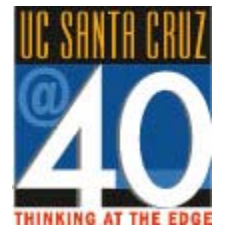
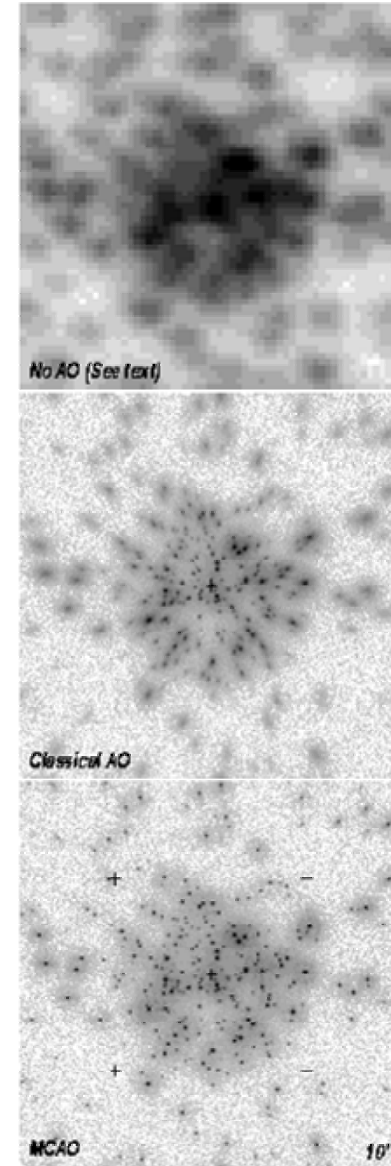
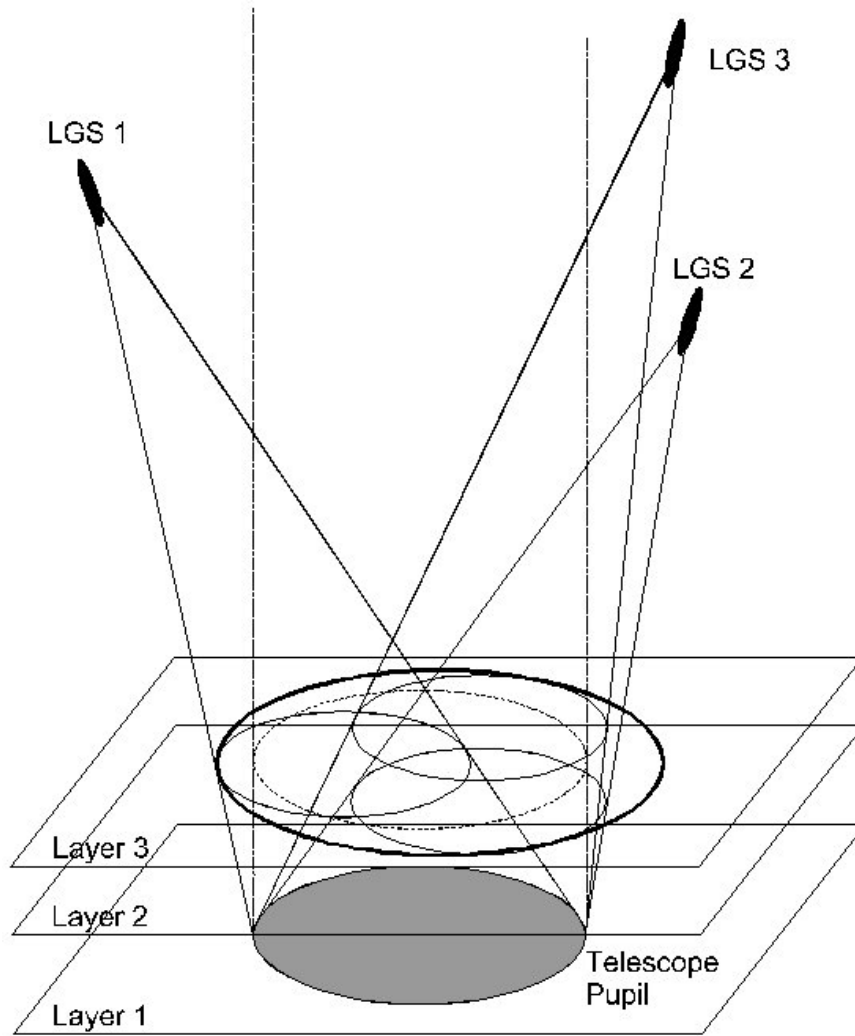


# ExAO Testbed Control Console



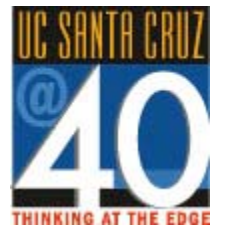
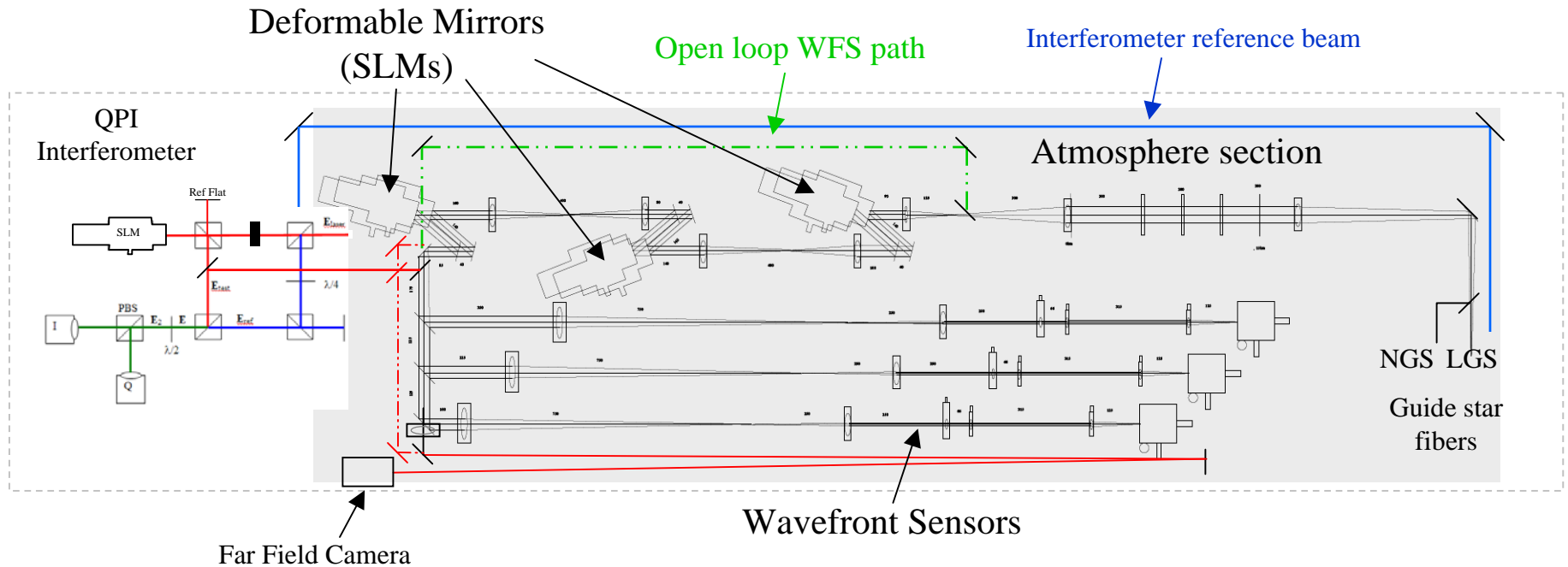


# Multi-conjugate AO





# MCAO testbed layout

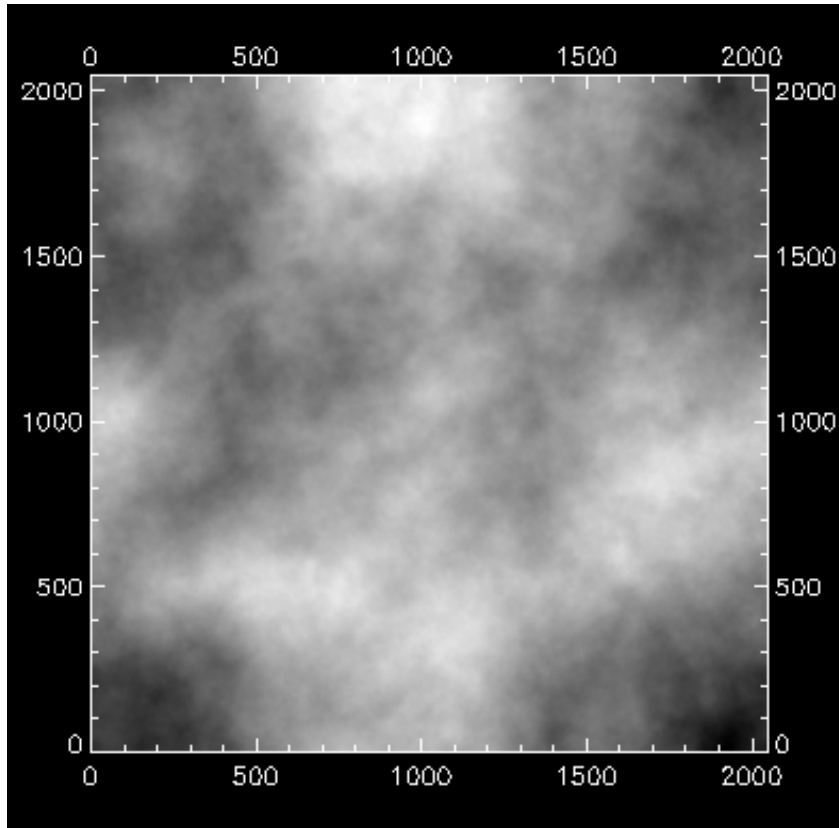




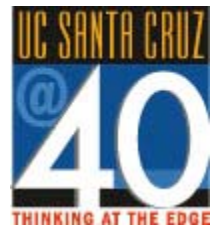
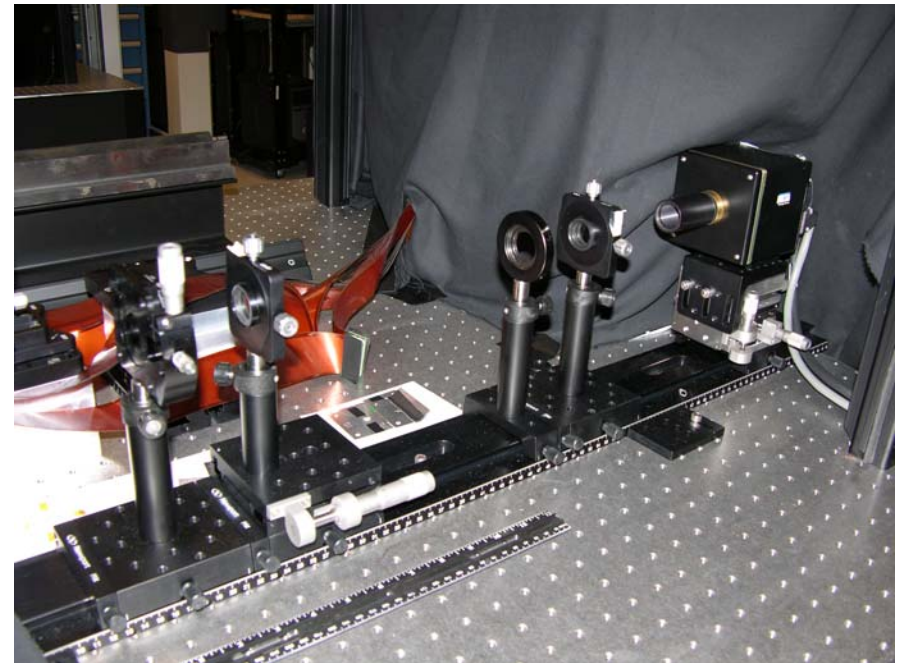
# MCAO Testbed Components



Kolmogorov phase plates

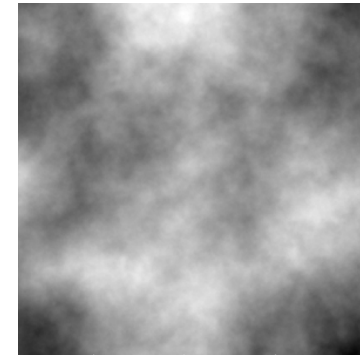
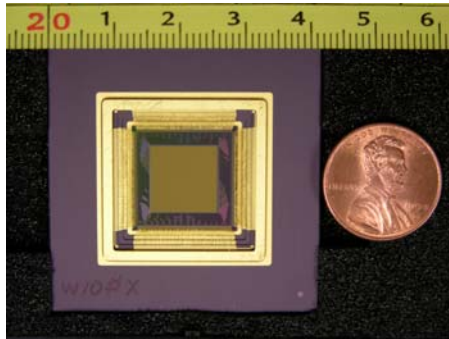


Hartmann wavefront sensor

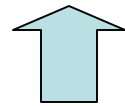




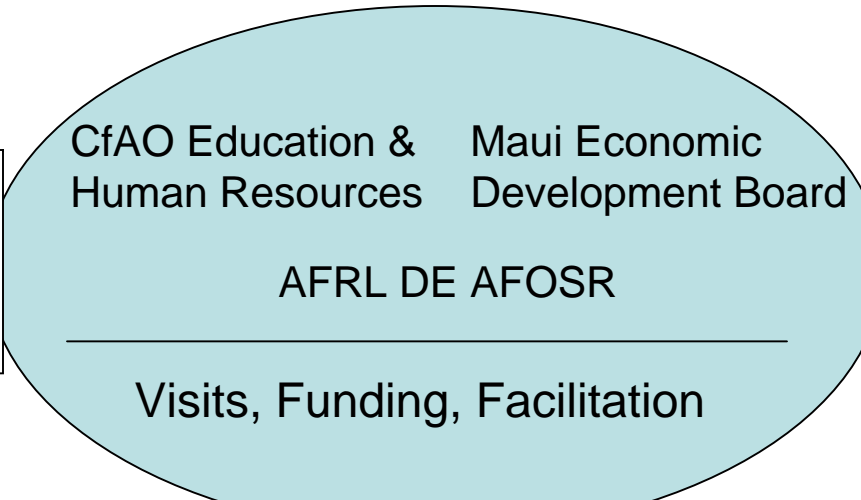
# LAO connections to Maui



New AO  
Collaborations

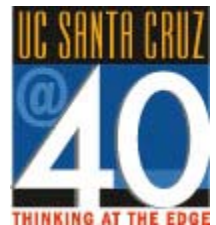


Laboratory for  
Adaptive Optics  
Santa Cruz



Space Surveillance  
Simulator  
MSRC/Oceanit AO Lab  
Maui

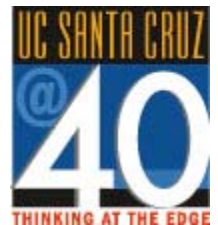
Maui Community College  
Adaptive Optics Demonstrator, courses,  
modules, and student projects





# Summary of experimental objectives for the LAO

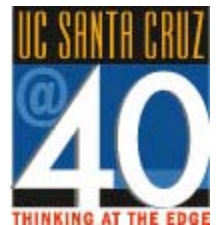
- Validate tomographic AO concepts
- Test woofer-tweeter control stability and performance
- Compare open and closed loop MCAO performance
- Validate open loop MOAO concept
- Test MEMS DMs
- Test alternative wavefront sensor concepts

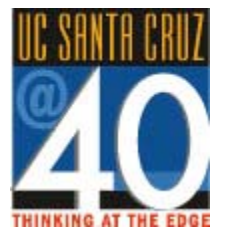




# Conclusion

- LAO ExAO testbed has made considerable progress toward a prototype planet-imager instrument
- LAO MCAO testbed experiments starting now, layout in progress, experiments design responding to suggestions from ELTs and tied to CfAO analysis/modeling/simulation
- Postdoc opening

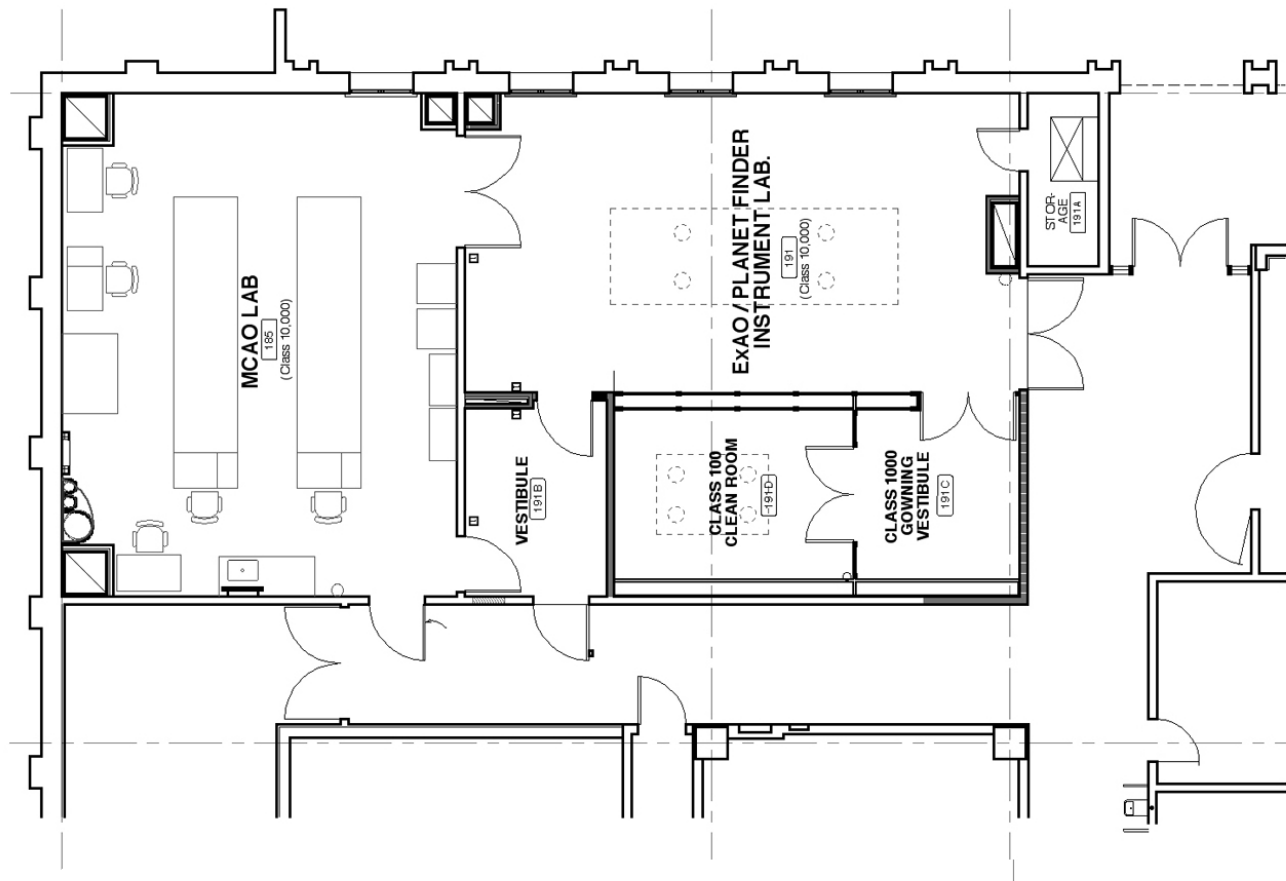






# LAO Facility

in Thimann Labs Building, UCSC



LAB FOR ADAPTIVE OPTICS - PLAN

0 2 4 8 16



- Occupy Phase 2 MCAO Lab: Jan 2005
- Occupy Phase 3 ExAO Lab: May 2005
- Completed facility: 1900 square foot total space

